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November 12, 2019

James M. Lynch
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Director
Office of Environmental Quality Control
State of Hawai'i
235 S Beretania Suite # 702
Honolulu, HI 96813

Re: Transmittal of Draft Environmental Impact Statement

Dear Director:

With this letter, the Pet Industry Joint Advisory Council (PIJAC) hereby transmits the documents package for the Draft Environmental Impact Statement (DEIS) for the Issuance of Commercial Aquarium Permits for the West Hawai'i Regional Fishery Management Area situated in the West Hawai'i Regional Fishery Management Area in the Puna, South Hilo, North Hilo, Kau, Hamakua, South Kona, North Kona, South Kohala, and North Kohala districts on the island of Hawai'i for publication of a notice of availability for public comment for 45-days in the next available edition of the Environmental Notice. The DEIS includes copies of all written comments received during the 30-day public consultation period for the FEA EISPN.

Also enclosed is an Adobe Acrobat PDF file containing the DEIS and a distribution list for the verification of OEQC under Section 11-200-20, Hawai'i Administrative Rules. Upon receiving verification from OEQC (along with the bulletin proof of the notice containing the pertinent details for commenters), we will make the DEIS and the bulletin proof available to those so indicated on the distribution list so that they will have the full 45-day statutory period to review and comment on the DEIS.

If you have any questions or if you need additional information, please feel free to contact me.

Sincerely,

James Lynch

James M. Lynch

Enclosures

20-133

Submittal Form for HRS Chapter 343 Publications in the Periodic Bulletin : Entry # 622

Action Name

ssuance of Commercial Aquarium Fishing Permits for the West Hawai'i Regional Fishery Management Area

Type of Document/Determination

Draft environmental impact statement (DEIS)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district

Hawai'i - multiple districts

Tax Map Key(s) (TMK(s))

West Hawaii Regional Fishery Management Area identified in Figure 1 of DEIS

Action type

Applicant

Other required permits and approvals

Numerous

Discretionary consent required

Commercial Aquarium Fishing Permits

Approving agency

Hawaii Department of Land and Natural Resources

Agency contact name

David Sakoda

Agency contact email (for info about the action)

david.sakoda@hawaii.gov

Email address or URL for receiving comments

david.sakoda@hawaii.gov

Agency contact phone

(808) 587-0104

Agency address

Submittal Form for HRS Chapter 343 Publications in the Periodic Bulletin : Entry # 622

1151 Punchbowl Street
Room 330
Honolulu, Hawaii 96813
United States
Map It

Accepting authority

Department of Land and Natural Resources

Applicant

Pet Industry Joint Advisory Council

Applicant contact name

JAMES LYNCH

Applicant contact email

jim.lynch@klgates.com

Applicant contact phone

(206) 370-6587

Applicant address

925 Fourth Ave
Suite 2900
SEATTLE, WA 98104
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Stantec Consulting Services Inc

Consultant contact name

Terry VanDeWalle

Consultant contact email

terry.vandewalle@stantec.com

Consultant contact phone

(319) 334-3755

Submittal Form for HRS Chapter 343 Publications in the Periodic Bulletin : Entry # 622

Consultant address

2300 Swan Lake Blvd.
Suite 202
Independence, Iowa 50644
United States
Map It

Action summary

The purpose of the Applicant's action is to ensure that commercial aquarium fish collection allows for the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats of the West Hawai'i Regional Fishery Management Area (WHRFMA). The objective of the proposed action is for the Department of Land and Natural Resources (DLNR) to issue 14 Aquarium Permits for the WHRFMA.

The need for the Applicant's action is to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry.

Attached documents (signed agency letter & EA/EIS)

- Distribution-List-for-DEIS.pdf
- Hawaii-AQ-Collection-DEIS_11082019.pdf
- Hawaii-AQ-Collection-DEIS_110820191.pdf
- Hawaii-AQ-Collection-DEIS_110820192.pdf
- Hawaii-AQ-Collection-DEIS_110820193.pdf
- Letter-to-Director-OEQC.pdf
- Hawaii-AQ-Collection-DEIS.pdf
- Letter-to-Director-OEQC1.pdf

Shapefile

- The location map for this Draft EIS is the same as the location map for the associated EIS Preparation Notice.

Action location map

- Publication-Form_Chapter-343-Applicant_Hawaii-AQ-Collection_PIJAC.zip

Authorized individual

JAMES LYNCH

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Draft Environmental Impact Statement

Issuance of Commercial Aquarium Permits for the West Hawai'i Regional Fishery Management Area

November 8, 2019

Applicant
Name: Pet Industry Joint Advisory Council (PIJAC)
Address: 1615 Duke St., #100 Alexandria, VA 22314
Phone: 202.452.1525

Approving Agency
Hawai'i Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, HI 96813-3088

APPLICANT PUBLICATION FORM

Project Name:	Issuance of Commercial Aquarium Permits for the West Hawai'i Regional Fishery Management Area
Project Short Name:	DEIS WHRFMA Commercial Aquarium Permits
HRS §343-5 Trigger(s):	Trigger 1 (use of state lands) and Trigger 2 (use of conservation districts)
Island(s):	Hawai'i
Judicial District(s):	Puna, South Hilo, North Hilo, Kau, Hamakua, South Kona, North Kona, South Kohala, North Kohala
TMK(s):	West Hawai'i Regional Fishery Management Area identified in Figure 1
Permit(s)/Approval(s):	Commercial Aquarium Fishing Permits issued pursuant to HRS §188-31, Commercial Marine License issued pursuant to HRS 189-2,3, West Hawai'i Aquarium Permit issued pursuant to HAR 13-60.4
Approving Agency:	Department of Land and Natural Resources
Contact Name, Email, Telephone, Address	David Sakoda; david.sakoda@hawaii.gov, 808-587-0104,1151 Punchbowl Street, Room 330, Honolulu, HI 96813
Applicant:	Pet Industry Joint Advisory Council (PIJAC)
Contact Name, Email, Telephone, Address	Jim Lynch; jim.lynch@klgates.com; 206.370-6587; 925 Fourth Ave., Suite 2900 Seattle, WA 98104
Consultant:	Stantec Consulting Services Inc
Contact Name, Email, Telephone, Address	Terry VanDeWalle; terry.vandewalle@stantec.com; (319) 334-3755; 2300 Swan Lake Blvd., Suite 202 Independence, IA 50644

Status (select one)	**Submittal Requirements**
__ DEA-AFNSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
__ FEA-FONSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required, and a 30-day comment period follows from the date of publication in the Notice.
__XX__ DEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.

___ FEIS Acceptance Determination	The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
____ FEIS Statutory Acceptance	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
____ Supplemental EIS Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required, and no comment period ensues upon publication in the Notice.
____ Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____ Other	Contact the OEQC if your action is not one of the above items.

Project Summary

The purpose of the Applicant's action is to ensure that commercial aquarium fish collection allows for the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats of the West Hawai'i Regional Fishery Management Area (WHRFMA). The objective of the proposed action is for the Department of Land and Natural Resources (DLNR) to issue 14 Aquarium Permits for the WHRFMA.

The need for the Applicant's action is to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry.

Project Summary

Project Name: Issuance of Commercial Aquarium Permits for the West Hawai'i Regional Fishery Management Area.

Proposed Action: Issuance of 14 Commercial Aquarium Permits ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats of the West Hawai'i Regional Fishery Management Area pursuant to Aquarium Fishing Permits issued under HRS §188-31.

Applicant: Pet Industry Joint Advisory Council (PIJAC).

Applicant Contact: Jim Lynch, KL Gates LLP, 206-370-6587

Approving Agency: Department of Land and Natural Resources

Project Location: Throughout the West Hawai'i Regional Fishery Management Area (to depths of 100 fathoms), except in those areas already designated as no collection areas such as Fish Replenishment Areas.

Land Use Classification: N/A

Land Area: N/A NON-MLCDs

Tax Map Key: N/A

State Land District: N/A

Land Owner: State of Hawai'i

Permits Required: Commercial Aquarium Fishing Permits issued pursuant to HRS §188-31, Commercial Marine License issued pursuant to HRS 189-2,3, West Hawai'i Aquarium Permit issued pursuant to HAR 13-60.4.

HRS §343-5 Trigger: Trigger 1 (use of state lands) and Trigger 2 (use of conservation districts). Review of an Environmental Assessment (EA) prepared in 2018 determined an EIS was required based on Significance Criteria #1, #2, #3, #4, and #8.

Anticipated Determination: Acceptance

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Executive Summary

In October 2017, the circuit court ruled that, based upon the Supreme Court of Hawai'i's opinion, existing Commercial Aquarium Permits (Aquarium Permits) for use of fine mesh nets to catch aquatic life for aquarium purposes are illegal and invalid. The circuit court ordered the Department of Land and Natural Resources (DLNR) not to issue any new Aquarium Permits pending environmental review. The DLNR has not issued new or additional Aquarium Permits under HRS §188-31 since September of 2017.

The Applicant initially prepared and submitted an Environmental Assessment on April 8, 2018, evaluating the impacts of issuance of Aquarium Permits on the island of Hawai'i programmatically to any applicant over a 12-month analysis period. The DLNR determined on July 26, 2018, that preparation of an Environmental Impact Statement (EIS) was required, based on five significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules. An evaluation of the significance criteria, including the five identified by the DLNR, is provided in Section 5.6 of this document.

This Draft Environmental Impact Statement (DEIS) evaluates the impacts of issuance of 14 Aquarium Permits for the West Hawai'i Regional Fishery Management Area (WHRFMA). The Applicant has prepared this DEIS to inform the public of the proposed action (i.e., issuance of 14 Aquarium Permits) and the impacts of the proposed action and its alternatives, and to incorporate information gained through public involvement. The Preferred Alternative includes issuance of 14 Aquarium Permits for the WHRFMA, and implementation of a reduced bag limit for Achilles Tang of 5 per day. No Aquarium Permits would be issued for other areas of the state, including East Hawai'i. Implementation of the Preferred Alternative would ensure the lawful, responsible, and sustainable commercial collection of various fish species from the WHRFMA.

Aside from the additional conservation measure included in the Preferred Alternative, the issuance of 14 Aquarium Permits under the Preferred Alternative does not include any activities different from, or in addition to, those that have occurred in the past. There would be no construction of permanent or semi-permanent infrastructure, no discharges into coastal, surface or ground waters, no dredging, and no significant use of hazardous materials that could be released into the environment. The DLNR's issuance of 14 Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts to water and air quality, geology and soil resources, aesthetics, noise, vegetation, terrestrial wildlife, and avian species, threatened and endangered species, land use, public health and safety, communications, transportation, utilities, or population and demographics from their current condition.

The Preferred Alternative does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource. Both the National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Ecosystems Program (CREP; now known as the Ecosystem Sciences Division) and Hawai'i's DLNR, Division of Aquatic Resources' (DAR) West Hawai'i Aquarium Project (WHAP) collect data on fish populations in nearshore waters of the island of Hawai'i that are available and appropriate for estimating population size, within the limitations of each survey, and for analysis of the impact of fish collection under Aquarium Permits. The WHAP data are collected from 25 transect survey sites located solely within the West Hawai'i Regional Fishery Management Area between depths of 30-60 feet. The CREP data are collected from 257 stationary point count locations located around the island of Hawai'i (except for collection zone 107; Figure 4), from depths of 0-98 feet. Both data sets are presented and analyzed in this DEIS. However, due to the larger spatial coverage and greater range of depths surveyed by the CREP, these data are considered to be a better estimator of island-wide fish population size, and therefore serve as the primary basis for the impact analysis in this DEIS.

Analysis of the CREP data indicates that if the average catch from 2000-2017 for the 14 fishers requesting Aquarium Permits under the Preferred Alternative were to occur over the 5-year analysis period considered in this DEIS, the annual collection of 38 of the 40 White List Species would be less than 1% of their respective overall island of Hawai'i populations. Collection of the remaining two species would be less than 2% of their overall population. Even if the collection rates of the 40 White List Species were closer to the maximum collection by the 14 fishers from 2000-2017, the annual collection of all species would be less than 3.5% of the island-wide population. Research suggests collection of between 5%-25% is sustainable for various reef species similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish). Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection likely has minimal impacts on populations in general.

Based on WHAP data, the DAR has suggested decreasing population trends for the Achilles Tang in the WHRFMA, and in 2014 a bag limit of 10 Achilles Tang per day was imposed on commercial aquarium collection (recreational and non-aquarium commercial harvest are not subject to the bag limit). Under the Preferred Alternative, the daily bag limit for Achilles Tang would be reduced from 10 per day to 5 per day, and only 14 Aquarium Permits would be issued. Under the Preferred Alternative, catch of Achilles Tang is estimated to be reduced by over 50% from rates seen prior to the October 2017 ban on commercial aquarium collection, resulting in an estimated 0.88% to 1.09% of the island-wide population collected annually over the 5-year analysis period. This level of collection is below the lower end of what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).

Two studies have concluded that the aquarium fishery has no significant impact on coral or the reef ecosystem. In addition, herbivores collected by the aquarium fishery typically consist of the smaller size classes which are the least effective sizes for cropping algae. One study found there were no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting.

As concluded in the Cultural Impact Assessment (CIA; Appendix A), cultural impacts would occur if issuance of Aquarium Permits would cause a significant decline in the population of a White List Species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the 33 species on the White List identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted. Populations of the White List Species are not anticipated to significantly decline under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on cultural resources would occur as a result of the Preferred Alternative.

The Preferred Alternative does not substantially affect the economy but plays an important role as a nearshore fishery in the state. The Preferred Alternative would add an estimated $4.4 to $6.5 million over the 5-year analysis period (average of $883,081 to $1,294,497 per year), and another five times this value in indirect economic benefits. Loss of the fishery would result in the loss of income, tax revenue, and jobs.

Abbreviations

BIAAF	Big Island Association of Aquarium Fishermen
BLNR	Board of Land and Natural Resources
CML	Commercial Marine License
CREP	Coral Reef Ecosystems Program
DAR	Division of Aquatic Resources
DEIS	Draft Environmental Impact Statement
DLNR	Department of Land and Natural Resources
DOCARE	Division of Conservation and Resources Enforcement
DOH	Department of Health
EA	Environmental Assessment
EC	Environmental Council
EIS	Environmental Impact Statement
ENSO	El Niño Southern Oscillation
EQC	Environmental Quality Commission
ESA	Endangered Species Act
FEA	Final Environmental Assessment

FMA	Fisheries Management Area
FONSI	Finding of No Significant Impact
FRA	Fish Replenishment Area
HDBEDT	Hawai'i Department of Business, Economic Development & Tourism
HEPA	Hawai'i Environmental Policy Act
HAR	Hawai'i Administrative Rule
HRS	Hawai'i Revised Statute
IUCN	International Union for the Conservation of Nature
KMLAC	Ka'ūpūlehu Marine Life Advisory Committee
MLCD	Marine Life Conservation District
MHI	Main Hawaiian Islands
MPA	Marine Protected Areas
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWHI	Northwestern Hawaiian Islands
OEQC	Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs

PIJAC	Pet Industry Joint Advisory Council
QUEST	Quantitative Underwater Ecological Survey Techniques
SAWCS	Statewide Aquatic Wildlife Conservation Strategy
SCUBA	Self-contained Underwater Breathing Apparatus
SGCN	Species of Greatest Conservation Need
SWAP	State Wildlife Action Plan
TL	Total Length
UH	University of Hawai’i
USFWS	United States Fish and Wildlife Service
WHAP	West Hawai’i Aquarium Project
WHFC	West Hawaiʻi Fishery Council
WHRFMA	West Hawai’i Regional Fishery Management Area
WHRFWG	West Hawai'i Reef Fish Working Group

1.0 INTRODUCTION

This Draft Environmental Impact Statement (DEIS) has been prepared by the Pet Industry Joint Advisory Council (PIJAC; the Applicant) pursuant to the Hawai'i Environmental Policy Act (HEPA).This DEIS evaluates the impacts of issuance of 14 Commercial Aquarium Permits (Aquarium Permit) for the West Hawai'i Regional Fishery Management Area (WHRFMA; Section 1.2.2), pursuant to Hawai'i Revised Statute (HRS) 188-31 (2013; Title 12 – Conservation and Resources; 188 – Fishing Rights and Regulations; 188-31 – Permits to take aquatic life for aquarium purposes). The Applicant has prepared this DEIS to inform the public of the proposed action (i.e., issuance of 14 Aquarium Permits) and the impacts of the proposed action and its alternatives, and to incorporate information gained through public involvement in order to aid decision makers in making an informed decision regarding the proposed action.

Hawai'i Revised Statute 188-31 states that, "Except as prohibited by law, the department (Department of Land and Natural Resources; DLNR), upon receipt of a written application, may issue an Aquarium Permit, not longer than one year in duration, to use fine meshed traps, or fine meshed nets other than throw nets, for the taking of marine or freshwater nongame fish and other aquatic life for aquarium purposes." As set down by the Supreme Court of Hawai'i (SCWC-13-0002125), issuance of an Aquarium Permit constitutes a discretionary State action by the DLNR and is thus subject to the HEPA, which requires that State agencies consider the impact of governmental actions on the environment by preparing an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) to document the potential impacts of the State action. A Draft Environmental Assessment (DEA) evaluating the impacts of the proposed action of issuing Aquarium Permits to fishermen on the island of Hawai'i and its alternatives was made available for public comment on April 8, 2018. After review of the EA, the DLNR determined on July 26, 2018, that preparation of an EIS is required, based on the significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules. Accordingly, the Applicant has prepared this DEIS to evaluate the potential impacts of alternatives associated with issuance of 14 Aquarium Permits for the WHRFMA, and a No Action Alternative. The consequences of these alternatives on various resources are discussed in this DEIS.

1.1 BACKGROUND

In 2017, the Hawai'i commercial aquarium fishery was the most economically valuable commercial inshore fishery in the State with fiscal year reported landings greater than $2.2 million (DAR 2019a). In 2017, the commercial aquarium fishery on the island of Hawai'i (excluding the other islands) reported landings near $1.4 million, with more than $1.29 million in the WHRFMA alone (DAR 2018a). The fishery developed initially on O'ahu in the late 1940's, went through a period of expansion in the 1970's and has subsequently declined on O'ahu both in terms of catch and overall value (DAR 2014a). The West Hawai'i aquarium fishery has undergone substantial and sustained expansion over the past 40 years. As of 2017, approximately 45% of the aquarium fish caught in the State and nearly 67% of value came from the WHRFMA (DAR 2018a).

Commercial aquarium fish collection in Hawai'i, and especially in West Hawai'i has long been a subject of controversy (DAR 2019a). As early as 1973, public concern over collecting activities prompted Hawai'i's DLNR, then Division of Fish and Game, to suspend the issuance of Aquarium Permits for a week while issues were considered and addressed (DAR 2014a). As a result, Aquarium Permit holders were required to submit monthly catch reports. However, no studies were conducted, and no 'sanctuary' areas were created at that time. The first sanctuary areas were created through a gentleperson's agreement primarily between dive/snorkel operators and commercial aquarium fishers in 1987, and four of these sanctuaries were incorporated into the Kona Coast Fisheries Management Area (FMA) in 1991 (DAR 2004). This interindustry collaboration and cooperation laid the groundwork for a more inclusive management approach to the fishery. The WHRFMA was created by Legislative Act 306 (1998) largely in response to longstanding and widespread conflict surrounding commercial aquarium fish collection (Section 1.2.3). The Act required substantive community input in management decisions (DAR 2019a).

In order to accomplish the mandates of Act 306, a community advisory group, the West Hawai'i Fishery Council (WHFC), was convened by the Division of Aquatic Resources (DAR) in 1998 (Section 1.2.3.1). Consisting of 24 voting members and 6 ex-officio agency representatives from DLNR, Sea Grant, and the Governor's Office, the WHFC's members represented diverse geographic areas and various stakeholder, community, and user groups in West Hawai'i. Four aquarium representatives (three collectors and one aquarium shop owner) were members of the WHFC, 40% of the WHFC were *maka'āinana* (i.e., native fishers) and most of the members were previously on the West Hawai'i Reef Fish Working Group (WHRFWG). The first action of the WHFC was the designation of a network of nine Fish Replenishment Areas (FRAs), in which no aquarium fish collection is allowed. The FRA's, along with existing Marine Protected Areas (MPA), comprise 35.2% of the West Hawai'i coastline (DAR 2019a). Although closed to commercial and recreational aquarium fishing, FRAs are still open to other forms of permitted fishing. Concerns over continued expansion of the commercial aquarium fishery and collecting effects in the Open Areas (i.e., areas where aquarium fish collection is allowed) prompted the DLNR in 2013 to establish a 'White List' of 40 species that can be collected by commercial aquarium fishers within the WHRFMA (Section 4.4.1). All other species are off limits within the WHRFMA (DAR 2019a) but can be collected in East Hawai'i.

1.1.1 Status of Aquarium Permits

In October 2012, Earthjustice filed a complaint under the HEPA in the First Circuit Court on behalf of four individuals and three non-governmental organizations. The complaint sought a court order to force the State to comply with the HEPA's requirement to examine commercial aquarium fish collection's effects on the environment before issuing collection permits. The complaint also asked the court to halt collection under existing Aquarium Permits and to stop DLNR from issuing new permits until the environmental review is complete (Earthjustice 2012). On June 24, 2013, the Circuit Court of the First Circuit announced their findings on the case through an 'Order Granting Department of Land and Natural Resources State of Hawai'i's, Motion for Summary Judgment filed February 4, 2013, and Denying Plaintiffs' Motion for Summary Judgment filed February 5, 2013 (Summary Judgment Order), and the Final Judgment in Favor of Defendant and Against Plaintiffs (Judgment), also filed on June 24, 2013. The Hawai'i Intermediate Court of Appeals upheld this decision in August 2016. Permit issuance by DLNR's DAR continued.

Through the appeals process, Earthjustice brought the case before the Supreme Court of Hawai'i. On September 6, 2017, the Supreme Court of Hawai'i ruled that aquarium collection using fine meshed traps or nets is subject to the environmental review procedures provided in the HEPA (SCWC-13-0002125). The issue was remanded to the circuit court for further proceedings. In light of the ruling, DLNR discontinued issuance of new Aquarium Permits and renewal of existing Aquarium Permits (DAR 2017).

On October 27, 2017, the circuit court ruled that, based upon the Supreme Court of Hawai'i's opinion, existing permits for use of fine mesh nets to catch aquatic life for aquarium purposes are illegal and invalid. The circuit court ordered the DLNR not to issue any new permits pending environmental review. The DLNR has not issued new or additional permits under HRS §188-31 since the Supreme Court's opinion was issued in September of 2017 (DAR 2017).

On January 5, 2018 the DNLR issued a press release clarifying that no aquatic life may be taken for commercial aquarium purposes in West Hawai'i until an environmental review is complete

1.1.2 Previous HEPA Documents

PIJAC initially prepared and submitted an EA on April 8, 2018, evaluating the impacts of issuance of Aquarium Permits on the island of Hawai'i programmatically to any applicant over a 12-month analysis period. In accordance with HEPA, the Draft EA was circulated for public review and comment through publication in The Environmental Notice and was also distributed via copies or email to a variety of elected officials, federal agencies, state, county and local offices, and individuals and organizations. Public comments were accepted during a 30-day period following publication. A total of 836 responses were received: 435 supported the conclusions of the DEA and issuance of Aquarium Permits; 398 did not support the conclusions of the DEA and opposed issuance of Aquarium Permits; and 3 did not express support or opposition. Comments received during the comment period were taken into account in assessing impacts of the proposed action and resulted in some modifications in the Final EA, which are also reflected in this EIS. Responses to comments on the DEA can be found in Appendix B of the Final EA[1].

In the cover letter for the publication of the DEA, the DLNR requested comment on four specific issues:

1. The effects of the Commercial Aquarium Fishery on Achilles Tang (*Acanthurus achilles*), and its sustainability given its life history characteristics, current population trends, and harvest by other fisheries.

2. The adequacy of the analysis presented in this DEA, including but not limited to removal and replenishment rates for vulnerable species; specifically, how is the estimated sustainable range of 5% to 25% annual take of the estimated total population arrived at, and should the threshold be 5% or 25%.

3. The interpretation of data presented in this DEA, including the analysis of NOAA NMFS Coral Reef Ecosystem Project (CREP) data versus DLNR Division of Aquatic Resources West Hawai'i Aquarium Project (WHAP) data.

4. Conservation measures to minimize or avoid impacts to target species, and specifically, whether other alternatives might be proposed to minimize or avoid impacts other than the two presented of

[1] http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf

no action, with no Aquarium Permits issued, and the preferred alternative of programmatic issuance of Aquarium Permits for the Island of Hawai'i - such as consideration of specific management measures for Achilles tang and other species.

The Applicant's responses to the request for comment along with an independent scientific reviewer's comments on the responses are found in Appendix D of the Final EA. After review of the Final EA, the DLNR determined on July 26, 2018, that preparation of an EIS is required, based on the significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules[2]. Specifically, the DLNR requested further analysis related to five specific significance criteria:

- Significance Criteria #1 - Is the annual take of cumulative numbers of fish as a percentage of the estimated population an irrevocable loss or destruction of said populations?
- Significance Criteria #2 - To what extent does the take of aquarium fish curtail the use of the environment, including:
    - Aquatic invasive algae control
    - Tourism industry
    - Integrity of diverse aquatic ecosystems
- Significance Criteria #3 - Does the take of aquarium fish conflict with the state's long-term environmental goals?
- Significance Criteria #4 - To what extent does the take of aquarium fish impact cultural practices in the state?
- Significance Criteria #8 - What is the cumulative impact of the take of aquarium fish when combined with:
    - Commercial take of aquarium fish using other legal methods
    - Recreational take of aquarium fish
    - Commercial and non-commercial take of aquarium fish for consumption (particularly the Achilles Tang and Kole)

[2] https://governor.hawaii.gov/wp-content/uploads/2018/07/Final-EA-NOD-Aquarium-Permits-Hawaii-Island-7-26-18.pdf

1.2 RELEVANT POLICIES AND CONTROLS

1.2.1 Hawai'i Revised Statute (HRS) 188-31

Hawai'i Revised Statute 188-31 (2013; Title 12 – Conservation and Resources; 188 – Fishing Rights and Regulations; 188-31 – Permits to take aquatic life for aquarium purposes) states that:

1. Except as prohibited by law, the department, upon receipt of a written application, may issue an aquarium fish permit, not longer than one year in duration, to use fine meshed traps, or fine meshed nets other than throw nets, for the taking of marine or freshwater nongame fish and other aquatic life for aquarium purposes.
2. Except as prohibited by law, the permits shall be issued only to persons who can satisfy the department that they possess facilities to and can maintain fish and other aquatic life alive and in reasonable health.
3. It shall be illegal to sell or offer for sale any fish and other aquatic life taken under an aquarium fish permit unless those fish and other aquatic life are sold alive for aquarium purposes. The department may adopt rules pursuant to HRS chapter 91 for the purpose of this section.

1.2.2 Hawai'i Environmental Policy Act[3]

The HEPA requires that State agencies consider the impact of governmental actions on the environment because humanity's activities have broad and profound effects upon the interrelations of all components of the environment, and an environmental review process would integrate the review of environmental concerns with existing planning processes of both the State and county governments. The HEPA includes the following statutes and administrative rules: a) HRS Chapter 343, Environmental Impact Statements; b) Hawai'i Administrative Rule (HAR) 11-200, Environmental Impact Statement Rules; c) HAR 11-201, Environmental Council Rules of Practice and Procedure (OEQC 2012).

The authorities governing the HEPA process include:

1. The text of the statute (Chapter 343, HRS) and its implementing administrative rules (Chapters 11-200, and 11-201, HAR, Department of Health;
2. The State Environmental Policy (Chapter 344, HRS);
3. The enumerated and written advisory opinions of the Attorney General of the State of Hawai'i;
4. The declaratory rulings of the Environmental Quality Commission (EQC) and the Environmental Council (EC); and,

[3] The HEPA was updated in August 2019, however, the EISPN for this DEIS was published on August 8, 2018, prior to the adoption of the new rules. Therefore, as per the new rules, the previous HEPA regulations apply to this DEIS.

5. The appellate rulings of the Intermediate Court of Appeals and the Supreme Court of the State of Hawai'i.

The HEPA process also alerts decision makers to significant environmental effects that may result from the implementation of certain actions (HRS 343-1). The specific instances when a proposing agency or an approving agency must prepare an EA (for an action not declared exempt under Section 11-200-8, HAR) derive from Section 343-5(a) HRS and are listed in Table 1-1.

Table 1-1. Statutory Triggers for Hawai'i Environmental Policy Act (HEPA).

	Instances	Responsible Agency
1.	Use of State or County lands or use of State or County funds, other than funds to be used for feasibility or planning studies for possible future programs or projects that the agency has not approved, adopted, or funded, or funds to be used for the acquisition of unimproved real property; provided that the agency shall consider environmental factors and available alternatives in its feasibility or planning studies; provided further that an EA for proposed uses under Section 205-2(d)(11) or 205-4.5(a)(13) shall only be required pursuant to Section 205-5(b).	The agency with title to the land or is using funds.
2.	Use of any land classified as conservation district by the state land use commission under Chapter 205.	Office of Conservation and Coastal Lands of the DLNR.
3.	Use within a shoreline area as defined in Section 205A-41. The shoreline area in question is defined by county ordinance and consists of a predetermined distance going inland from the certified shoreline. In the City and County of Honolulu, this is forty-feet.	The respective county planning department.
4.	Use within any historic site as designated in the National Register or Hawai'i Register, as provided for in the Historic Preservation Act of 1966, Public Law 89-665, or Chapter 6E.	The respective county planning department.
5.	Use within the Waikiki area of O'ahu, the boundaries of which are delineated in the land use ordinance as amended, establishing the "Waikiki Special District".	The Department of Planning and Permitting of the City and County of Honolulu.
6.	Any amendments to existing county general plans where the amendment would result in designations other than agriculture, conservation, or preservation, except actions proposing any new county general plan or amendments to any existing county general plan initiated by a county.	The respective county planning department.
7.	Any reclassification of any land classified as a conservation district by the state land use commission under Chapter 205.	The Land Use Commission, except in cases involving less than fifteen-acres (which cases are processed by the respective county planning department).
8.	Any construction of new or the expansion or modification of existing helicopter facilities within the State, that may affect: A. Any land classified as a conservation district by the state land use commission B. A shoreline area c. Any historic site as designated in the National Register or Hawai'i Register	The respective county planning department where the project is located processes the clearance of this trigger.
9.	Propose any: A. Wastewater treatment unit, except an individual wastewater system or a wastewater treatment unit serving fewer than fifty single family dwellings or the equivalent B. Waste-to-energy facility C. Landfill D. Oil refinery E. Power-generating facility	The agencies of the State or County government that issue discretionary approvals for the listed items.

The Supreme Court of Hawai'i ruled (SCWC-13-0002125) that an environmental review of the Aquarium Permit process is warranted based on the first (use of state lands) and second (use of conservation districts) statutory triggers identified in Table 1-1, above.

Actions that do not fall under one of the triggers are excluded by statute from the HEPA process. Any action that is not excluded by statute must undergo the HEPA environmental review process (OEQC 2012). The analysis within an EA is used to determine whether the impact on the environment would be significant enough to warrant the preparation of a full EIS or would be used to declare a Finding of No Significant Impact (FONSI) thus clearing the HEPA process.

In most cases, an agency determines that an action may have a significant impact on the environment and require an EIS if it meets any of the following 13 criteria:

1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;
2. Curtails the range of beneficial uses of the environment;
3. Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;
4. Substantially affects the economic or social welfare of the community or State;
5. Substantially affects public health;
6. Involves substantial secondary impacts, such as population changes or effects on public facilities;
7. Involves a substantial degradation of environmental quality;
8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;
9. Substantially affects a rare, threatened, or endangered species, or its habitat;
10. Detrimentally affects air or water quality or ambient noise levels;
11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;
12. Substantially affects scenic vistas and view planes identified in county or state plans or studies; or
13. Requires substantial energy consumption.

Since its inception, the HEPA process has bifurcated into two separate procedural tracks (OEQC 2012):

1. Agency actions (set forth in Section 343-5(b), HRS); refers to those proposed by a government agency; and

2. Applicant actions (set forth in Section 343-5(c), HRS); refers to those that are initiated by a private party and “triggers” an environmental review.

The need for this DEIS is based on the proposed action (i.e., DLNR issuance of 14 Aquarium Permits) and the agency determination that an EIS is required due to possible significant impacts on the environment.

The environmental review process described in the findings and purpose section of Chapter 343, HRS, necessitates integrating citizen concerns into the planning process and forewarning decision makers of potential significant environmental effects should implementation take place. The Hawai’i Office of Environmental Quality Control (OEQC) finds that the process of reviewing environmental effects is desirable because environmental consciousness is enhanced, cooperation and coordination are encouraged, and public participation during the review process benefits all parties involved and society as a whole (OEQC 2012).

1.2.3 Act 306 SLH – West Hawai’i Regional Fishery Management Area

Act 306 Session Laws of Hawai’i (SLH 1998) directed DLNR to establish the WHRFMA along the entire west coast of the Island of Hawai'i; ‘bounded by the west coast of Hawai‘i Island, from Ka Lae, Ka‘ū (South Point) to ‘Upolu Point, North Kohala, and extending from the upper reaches of the wash of the waves on shore, seaward to the limit of the State’s police power and management authority.

From Act 306:

The purpose of the WHRFMA shall be to:

1. Ensure the sustainability of the state's nearshore ocean resources;
2. Identify areas with resource and use conflicts;
3. Provide management plans as well as implementing regulations for minimizing user conflicts and resource depletion through the designation of sections of coastal waters in the WHRFMA as FRAs where certain specified fish collecting activities are prohibited and other areas where anchoring and ocean recreation activities are restricted;
4. Establish a system of day-use mooring buoys in high-use coral reef areas and limit anchoring in some of these areas to prevent anchor damage to corals;
5. Identify areas and resources of statewide significance for protection;
6. Carry out scientific research and monitoring of the nearshore resources and environment; and
7. Provide for substantive involvement of the community in resource management decisions for this area through facilitated dialogues with community residents and resource users. The DLNR shall identify the specific areas and restrictions after close consultation and facilitated dialogue with working groups of community members and resource users.

The department shall develop a WHRFMA plan that identifies and designates appropriate areas of the management area in accordance with HRS Chapter 91 as follows:

1. Designate a minimum of thirty percent (30%) of coastal waters in the WHRFMA as FRAs in which aquarium fish collection is prohibited (other fishing still permitted);

2. Establish a day-use mooring buoy system along the coastline of the WHRFMA and designate some high-use areas where no anchoring is allowed;

3. Establish a portion of the FRAs as fish reserves where no fishing of reef-dwelling fish is allowed; and,

4. Designate areas where the use of gill nets as set nets shall be prohibited.

A review of the effectiveness of the WHRFMA plan shall be conducted every five years by the DLNR in cooperation with the University of Hawai'i (UH). The DLNR shall submit a report of its findings and recommendations based on the review to the legislature no later than 20 days before the convening of the regular session following the review. The most recent review was completed in 2014 (DAR 2014a), though data from that report has been updated as of 2019 (DAR 2019a).

1.2.3.1 West Hawai'i Fishery Council

The DAR (DAR 2014a) stated:

> *In order to accomplish the mandates of Act 306 with substantive community input, The West Hawai'i Fishery Council (WHFC) was convened on June 16, 1998 under the aegis of the DLNR and the University of Hawai'i Sea Grant. Consisting of 24 voting members and 6 ex-officio agency representatives from the DLNR, University of Hawai'i Sea Grant, and the Governor's Office, the WHFC's members represented diverse geographic areas and various stakeholder, community, and user groups in West Hawai'i. Four aquarium representatives (three collectors and one aquarium shop owner) were members of the WHFC, 40% of the WHFC were maka'āinana (i.e., native fishers) and most of the members were previously on the West Hawai'i Reef Fish Working Group (WHRFWG). The WHRFWG included over 70 members of the West Hawai'i community including aquarium collectors and charter operators and other stakeholders. The group held 9 meetings over a 15-month period. The WHRFWG opened a dialog between user groups and community members and provided a forum for the education of its members on social and biological issues involved in resource management.*

The WHFC developed a FRA plan consisting of nine separate areas along the west coast of the Island of Hawai'i (Figure 1) encompassing a total of 35.2% of the West Hawai'i coastline (including already protected areas). The WHFC's FRA plan was subsequently incorporated by the DLNR into administrative rule. The FRA administrative rule became effective on December 31, 1999.

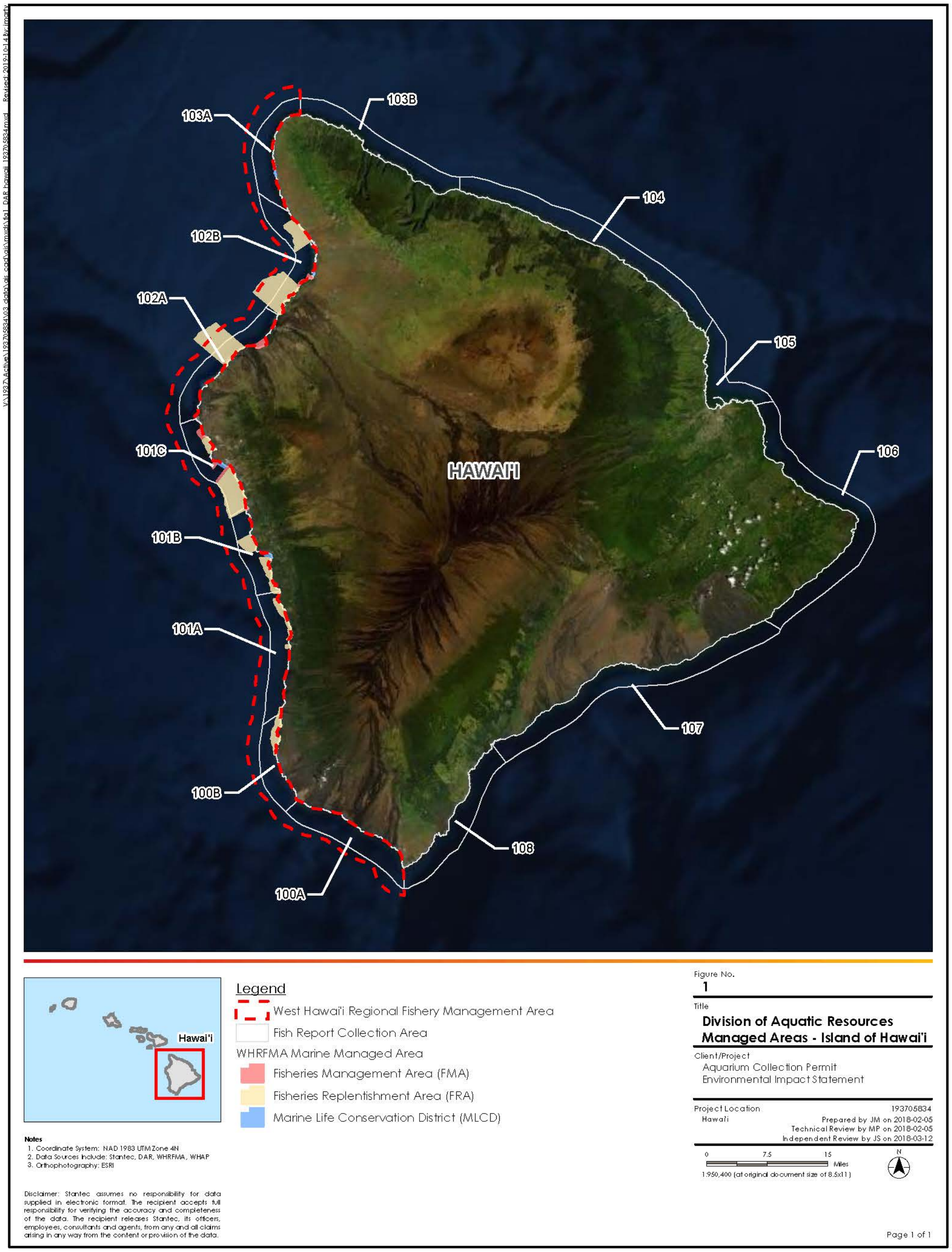


Figure 1. Division of Aquatic Resources Managed Areas - Island of Hawai'i.

The FRAs prohibit all collecting of aquarium animals within their boundaries as well as non-fishing related fish feeding. The seaward boundaries of the FRAs extend to a depth of 600 feet (100 fathoms) and distinctive signs mark the boundaries on shore; although some have fallen into disrepair and are not easily observed (Big Island Association of Aquarium Fishers [BIAAF] pers. comm.).

In addition to the development of the FRA network, the WHFC, in conjunction with the DAR and University of Hawai'i Sea Grant, also implemented the following initiatives:

1. Sea Urchin Limited Harvest: The WHFC developed a management plan permitting the sustainable harvest of *Wana* (long-spine/black sea urchin) at Makae'o, the Old Kona Airport Marine Life Conservation District (MLCD). This recommendation was adopted by the DLNR as an administrative rule amendment in 2005.

2. Gill Net Rules: The WHFC developed a set of gill net rule recommendations focused on limiting impacts of large-scale commercial netting while providing for subsistence netting. This recommendation was adopted as an administrative rule amendment in 2005 and served as a model for the statewide gill net rule (HAR §13-75-12.4) which was adopted in 2007.

3. Day-Use Mooring Buoys: In collaboration with the Malama Kai Foundation, the WHFC is a working partner in the site selection process and educates communities on the value of day use moorings to preserve our coral reefs.

4. Ka′ūpūlehu Marine Reserve: DAR worked with the WHFC and the Ka'ūpūlehu Marine Life Advisory Committee (KMLAC) to develop draft rules to re-designate the Ka'ūpūlehu Fish Replenishment Area as a Marine Reserve where the take of nearshore marine life will be prohibited for 10 years, with exceptions to allow for the continued collection of pelagic and deep benthic species using specific fishing gear. The proposal is the initial first step in complying with the statutory mandate of HRS §188F-4(3) to establish a portion of the FRAs where no fishing of reef-dwelling fish is allowed. In October 2014, the Board of Land and Natural Resources (BLNR) approved holding a Public Hearing on this rule amendment. The rule subsequently took effect on July 29, 2016. Several other local communities are actively engaged in developing management recommendations which include some form of a highly protected nearshore area.

5. Self-contained underwater breathing apparatus (SCUBA) Spear Fishing Prohibition: The WHFC proposed banning SCUBA (and rebreather) spear fishing in West Hawai'i as is the case in most other Pacific island jurisdictions.

6. Pebble Beach User Conflict: The WHFC drafted recommendations addressing a conflict between aquarium collectors and this South Kona community. It recommended creating a new FRA in the Pebble Beach area and opening up to collecting a similarly sized section of another FRA (by a non-residential area). The latter part of the 'swap' was subsequently rejected by aquarium collectors. The Big Island Association of Aquarium Fishermen (BIAAF) agreed to the creation of the Pebble Beach FRA, with nothing in return, as an act of good faith to further mitigate user conflict (BIAAF, pers. comm.). The BIAAF conceded directly with the representatives of the "Friends of Pebble Beach." The meeting was orchestrated DAR.

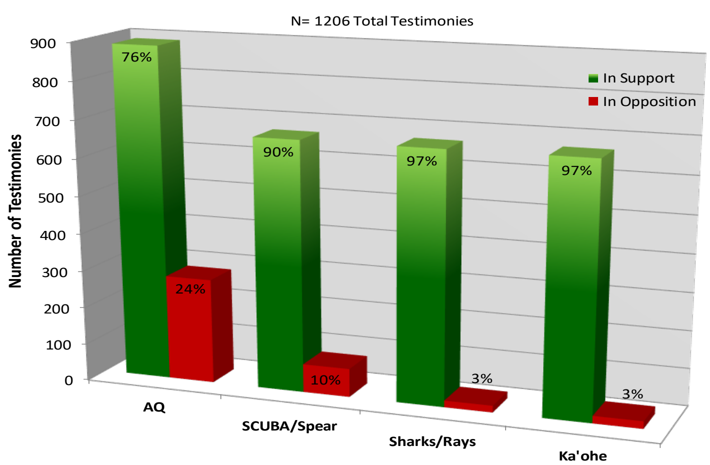
7. Aquarium 'White List' (Section 4.4.1): Working with commercial aquarium collectors the WHFC established a list of 40 fish species permitted for aquarium take. Only those fish found on the White List can be collected live for aquarium use. All other fishes and all invertebrates are off-limits to collecting. Size and bag limits are also established for three of the species on the White List, Yellow Tang, Kole, and Achilles Tang.

8. Species of Special Concern: Prohibition on the take or possession of nine species of inshore sharks and rays and two invertebrate crown-of-thorns predators (Table 1-2).

Table 1-2. List of marine species for which all take or possession is prohibited.

Common Name	Scientific Name	Hawaiian Name
Spotted Eagleray	*Aetobatus narinari*	*Hīhīmanu*
Broad Stingray	*Dasyatis lata*	*Hīhīmanu*
Pelagic Stingray	*Pteroplatytrygon violacea*	*Hīhīmanu*
Hawaiian Stingray	*Dasyatis hawaiiensis*	*Hīhīmanu*
Tiger Shark	*Galeocerdo cuvier*	*Manō/niuhi*
Whale Shark	*Rhincodon typus*	*Lele wa'a*
Whitetip Reef Shark	*Triaenodon obesus*	*Manō lālākea*
Blacktip Reef Shark	*Carcharhinus melanopterus*	*Manō pā'ele*
Gray Reef Shark	*Carcharhinus amblyrhynchos*	*Manō*
Triton's Trumpet	*Charonia tritonis*	*'Ōlē*
Horned Helmet	*Cassis cornuta*	*Pū puhi*

Initiatives identified above and shown in Figure 2 received overwhelming support during the Hawai'i Administrative Rule public hearing process and were adopted as a new administrative rule (HAR 13-60.4) which became effective December 26, 2013.



AQ – Aquarium White List; Ka'ohe – Pebble Beach

Figure 2. Summary of all public testimonies on the WHRFMA rule (DAR 2014a).

1.2.3.2 HAR 13-60.4

In addition to incorporating Act 306 into the Hawai'i Administrative Rules, HAR 13-60.4 identified West Hawai'i Aquarium Permit Terms and Conditions by implementing the following provisions:

- No person shall engage in aquarium collecting activities within the WHRFMA without first having been issued and possessing a West Hawai'i Aquarium Permit in addition to a valid State of Hawai'i aquarium fish permit.
- Collectors must carry either their Commercial Marine License (CML) card with both State of Hawai'i and West Hawai'i Aquarium Permit endorsements or their recreational aquarium fish permit card while collecting fish within the WHRFMA.
- In addition to applying any other penalties provided by law, the DLNR may revoke any West Hawai'i Aquarium Permit for any infraction of these rules or the terms and conditions of the permit, and any person whose permit has been revoked shall not be eligible to apply for another West Hawai'i Aquarium Permit (commercial or recreational) until one year from the date of revocation.
- Aquarium collectors (commercial and noncommercial) may take or possess only the 40 "White List" fish species.
- It is prohibited for anyone to take more than 5 Yellow Tang (*Zebrasoma flavescens*) larger than 4.5 inches in total length (TL) or more than 5 Yellow Tang smaller than 2 inches TL per day or possess more than this amount at any time while within the WHRFMA. (Note: This is called a slot limit and is meant to protect the breeding population. Yellow Tang become sexually mature at 4.5 inches TL and begin reproducing [Bushnell 2007]).
- It is prohibited for aquarium collectors to take or possess more than 5 Kole (= Goldring Surgeonfish, Yelloweye, Goldring) (*Ctenochaetus strigosus*) larger than 4 inches TL per day. Again, this measure is meant to protect the breeding population.
- It is prohibited for aquarium collectors to take or possess more than 10 Achilles Tang (*Acanthurus achilles*) of any size per day.
- It is prohibited to possess aquarium collecting gear or possess fish taken for aquarium purposes on a vessel after sunset or before sunrise without prior phone notification to the DAR Kona office. Such notification will allow the possession of more than one day's bag limit for Yellow Tang, Kole and Achilles Tang on multiple day trips.
- Aquarium collection is prohibited within FRAs, FMAs, and MLCDs. Note that a new FRA has been established in South Kona at Ka'ohe Bay (Pebble Beach) where no aquarium collecting, or recreational fish feeding is allowed.
- It is prohibited to take or possess aquarium collecting gear or fish taken for aquarium purposes on a vessel that is adrift, anchored, or moored within any of the areas prohibiting aquarium collecting.

- All aquarium collecting vessels shall be registered every year with the DAR Kona office. The current vessel identification number issued by either the DLNR or the U.S. Coast Guard (USCG) shall serve as the registration number for each vessel. After the initial vessel registration renewal can be done via mail or online.

- All aquarium collecting vessels shall permanently affix the capital letters “AQ” to both sides of the vessel. The "AQ" letters shall be no less than 6 inches high and 3 inches wide in either black or a color that contrasts with the background color of the vessel.

- Aquarium vessels must fly a "stiffened" flag or pennant from the vessel with the letter "A" as specified by the DLNR. The flag or pennant shall be displayed and clearly visible from both sides of the vessel at all times while aquarium collecting gear or collected aquarium fish, or both are onboard. The flag or pennant shall be provided at cost to West Hawai’i Aquarium Permittees.

- Aquarium vessels must display a dive flag at all times when divers are in the water.

- In the event an aquarium collecting vessel becomes inoperable while at sea, the operator of the vessel shall immediately notify the DLNR’s Division of Conservation and Resources Enforcement (DOCARE) or USCG or both by VHF radio or by cellular phone.

- It is prohibited to possess or use any net or container employed underwater to capture or hold fish taken for aquarium purposes that is not labeled with the CML number (or numbers) of the person (or persons) owning, possessing, or using the equipment. Clearly mark each piece of the above gear with your CML number. There is no specific marking requirement as to size or color of lettering other than the CML number must be clearly visible and legible.

- Aquarium collectors must submit each month’s daily aquarium fishing trip reports before every 10th day of the following month.

- Recreational aquarium collectors, without a valid CML, may not take more than a total of five of the White list fish specimens per person per day. Recreational aquarium collectors may not sell collected fish.

- A control date was established on August 1, 2005, to possibly limit participation in the WHRFMA commercial aquarium fishery. Persons who begin fishing in the WHRFMA commercial aquarium fishery on or after the control date will not be assured continued participation in the fishery if the DLNR establishes an aquarium limited entry program in the future. Nothing in this chapter shall prevent the DLNR from establishing another control date.

- It is prohibited to engage in or attempt to engage in SCUBA spearfishing and/or possess both SCUBA gear and a spear or speared aquatic life.

As indicated above, HAR 13-60.4 had overwhelming public support, with 76% of all testimony in favor of the rules, and 85% of testimony from West Hawai’i being supportive, the area most closely associated with the rule (Walsh 2013).

Coral/Live Rock Damage

State law prohibits the breaking or damaging, with any implement, any stony coral from the waters of Hawai'i, including any reef or mushroom coral (HAR 13-95-70). It is unlawful to take, break or damage, any implement, any rock or coral to which marine life of any type is visibly attached or affixed (HAR 13-95-71). The taking of sand, coral rubble or other marine deposits is permitted in certain circumstances. The material may not exceed one gallon per person per day, and may be taken only for personal, noncommercial purposes (HRS § 171-58.5, § 205A-44).

Fines per specimen may be imposed for each damaged coral head or colony less than one square meter in surface area or for a colony greater than one square meter in surface area, each square meter of colony surface area and any fraction remaining constitutes an additional specimen. Penalties for damage to live rock are based on each individual rock or if the violation involves greater than one square meter of bottom area, then the penalty is based on each square meter of bottom area.

No liability shall be imposed for inadvertent breakage, damage, or displacement of an aggregate area of less than one half square meter of coral if caused by a vessel with a single anchor damage incident, in an area where anchoring is not otherwise prohibited, and not more frequently than once per year; or by accidental physical contact by an individual person.

2.0 PURPOSE AND NEED

2.1 PURPOSE FOR APPLICANT'S ACTION

The purpose of the Applicant's action is to ensure that commercial aquarium fish collection allows for the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats. The objective of the proposed action is to allow for the issuance of Commercial Aquarium Permits to 14 fishers for the WHRFMA.

2.2 NEED FOR APPLICANT'S ACTION

The need for the Applicant's action is to continue commercial aquarium fishers' livelihoods in compliance with all applicable laws, rules, and regulations pertaining to the industry.

2.3 PURPOSE FOR APPROVING AGENCY'S (DLNR) ACTION

The purpose of an environmental review process under the HEPA is to provide the Approving Agency (DLNR) with the framework necessary for reviewing the Applicant's action and the environmental effects of issuing Aquarium Permits for the WHRFMA. The HEPA review also provides an opportunity for the public to be involved in the DLNR's decision-making process. The DLNR can also use a properly conducted HEPA analysis to review and improve plans, functions, programs, and resources under its jurisdiction. Furthermore, this DEIS is the mechanism for recording the results of a comprehensive planning and decision-making process surrounding the Applicant's action.

The underlying purpose of the DLNR's action is to determine the level of significance that issuing 14 Aquarium Permits for the WHRFMA, may have on the environment, based on the 13 criteria listed in Section 1.2.2, with emphasis on the 5 criteria the DLNR determined to need further evaluation (Section 1.1.2). The final determination will be either acceptance or non-acceptance.

2.4 NEED FOR APPROVING AGENCY'S (DLNR) ACTION

The need for DLNR's action is the Applicant's submittal of this DEIS, to which the DLNR must respond.

2.5 SCOPE OF ANALYSIS

The scope of this DEIS's analysis incorporates accepted methods, regulations, and historical data to determine past influences the commercial aquarium fishery and its management have had on resources, including socioeconomic, cultural, and biological resources, in order to evaluate the potential direct, indirect, and cumulative impacts that the five alternatives presented in Section 3.0 would have annually over a 5-year period for the island of Hawai'i, including the WHRFMA. Regarding biological resources, this DEIS focuses primarily on the effects of aquarium fishing on wild populations of White List Species, as it is at the population level that DAR measures changes in White List Species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population.

Commercial Aquarium Permits issued by DLNR under HRS §188-31 are valid for no longer than one year and, therefore, must be renewed annually. Accordingly, every year, DLNR must take an action to issue Aquarium Permits. As Aquarium Permits for the 14 fishers requesting permits come up for renewal each year, DLNR will evaluate whether there are significant new circumstances or information relevant to environmental concerns and bearing on the commercial aquarium fishery or its impacts requiring a supplemental HEPA review. Under this approach, any changes in resource data (e.g., increase or decrease in population estimates, unforeseen circumstances, etc.) would be addressed, as necessary, by supplemental HEPA documents, allowing for the HEPA process to quickly recognize and address any potential issues. Section 5.0 addresses the cumulative impacts of reasonably foreseeable future commercial aquarium collection.

2.5.1 Resources Evaluated and Dismissed from Further Consideration

This DEIS evaluates the impacts of five commercial aquarium fish collection alternatives on the nearshore habitat (0-600 feet; 0-100 fathoms) in which commercial aquarium fishing (or lack thereof) would take place over a 5-year period. During the evaluation process, it was determined that some resources typically evaluated in an EIS would not be impacted by any of the alternatives under consideration. The evaluation includes past use and potential impacts by the commercial aquarium fishery because it has been a part of the baseline condition of these resources since the late 1940s. Because a significant increase in commercial aquarium fishing is not anticipated during the 5-year assessment period evaluated in this DEIS, and in fact a decrease when compared to historic conditions is anticipated due to the issuance of only 14

Aquarium Permits, this DEIS does not anticipate a significant change in the current baseline condition of these resources.

The proposed action and resulting commercial aquarium collection does not include any activities different from or in addition to those that have occurred in the past. There would be no construction of permanent or semi-permanent infrastructure, no discharges into coastal, surface or ground waters, and no dredging, and no significant use of hazardous materials that could be released into the environment.

The DLNR's issuance of 14 Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts to water and air quality, geology and soil resources, aesthetics, noise, vegetation, terrestrial wildlife and avian species, threatened and endangered species, land use, public health and safety, communications, transportation, utilities, or population and demographics from the current baseline condition, therefore, these resources will not be evaluated further.

2.5.2 Resources Retained for Further Analysis

The following resources could be impacted by the alternatives under consideration. Current baseline conditions of these resources are presented in Section 4.0 and impacts to these resources are evaluated in Section 5.0 of this DEIS:

- Socioeconomic Resources
- Cultural Resources
- Physical Resources
    - Climate
- Biological Resources
    - White List Species
    - Non-White List Species
    - Hawai'i Species of Greatest Conservation Need
    - Reef Habitat

3.0 ALTERNATIVES

Reasonable alternatives include those that are practical or feasible from cultural, scientific, technical, and economic perspectives. The HEPA recommends that applicants consider and objectively evaluate reasonable alternatives to the preferred alternative and briefly explain the basis for eliminating any alternatives that were not retained for detailed analysis.

The DLNR has been working with stakeholders (e.g., public, various fishing and tourism industries, local governments) since the 1970's, and continues to work with them to ensure the commercial aquarium fishery is environmentally sustainable and prevents degradation of fish populations and the habitats in which they occur. As a result, many aspects of the fishery have changed over the past 40+ years due to the various alternatives recommended by stakeholders and implemented by the DLNR. The Applicant has no legislative or regulatory authority and cannot create, eliminate, or alter conservation areas (e.g., MPAs, FRAs, MLCDs); create, eliminate, or alter current regulations (e.g., bag and size limits, season length, permit term); or change reporting requirements. Despite this, during the public comment period on the Draft EA that was published on April 8, 2018, in response to DLNR concerns and in coordination with the DLNR, the Applicant developed an alternative that required regulation creation by DLNR (i.e., implementation of bag limits). After review of the EA, the DLNR determined on July 26, 2018 that preparation of an EIS is required based on five specific significance criteria outlined in Title II, Chapter 200, Hawai'i Administrative Rules (Criteria 1,2,3,4, and 8, see Section 1.1.2). Based on public and DNLR comments on the Draft and Final EAs, the Applicant has analyzed five alternatives in the EIS, including a new Preferred Alternative based on issuance of a limited number of Aquarium Permits. These alternatives were evaluated based on their capacity to meet the purpose and need of the Approving Agency's action (Sections 2.3 and 2.4). The potential effects on the environment for each alternative are described and analyzed in Section 5.0; Environmental Consequences. The alternatives are summarized in Table 3-1 and discussed in detail in Sections 3.1 through 3.5.

Table 3-1. Summary of alternatives.

Alternative	WHRFMA	East Hawai'i
No Action	No Aquarium Permits issued; no commercial aquarium collection allowed	No Aquarium Permits issued; commercial collection allowed without the use of fine mesh nets
Pre-Aquarium Collection Ban	Unlimited # of Aquarium Permits issued	Unlimited # of Aquarium Permits issued
WHRFMA-Only Programmatic Issuance of Permits	Unlimited # of Aquarium Permits issued	No Aquarium Permits issued; commercial collection allowed without the use of fine mesh nets
Achilles Tang Conservation	Unlimited # of Aquarium Permits issued; bag limit reduced for Achilles Tang	Unlimited # of Aquarium Permits issued
Limited Permit Issuance (Preferred)	14 Aquarium Permits issued; bag limit reduced for Achilles Tang	No Aquarium Permits issued; commercial collection allowed without the use of fine mesh nets

3.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the court order would remain in place, and no Aquarium Permits would be issued for the entire island of Hawai'i and the taking of aquarium fish or other aquatic life in the WHRFMA for commercial aquarium purposes would be prohibited. The No Action Alternative meets the DLNR's objectives to ensure an applicant's actions do not lead to degradation of fish populations and the habitats in which they occur in the context of commercial aquarium collection alone (i.e., does not address impacts from other Hawaiian fisheries and influences discussed in Sections 4.0 and 5.0). Under the No Action Alternative, Aquarium Permits would not be issued for the island of Hawai'i, including the WHRFMA, and commercial collection of aquarium fish and other aquatic life in the WHRFMA would be prohibited. In East Hawai'i, aquarium collection using legal gear or methods other than fine-mesh nets would continue. However, the No Action Alternative does not meet the Applicant's purpose and need to continue fishers' livelihoods participating in lawful, responsible, and sustainable commercial collection of approved fish species from nearshore habitats (0-600 feet; 0-100 fathoms).

3.2 PRE-AQUARIUM COLLECTION BAN ALTERNATIVE

Under the Pre-Aquarium Collection Ban Alternative, the DLNR would issue an unlimited number of Aquarium Permits as was done prior to the September 6, 2017 Supreme Court ruling, thereby allowing commercial aquarium fish collection on the island of Hawai'i, including the WHRFMA, to resume. Permittees would abide by all existing rules and regulations set forth in HRS 189-2,3 (Commercial Marine Permit), HRS-188-31 (Section 1.2.1), governing Aquarium Permit use, and would obtain a West Hawaiʻi Aquarium Permit as required under HAR 13-60.4 (Section 1.2.3.2). These rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, collection in the WHRFMA restricted to 40 White List Species only, and reporting requirements.

3.3 WHRFMA-ONLY PROGRAMMATIC ISSUANCE OF PERMITS ALTERNATIVE

Under the WHRFMA-only Programmatic Issuance of Permits Alternative, the DLNR would issue an unlimited number of Aquarium Permits for the WHRFMA, thereby allowing commercial aquarium fishing collection within the WHRFMA. No Aquarium Permits would be issued for areas outside of the WHRFMA (in East Hawai'i aquarium collection using legal gear or methods other than fine-mesh nets could continue but use of fine mesh nets would not be allowed). Permittees would abide by all rules and regulations set forth in HRS 189-2,3 (Commercial Marine Permit), HRS-188-31 (Section 1.2.1), governing Aquarium Permit use, and would obtain a West Hawaiʻi Aquarium Permit as required under HAR 13-60.4 (Section 1.2.3.2). These rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, collection in the WHRFMA restricted to 40 White List Species only, and reporting requirements.

3.4 ACHILLES TANG CONSERVATION ALTERNATIVE

Under the Achilles Tang Conservation Alternative, which was the preferred alternative in the Final EA, the DLNR would issue an unlimited number of Aquarium Permits, thereby allowing commercial aquarium fish collection on the island of Hawai'i, including the WHRFMA. Permittees would abide by all rules and regulations set forth in HRS 189-2,3 (Commercial Marine Permit), HRS-188-31 (Section 1.2.1), governing Aquarium Permit use, and would obtain a West Hawaiʻi Aquarium Permit as required under HAR 13-60.4 (Section 1.2.3.2). These rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, collection in the WHRFMA restricted to 40 White List Species only, and reporting requirements. In addition, under this alternative, the daily bag limit for commercial aquarium collection of Achilles Tang within the WHRFMA would be reduced from 10 per day to 5 per day.

3.5 LIMITED PERMIT ISSUANCE (PREFERRED) ALTERNATIVE

Under the Limited Permit Issuance Alternative, the DLNR would issue Aquarium Permits to 14 aquarium fishers in the WHRFMA, thereby allowing these 14 individuals to resume commercial aquarium fish collection in the WHRFMA. No Aquarium Permits would be issued for areas outside of the WHRMA (in East Hawai'i aquarium collection using legal gear or methods other than fine-mesh nets could continue but use of fine mesh nets would not be allowed). Permittees would abide by all rules and regulations set forth in HRS 189-2,3 (Commercial Marine Permit), HRS-188-31 (Section 1.2.1), governing Aquarium Permit use, and would obtain a West Hawai'i Aquarium Permit as required under HAR 13-60.4 (Section 1.2.3.2). These rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, collection in the WHRFMA restricted to 40 White List Species only, and reporting requirements. In addition, under this alternative, the daily bag limit for commercial aquarium collection of Achilles Tang within the WHRFMA would be reduced from 10 per day to 5 per day.

This Alternative is based on the best available science, supports the DLNR's purpose to ensure Applicant's Actions do not lead to degradation of fish populations and the habitats in which they occur in the context of commercial aquarium collection, specifically addresses concerns related to Achilles Tang conservation, and supports the Applicant's purpose and need to continue fishers' livelihoods participating in the lawful, responsible, and sustainable commercial collection of various fish species from nearshore habitats.

4.0 AFFECTED ENVIRONMENT

The affected environment is the area and its resources (i.e., socioeconomic, cultural, physical, biological) potentially impacted by the proposed action and the alternatives under consideration. The purpose of describing the affected environment is to define the current baseline of conditions in which the impacts would occur. To make an informed decision about which alternative to select, it is necessary to first understand which resources would be affected and to what extent each alternative would result in changes from the baseline. This section attempts to provide the baseline for this understanding. Relative to the proposed action, the affected environment includes nearshore habitats within the WHRFMA from a depth of 0-600 feet (0-100 fathoms) along the west coast of the island of Hawai'i, although most fishers collect the majority of fish at depths between 30-70 feet (5-11.7 fathoms), with minimal collecting beyond this range.

Commercial aquarium fish collection has been taking place in Hawaiian waters since the late 1940s. In 1953, the territorial government of Hawai'i enacted Act 154, which authorized the Board of Agriculture and Forestry to establish a permit system for the use of fine-mesh nets and traps for the taking of aquarium fish (DAR 2014a). Beginning in 1973, collectors were required to report their monthly catch on a detailed aquarium fish catch report. As of 2014, Aquarium Permit holders are required to keep daily trip reports and submit on a monthly basis. Since 1999 when FRA's were established, the number of commercial aquarium fishers working in West Hawai'i has ranged from 24-63, and in East Hawai'i from <3-18 (DAR 2018a). The 14 commercial fishers who are part of this proposed action made up 3 to 11 of the WHRFMA fishers in any given year from 2000 – 2017. Permitted commercial aquarium fishing has been a part of the socioeconomic, cultural, physical, and biological resources for decades and is considered a part of the baseline condition of the affected environment.

The DLNR's mission statement is to 'Enhance, protect, conserve and manage Hawai'i's unique and limited natural, cultural, and historic resources held in public trust for current and future generations of the people of Hawai'i nei, and its visitors, in partnership with others from the public and private sectors.' In pursuit of this mission, the DLNR has compiled, analyzed, and reported on the many facets of Hawai'i's socioeconomic, cultural, physical, and biological resources that make up the affected environment. The following sections rely heavily on the DLNR's *Hawai'i's Comprehensive Wildlife Conservation Strategy* (CWCS; Mitchell et al. 2005) and the DLNR's Hawai'i's State Wildlife Action Plan (SWAP; DLNR 2015), with numerous other sources cited as appropriate.

4.1 SOCIOECONOMIC RESOURCES

The state of Hawai'i has four local governments: The City and County of Honolulu (island of O'ahu and the Northwestern Hawaiian Islands), the County of Kaua'i (islands of Kaua'i and Ni'ihau), the County of Maui (islands of Maui, Moloka'i, Lāna'i and Kaho'olawe), and the County of Hawai'i (island of Hawai'i). Hawai'i also has a fifth county, Kalawao County, which does not have a separate government unit (Mitchell et al. 2005). Kalawao County covers the former Hansen's disease settlement at Kalaupapa (Moloka'i) and is managed by the National Park Service (NPS) under a cooperative agreement with the State Department of Health (Mitchell et al. 2005).

The population of the island of Hawai'i was estimated at 185,079 in 2010. By 2018, the population is estimated to have grown by 8.4% to 200,983 (HDBEDT 2019). The number of people on the island of Hawai'i at any given time, however, is heavily influenced by tourists. Of the approximately 9.3 million visitors who arrived by air to the state in 2017[4], 19.0% (1.76 million people) spent time on the island of Hawai'i and 9.1% stayed entirely on the island of Hawai'i. Approximately 16.3% of visitors spent time in West Hawai'i while 7.1% spent time on the east side (HTA 2018).

In 2016, Hawai'i employed 647,544 people and generated $31.2 billion in wages and $84.9 billion in gross domestic product. Hawai'i's ocean economy in 2016 employed 118,083 people and generated $4.5 billion in wages and $8.6 billion in gross domestic product. The ocean economy accounted for 18.2% of Hawaii's employment, 14.3% of its wages, and 10.2% of its gross domestic product (NOAA 2019).

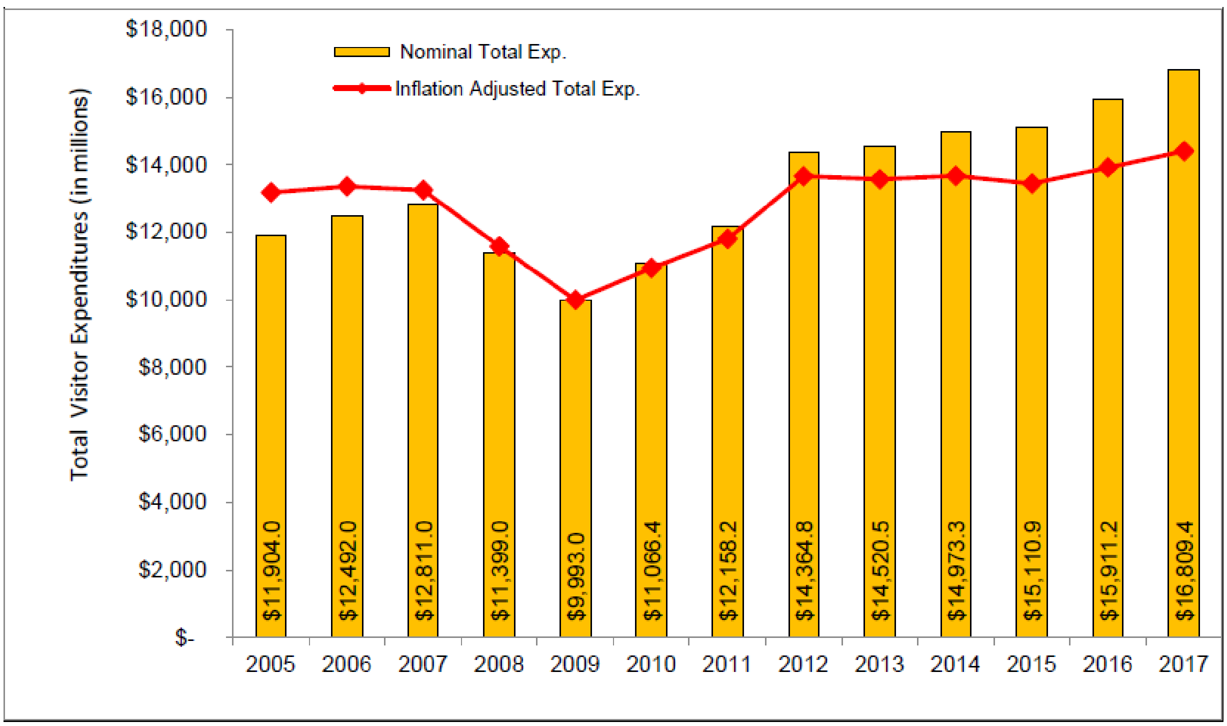
Much of the state's economy is based on the island's coastal and marine resources. Tourism accounts for the majority of the state's economy, with a significant portion of the tourist activities associated with beaches and marine wildlife (DLNR 2015). Coastal development and land values have both increased with the growth in tourism. In 2002, the Hawai'i Coral Reef Initiative funded a study regarding the economic valuation of the coral reefs of Hawai'i, where the value of coral reefs to the Hawai'i economy was estimated to be about $380 million dollars per year (DLNR 2015). In 2001, Cesar et al. documented the annual recreational value of the coral reefs of the Hawaiian reefs for snorkelers and divers was estimated to be $281 million and $44 million, respectively. Although the direct expenditure per diver is much larger than the direct expenditures of snorkelers, the overall value related to the latter group is much larger due to their large numbers. According to the 2019 National Oceanic and Atmospheric Administration (NOAA) Report on the Ocean and Great Lakes Economy of the United States, in 2016 (most recent data), Hawai'i employed 647,544 people and generated $31.2 billion in wages and $84.9 billion in gross domestic product. Hawai'i's ocean economy then employed 118,083 people and generated $4.5 billion in wages and $8.6 billion in gross domestic product. The ocean economy accounted for 18.2% of Hawaii's employment, 14.3% of its

[4] An additional 126,733 visitors arrived via cruise ship (HTA 2018) and are not included in further analysis due to the small proportion of total tourism.

wages, and 10.2% of its gross domestic product (NOAA 2019). Commercial fish landings in Hawai‘i have increased annually since 2006, and NOAA reported total landings in 2013 were valued near $108 million dollars (DLNR 2015).

Hawai‘i’s tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. Total spending by visitors to the Hawaiian Islands increased 5.6% to a new high of $16.21 billion (HTA 2018). When adjusted for inflation, total visitor spending was up 3.5% from 2016 (Figure 3). A total of 9,404,346 visitors came by air or by cruise ship to the state, up 5.3% from the previous record of 8,934,277 visitors in 2016. Total visitor days rose 4.8% compared to 2016. The average spending per day by these visitors ($198 per person) was also higher than 2016 ($197 per person; HTA 2018).

Arrivals by airlines in 2017 grew 5.2% to 9,277,613 visitors. Additionally, there were 126,733 visitors who came to the islands by cruise ship, which was an increase of 12.7% from 2016 (HTA 2018).



Note: Implicit price deflator (2009=100)
Source: 2017 State of Hawai‘i Data Book Table 7.35.

Figure 3. Total visitor spending: nominal and real 2005-2017 (HTA 2018).

Total Spending by Category (HTA 2018):

- Lodging was the largest spending category by visitors to Hawai’i, rising 3.4% to $6.96 billion and making up 41.4% of the total visitor spending in 2017.

- Food and beverage was the second largest category, increasing 6.4% to $3.48 billion (20.7%) of total visitor spending in 2017.
- Shopping expenses rose 5.0% to $2.36 billion.
- Transportation expenditures rose 7.9% to $1.67 billion.
- Entertainment and recreation spending rose 10.8% to $1.57 billion.
- Supplemental business spending grew 5.9% to $125.1 million. This includes additional business spending spent locally on conventions and corporate meetings by out-of-state visitors that were not included in personal spending (i.e., costs on space and equipment rentals, transportation, etc.).

The military has a significant presence in Hawaiʻi with large Naval installations located on estuarine and coastal areas such as Pearl Harbor and Kāneʻohe Bay on Oʻahu, the Pacific Missile Range Facility on the south shore of Kauaʻi, and the Pōhakuloa Training Area on the Hawai'i, the largest United States Department of Defense installation in the state of Hawai'i, or anywhere in the Pacific.

The history of Hawai'i has always included agriculture, and it continues to be an important industry, adding $2.9 billion to the state's annual economy, and providing 42,000 direct and indirect jobs (HDA 2013). The sugar and pineapple industries boomed during the plantation era, covering thousands of acres of prime agricultural lands. As these industries have been declining, these lands are being converted to smaller farms growing diversified agricultural product (HDA 2013). Specialty exotic fruits, coffee, macadamia nuts, flowers and foliage are examples of crops that have become major exports to destinations around the globe, as well as providing fresh produce and flowers to local Hawaiian markets. High-tech aquaculture ventures have evolved from the early fishponds, farming varieties of fish, shrimp, lobster, abalone, and seaweed (HDA 2013).

4.1.1 Socioeconomic Aspects of the Commercial Aquarium Fishery

Commercial aquarium fishers on the island of Hawai'i often perform day or short overnight trips, operate individually or in small groups of two or three people, and use SCUBA and barrier nets (nets used to exclude, contain, or direct fish) to capture fish (Stevenson et al. 2011). Most aquarium fishers are between the ages of 40 and 60 years, have remained active in the fishery for more than 20 years, and fish approximately 3–4 days per week (Stevenson et al. 2011). Commercial aquarium fishers are required to report their monthly catch on an aquarium fish catch report separate from, and more detailed than, the CML reports.

The commercial aquarium fishery has contributed an average of $2,172,028 (inflation-adjusted 2019 dollars) to the State's economy over the past 18 years (Table 4-1). According to DAR (2019a), the marine aquarium fishery is the most economically valuable commercial inshore fishery in the State of Hawai'i, with 68% of the value coming from the Island of Hawai'i, mainly West Hawai'i.

Table 4-1. Summary of commercial Aquarium Permits and values by year from 2000-2017 for the State of Hawai'i (DAR 2018a). These data include n.d. data and summation of East and West Hawai'i data, as well as the other islands that make up the state of Hawai'i.

Fiscal Year[1]	Number of Commercial Aquarium Permits	Number Reporting	Total Value	Total Value Adjusted for Inflation[2]
2000	113	82	$1,000,750	$1,491,077
2001	128	75	$936,811	$1,357,958
2002	139	63	$935,009	$1,333,497
2003	123	68	$1,174,168	$1,637,269
2004	145	77	$1,442,946	$1,959,863
2005	142	79	$1,579,370	$2,074,862
2006	186	87	$2,093,857	$2,664,797
2007	195	99	$1,646,167	$2,037,015
2008	178	94	$2,065,816	$2,461,779
2009	197	92	$1,894,015	$2,265,107
2010	178	91	$2,282,618	$2,685,794
2011	172	87	$2,188,227	$2,495,946
2012	166	77	$2,306,179	$2,577,152
2013	153	64	$2,172,561	$2,392,786
2014	165	61	$2,322,564	$2,517,161
2015	163	69	$2,502,178	$2,708,609
2016	166	66	$2,257,021	$2,412,789
2017	226	68	$1,932,747	$2,023,037
Average	**163**	**78**	**$1,818,500**	**$2,172,028**

[1]Fiscal year runs from July 1 through June 30.
[2]http://www.usinflationcalculator.com/, adjusted for 2019 values in August 2019.

In 2017, the commercial aquarium fishery on the island of Hawai'i reported landings near $1.4 million, with more than $1.29 million coming from the WHRFMA (DAR 2018a). For the 14 fishers requesting commercial Aquarium Permits under the Proposed Action, 3 to 11 fishers reported catch in any given year between 2000 and 2017, contributing from 22.3% to 69.1% to the total overall WHRFMA fishery value (Table 4-1).

Since 2000, the commercial aquarium fishery within the WHRFMA on the island of Hawai'i has averaged annual landings valued at approximately $1.4 million, with a low of approximately $731,828 (inflation-adjusted 2019 dollars) in 2000 and a high of $1,842,016 (inflation-adjusted 2019 dollars) in 2015 (Table 4-1; DAR 2018a).

It should be noted that the dollar value of these fisheries represents only the ex-vessel value, i.e., what the fishers are paid for their catch and does not include the value which would be generated by additional dealer and retail sales. The actual economic value of the catch is thus substantially greater than the ex-vessel value. A study done in 1994 found that the DAR reported total average value for FY 1993/FY 1994 at only $819,957 (Miyasaka 1994), while analysis in 1993 by an aquarium trade group (Hawai'i Tropical

Fish Association) estimated the total sales of Hawaiian aquarium fish (including freight and packaging) to be nearly 6 times this, at $4.9 million (Walsh et al. 2003).

Although specific export data do not exist for the aquarium fishery, it is clear that most of the aquarium catch is shipped out of the state to dealers on the mainland United States, Europe, and Asia (Dierking 2002). This is neither surprising nor atypical for commercial fisheries in Hawai'i (DAR 2019). For example, seafood exports of various Hawaiian species exceed 3.7 million pounds annually (Loke et al. 2012).

On the island of Hawai'i, the total aquarium catch and its value have continued to increase overall since the FRAs were established in 2000, while the number of reporting fishers has fluctuated (Table 4-1 and Table 4-2; DAR 2018a). Since FRAs were established, overall catch has not declined and recent work (Stevenson et al. 2013) has indicated that the economic status of West Hawai'i aquarium collectors has significantly improved since the FRA network was implemented (DAR 2019a).

Table 4-2. Number of Commercial Aquarium Permits and fishery value for the WHRFMA and East Hawai'i since 2000 (DAR 2018a). n.d. indicates data not disclosed due to Hawai'i confidentiality statute (Section 5.1).

	WHRFMA								East Hawai'i							Total for Island of Hawai'i (adjusted for inflation[2])
	All Fishers				14 Fishers Requesting Aquarium Permits				All Fishers				14 Fishers Requesting Aquarium Permits			
Fiscal Year[1]	# Aquarium Permits	# Permits Reporting	Total Value	Total Value Adjusted for Inflation[2]	# Permits Reporting	Total Value	Total Value Adjusted for Inflation[2]	% Contribution of 14 fishers	# Aquarium Permits	# Permits Reporting	Total Value	Total Value Adjusted for Inflation[2]	# Permits Reporting	Total Value	% Contribution	
2000	24[3]	25	$491,173	$731,828	4	$163,389	$243,443	33.3%	6	3	$11,832	$17,629	1	$3,255	27.5%	$749,457
2001	26	23	$506,749	$734,560	3	$113,166	$164,040	22.3%	8	0	$0	$0	0	$0	n/a	$734,560
2002	37	19	$529,182	$754,712	5	$181,425	$258,746	34.3%	n.d.	n.d.	n.d.	n.d.	0	$0	n/a	$754,712
2003	30	22	$666,153	$928,889	7	$258,395	$360,308	38.8%	9	n.d.	n.d.	n.d.	1	$18,414	n/a	$928,889
2004	53	30	$866,630	$1,177,089	7	$465,599	$632,394	53.7%	n.d.	n.d.	n.d.	n.d.	1	$3,579	n/a	$1,177,089
2005	41	34	$1,168,265	$1,534,782	8	$532,883	$700,063	45.6%	11	3	$25,263	$33,189	1	$18,574	73.5%	$1,567,971
2006	63	34	$1,459,004	$1,856,836	8	$591,659	$752,989	40.6%	11	6	$74,519	$94,838	1	$5,632	7.6%	$1,951,674
2007	61	40	$1,065,093	$1,317,977	8	$577,710	$714,875	54.2%	14	4	$33,648	$41,637	1	$1,290	3.8%	$1,359,614
2008	52	31	$1,308,629	$1,559,459	9	$819,040	$976,029	62.6%	17	9	$100,304	$119,530	1	$179	0.2%	$1,678,989
2009	55	30	$1,159,746	$1,386,974	9	$703,396	$841,212	60.7%	13	8	$84,022	$100,484	1	$33,737	40.2%	$1,487,458
2010	60	36	$1,582,644	$1,862,185	9	$858,973	$1,010,692	54.3%	12	7	$30,062	$35,372	1	$5,995	19.9%	$1,897,557
2011	60	42	$1,473,530	$1,680,745	9	$751,146	$856,776	51.0%	13	6	$41,238	$47,037	1	$3,249	7.9%	$1,727,782
2012	48	28	$1,504,487	$1,681,262	9	$897,493	$1,002,947	59.7%	16	7	$79,067	$88,357	2	$18,785	23.8%	$1,769,619
2013	45	26	$1,560,517	$1,718,701	8	$847,033	$932,894	54.3%	15	9	$68,234	$75,151	1	$22,573	33.1%	$1,793,852
2014	43	20	$1,570,057	$1,701,605	8	$983,943	$1,066,383	62.7%	18	7	$131,086	$142,069	2	$92,446	70.5%	$1,843,674
2015	38	19	$1,701,631	$1,842,016	9	$1,035,500	$1,120,929	60.9%	13	4	$104,110	$112,699	1	$40,532	38.9%	$1,954,715
2016	37	19	$1,582,011	$1,691,193	10	$1,087,884	$1,162,964	68.8%	15	4	$80,441	$85,993	1	$39,436	49.0%	$1,777,186
2017	57	21	$1,290,314	$1,350,592	11	$891,106	$932,735	69.1%	18	4	$91,790	$96,078	2	$38,198	41.6%	$1,446,670
Average	46	28	$1,193,656	$1,417,300	8	$653,319	$793,352	51.5%	13	5	$63,708	$72,671	1	$19,035	31.9%	$1,477,859

[1]Fiscal year runs from July 1 through June 30
[2]http://www.usinflationcalculator.com/, adjusted for 2019 values on August 21, 2019
[3]Includes permittee that captured individuals in 1999, but reported captures in 2000

Of the 40 fish species which can now be collected in West Hawai'i (i.e., White List Species), over 90% of the economic value between 2000 and 2017 was derived from four species: the Yellow Tang which made up 75.3% of the total value; the Achilles Tang which made up 7.1% of the total value; the Kole which made up 5.6% of the total value; and, the Black Surgeonfish (*Ctenochaetus hawaiiensis*; = Chevron Tang) which made up 4.9% of the total value. The remaining 36 species made up the remaining 7.2% of value during this time period (DAR 2018a).

4.2 CULTURAL RESOURCES

The cultural significance of each of the 40 White List Species is discussed in Section 4.4.1.

Cultural, historic, and archaeological resources were evaluated within the nearshore habitats (0-600 feet; 0-100 fathoms, where commercial aquarium collection occurs). A Cultural Impact Assessment (CIA) was prepared assessing the potential cultural impacts of issuance of 14 Aquarium Permits, and is included as Appendix A. A brief overview of cultural resources is provided here.

The ocean, its ecosystem, and the practice of fishing were and continue to be important in Native Hawaiian culture and tradition. The belief system of Native Hawaiians links people with all living and non-living things (Mitchell et al. 2005). Under this belief system, because all components of ecosystems were descended from *Wākea* (sky father) and *Papahanau-moku* (earth mother) and their offspring, *kini akua* (multitude of gods), both living and non-living elements possess spiritual qualities and *mana* (spiritual power). As such, Native Hawaiians, as *kanaka maoli* (native people), are guardians of these ecosystems and their well-being is directly related to the well-being of these ecosystems (Mitchell et al. 2005).

For example, areas such as *wao akua* (upland forests) are sacred places, the realm of the gods (Mitchell et al. 2005). Native Hawaiian land ownership and resource management were often based on a unit called the *ahupuaʻa*, which typically corresponded with what we today call watershed areas. This understanding of the link from uplands to the ocean was ahead of its time (Mitchell et al. 2005). *Kapu* (taboo) systems that limited certain classes or sexes from eating certain animals or fishing in certain places or at certain times may have aided in the conservation of some species (e.g., only men were allowed to eat *honu* (green sea turtle) and only royalty could eat certain fishes) (Mitchell et al. 2005).

Additionally, native species in Hawaiʻi play a significant role in Native Hawaiian culture. Historically, feathers from forest birds were used to make elaborate capes, leis, and helmets for the *aliʻi* (royalty). Whale ivory, shells, and shark's teeth were used for necklaces and other adornments (Mitchell et al. 2005). Fish and sea turtle bones were used as kitchen implements, tools, and fishhooks, while sea turtle shells and scutes were used as containers. Koa (*Acacia koa*) trees were used for the ocean-voyaging canoes (Mitchell et al. 2005).

Native wildlife also play an important role in Native Hawaiian culture as many species such as the *pueo* (*Asio flammeus sandwichensis* [Hawaiian short-eared owl]), ʻ*io* (*Buteo solitarius* [Hawaiian hawk]), ʻ*elepaio* (*Chasiempis sandwichensis* [Hawaiian elepaio]), ʻalalā (*Corvus hawaiiensis* [Hawaiian crow]), sea turtles (e.g., *Caretta* spp., *Chelonia* spp., *Dermochelys* spp., *Eretmochelys*, and *Lepidochelys* spp.), and sharks (*Hexanchus* spp.) are believed to be ʻ*aumakua* (ancestors or guardians) of certain Hawaiian families

(Mitchell et al., 2005). Hawaiian names have been given to many of the native wildlife and they have been incorporated into *oli* (chants) and *mo'olelo* (legends).

Native Hawaiian culture also contains specific customs, beliefs, and practices related to fisheries and aquatic resources (Maly and Maly 2003). Historical narratives include specific references to cultural sites, such as *ko'a* (on shore and in ocean fishing shrines and station markers), resources procurement sites (both on land and in the water), and the traditional and customary laws governing the care for, and use of, the wide range of resources from the uplands to the ocean (Maly and Maly 2003). These historical accounts demonstrate that Native Hawaiians worked the land, water, and marine resources and, through a system of religious-based fisheries management protocols, were able to sustain themselves through the natural resources of the islands (Maly and Maly 2003). Native Hawaiian traditions surrounding aquatic resources demonstrate the cultural-historical importance of fisheries and land in the lives of Native Hawaiians and form the basis for Native Hawaiian's cultural attachment to the ocean and fishing today (Maly and Maly 2003).

Historical accounts demonstrate that Native Hawaiians were expert fishermen, and that fishing was a skill passed down generation to generation (Maly and Maly 2003). Native Hawaiians relied on fishing in the ocean for subsistence and consumption and employed traditional fishing methods that included the use of nets, hooks and lines, baskets, and hands (Maly and Maly 2003). In addition to serving as a source of food, aquatic resources and the practice of fishing were also linked to religious practices. Fishing was associated with religious ceremonies and fishermen traditionally worshipped fishing gods and goddesses and performed rituals related to certain species of fish (Maly and Maly 2003).

Numerous other examples of the use of native plants and animals in both daily life and ritual exist. In present day Hawai'i, the link between Native Hawaiian culture and native species has not been lost and continues to be practiced in belief systems, as well as in traditional practices such as gathering of native plants for hula, traditional medicines, carving, weaving, and ceremonies (Mitchell et al. 2005).

Today, Native Hawaiian teachings play an increasing role in natural resource management, especially in areas of cultural significance like *Kaho'olawe* or *Wao Kele o Puna* (island of Hawai'i). The CWCS recognizes that the State and its agencies are obligated to protect the reasonable exercise of customarily and traditionally exercised rights of Native Hawaiians to the extent feasible, in accordance with Public Access Shoreline Hawai'i versus Hawai'i County Planning Commission and subsequent case law (Mitchell et al. 2005).

4.2.1 Cultural Aspects of the Commercial Aquarium Fishery

4.2.1.1 In the WHRFMA

From Jokiel et al. (2011):

> *For the past century Hawaiʻi has been dominated by a "Western" model of marine environmental management. Recently, however, there has been a renewed interest in the traditional management practices of ancient Hawaiians. Throughout Hawaiʻi, a growing cultural, sociological, and scientific movement is working to investigate and revive some of these traditional management tools and to integrate them with modern scientific methodology. The native islanders had devised and implemented every basic form of what are now considered modern marine fisheries conservation measures centuries ago, long before the need for marine conservation was even recognized in Western nations (Johannes 1982). Traditional restrictions on fishing in Hawaiʻi were achieved by the use of closed seasons, closed areas, size restrictions, gear restrictions, and restricted entry. Additional social, cultural, and spiritual controls strengthened the conservation ethic under the old system. Ancient Hawaiians used a holistic approach that we might now recognize and strive for as integrated coastal management. Bridging the gap between traditional management and Western science represents a challenge to researchers, government agencies, resource managers, cultural practitioners and organizations, and to the people of Hawaiʻi.*

Act 306 and formation of the WHFC (Section 1.2.3) played a significant role in bridging that gap by creating a new aquarium fish management plan that is much closer to the traditional Hawaiian system. Commercial aquarium fish collection has been on-going in Hawai'i since the late 1940's, with most fishers active in the fishery for more than 20 years and many active for 35 – 40 years. Protecting and preserving the reef, the fish, and the cultural heritage of both Hawai'i and the fishery, is in their best personal and business interest. Commercial aquarium fish collection is not a part of Native Hawaiian culture; however, Native Hawaiians do participate in and support the fishery and Hawaiian culture has been a significant aspect of the fishery's management since the 1970's. Although the process has been contentious at times, the WHFC has been successful. See Section 1.2.3.1 for a further description of their contributions and accomplishments. Section 4.4.1 summarizes the cultural significance of the White List Species.

4.2.1.2 Public and Private Aquariums

More than 700 million people visit zoos and aquariums worldwide each year, and these zoos and aquariums spent more than $350 million on wildlife conservation in 2008 (Gusset and Dick 2011). Visits to aquariums may be for entertainment or educational purposes (as cited in Cracknell et al. 2015), but there are psychological benefits as well. Cracknell et al. (2015) looked at the behavioral, physiological and psychological reactions of people viewing a large aquarium exhibit, and found greater reduction in heart rate, greater increases in self-reported mood, higher interest, and longer spontaneous viewing times when species diversity within the aquarium was higher. Aquarium fish are also sold to home aquaria owners, of which 70% report that their fish are calming and stress reducing (Kidd and Kidd 1999, as cited in Cracknell et al. 2015), and for this reason aquariums are often present in health care settings as well, to provide a relaxing and calm environment (Cracknell et al. 2015).

4.3 PHYSICAL RESOURCES

The Hawaiian Archipelago is composed of 8 main islands and approximately 124 smaller islands, reefs, and shoals spanning over 1,500 miles that vary in size from fractions of acres to thousands of square miles (Mitchell et al. 2005). The Archipelago was formed over the last 70 million years through volcanic eruptions from a relatively stationary hotspot beneath the slowly moving seafloor. The island of Hawai‘i is the youngest island, with island age increasing to the northwest as the Pacific plate carries the older islands away from the hotspot (Mitchell et al. 2005). Millions of years of erosion, subsidence, and reef building resulted in the formation of the atolls which form the Northwestern Hawaiian Islands and the submersion under the sea surface of the seamounts which used to be islands (Mitchell et al. 2005).

Located over 2,000 miles from the nearest continent, Hawai‘i is the most remote island chain in the world (Mitchell et al. 2005). Despite its relatively small area (less than 4.1 million acres), an elevation range from sea level to 13,796 feet results in Hawai‘i containing all the major known ecological zones. With a wide temperature range due to the elevational gradient and with average annual rainfall ranging from less than 15 inches to over 480 inches per year, Hawai‘i displays most of the earth’s variation in climatic conditions. Finally, Hawai‘i possesses many natural wonders: the most active volcano in the world, the wettest place on earth, the tallest seacliffs, and extensive coral reefs (Mitchell et al. 2005).

Due to the large number and the varied geology of the islands, Hawai‘i has diverse marine habitats, which range from estuaries, tidepools, sandy beaches, and seagrass beds to nearshore deep waters, extensive fringing and atoll reef systems, and smaller barrier reef systems (DLNR 2015). However, introduced mangroves have altered native coastal habitats in a number of places. The distribution of marine ecosystems in Hawai‘i is a result of island age, reef growth, water depth, exposure to wave action, geography, and latitude. The marine habitats found on each island depend on the type of island: large and young, mature, or drowned islands and seamounts (DLNR 2015). Large and young islands such as the island of Hawai‘i have recent lava flows and few, living structural coral reefs. Beaches are rocky except around bays, and drowned reefs may be found in deep waters or off parts of the east coast of Maui. Mature islands, such as O‘ahu and Kaua‘i in the Main Hawaiian Islands (MHI) and Nihoa and Necker in the Northwestern Hawaiian Islands (NWHI) are the most diverse, with habitat types ranging from estuaries and sandy beaches to rocky beaches and fringing and barrier reefs to lagoons with patch or pinnacle reefs. Drowned islands, such as atolls in the rest of the NWHI, are the remains of volcanic islands with habitats ranging from coral islets and benches to caves and terraces along the slope of the atoll (DLNR 2015).

4.3.1 Climate

Features of Hawai’i's climate include mild temperatures throughout the year, moderate humidity, persistence of northeasterly trade winds, significant differences in rainfall within short distances, and infrequent severe storms (Price 1983). For most of Hawai’i, there are only two seasons: "summer," between May and October, and "winter," between October and April. Hawai’i’s length of day and temperature are relatively uniform throughout the year. Hawai’i's longest and shortest days are about 13.5 hours and 11 hours, respectively, compared with 14.5 and 10 hours for Southern California and 15.5 hours and 8.5 hours for Maine (Price 1983). Uniform day lengths result in small seasonal variations in incoming solar radiation and, therefore, temperature. On a clear winter day, level ground in Hawai’i receives at least 67% as much solar energy between sunrise and sunset as it does on a clear summer day. By comparison the percentages are only 33 and 20 at latitudes 40 and 50 degrees respectively (Price 1983).

Over the ocean near Hawai'i, rainfall averages between 25-30 inches per year. The islands receive as much as 15 times that amount in some places and less than one third of it in others. This is caused mainly by orographic or mountain rains, which form within the moist trade wind air as it moves from the sea over the steep and high terrain of the islands (Price 1983). Over the lower islands, the average rainfall distribution resembles closely the topographic contours. Amounts are greatest over upper slopes and crests and least in the leeward lowlands. On the higher mountains, the belt of maximum rainfall lies between 2,000-3,000 feet and amounts decrease rapidly with further elevation. As a result, the highest slopes are relatively dry (Price 1983). Another source of rainfall is the towering cumulus clouds that build up over the mountains and interiors on sunny calm afternoons. Although such convective showers may be intense, they are usually brief and localized. Hawai'i's heaviest rains are come from winter storms between October and April. While the effects of terrain on storm rainfall are not as great as on trade wind showers, large differences over small distances do occur, because of topography and location of the rain clouds. Differences vary with each storm. Frequently, the heaviest rains do not occur in areas with the greatest average rainfall. Relatively dry areas may receive, within a day or a few hours, totals exceeding half of their average annual rainfall (Price 1983). The leeward and other dry areas receive their rainfall mainly from a few winter storms. Therefore, their rainfall is usually seasonal and, their summers are dry. In the wetter regions, where rainfall comes from both winter storms and trade wind showers, seasonal differences are much smaller (Price 1983).

At the opposite extreme, drought is not unknown in Hawai'i, although it rarely affects an entire island at one time. Drought may occur when there are either no winter storms or no trade winds (Price 1983). If there are no winter storms, the normally dry leeward areas are hardest hit. A dry winter, followed by a normally dry summer and another dry winter, can have serious effects. The absence of trade winds affects mostly the windward and upland regions, which receive a smaller proportion of their rain from winter storms (Price 1983).

The waters surrounding Hawaiʻi are affected by seasonal variations in climate and ocean circulation. The surface temperature of the oceans around Hawaiʻi follow a north-south gradient and range from 75˚F in the MHI to 68˚F to 72˚F in the NWHI in winter and spring to 79˚F - 81˚F throughout all the islands in the late summer and fall (DLNR 2015). The depth of the thermocline, where water temperature reaches 50˚F, is 1,500 feet northwest of the islands and 1,000 feet off the island of Hawaiʻi. Surface currents generally move east to west and increase in strength moving southward (DLNR 2015). The seas are rougher between islands than in the open ocean, because wind and water are funneled through the channels. Waves generated by north Pacific low-pressure systems are larger in the winter months than in the spring and are generally bigger on the northern shores of the islands than the southern shores. Marine organisms have adapted to these general climatological and oceanographic conditions (DLNR 2015).

Climate and oceanographic indicators highlight long-term trends and recent anomalous conditions in West Hawaiʻi's natural environment. The El Niño Southern Oscillation (ENSO), an irregular, large-scale climate phenomenon that drives changes in regional oceanic and atmospheric conditions, has shifted over the last four decades towards increased frequency and severity in El Niño conditions, with the recent 2015 El Niño as one of the strongest on record (Gove et al. 2016). Rainfall, which can influence salinity, temperature, sediment load, and nutrient concentrations in the marine environment, has been at or below the long-term average over the past 15 years while the intensity of short-term events has increased over the same time period. Long-term sea level, an important indicator for coastal erosion and flooding, is rising by an estimated 0.15 inch per year and is expected to reach 1.6 feet higher than present day levels by 2100. Sea surface temperature, an indicator of regional and climatic forcing that is highly influential to a myriad of ecological processes, was anomalously warm in recent years and reached a record level of thermal stress in September 2015, resulting in widespread and severe coral reef bleaching in West Hawaiʻi (Gove et al. 2016).

4.3.2 Physical Aspects of the Commercial Aquarium Fishery

Commercial aquarium fishers typically interact with physical resources within recreational dive limits (RDL), generally from 35-70 feet deep (BIAAF, pers. comm.). Deeper waters are fished to a lesser extent, in depths beyond RDL (130 feet). Habitats most often fished are shallow water reefs consisting of rich coral growth over rocky substrate. These reefs can be adjacent to the shoreline or apart and isolated far offshore, with the distance usually dictated by how fast the bathymetric relief occurs. Deep water fish are caught off the edge (ledge) of the reefs where the depth drops off rapidly. Coral cover diminishes and typically the habitat consists of rocks and sand.

Aquarium fish collection is generally carried out by divers equipped with some form of underwater breathing apparatus (e.g., SCUBA, surface supplied air, rebreather equipment). Most fishing activity occurs off of a boat, although some shore diving does occur infrequently. Divers use hand nets, usually in combination with the placement of short, bottom-set barrier nets. Nets are typically 30 feet in length and 6 feet in height. Sometimes even smaller fence nets are used. Most often the netting is considered “fine” with a stretched mesh size less than 1 inch. The net is always made of monofilament. Other gear may include “poker sticks” (i.e., lightweight fiberglass poles used to herd fish), catch baskets or keeps (i.e., containers into which catch is transferred).

Once the fisher(s) reaches the bottom he/she quickly identify fish of interest. Fish are typically gathered into groups utilizing poker sticks to move fish along the reef until a satisfactory number have accumulated. At this point, the fisher with the barrier net looks for a natural demarcation in the reef (e.g., strip of sand or rubble) to set the net. The net is set in a “V” formation to corral the fish as they are advanced into the net. The net is pulled back, halfway up creating a “pocket” and hooked onto bare substrate with some sort of fastener (e.g., rubber band). At this point the net is set and the fisher circles back on the gathered fish. The fish are then directed to the net and into the pocket. From the pocket, the fish are either scooped with a hand net, or collected by hand and transferred into a catch basket. All incidental catch is released immediately, and the net is gathered up. At the end of the dive the catch baskets are clipped onto a line suspended off the boat for a slow decompression.

4.4 BIOLOGICAL RESOURCES

Because of Hawaiʻi’s geographical isolation, many of its coastal and marine species are endemic (i.e., native or restricted to a certain country or area) to the Hawaiian Archipelago (including Johnston Atoll). Approximately 15 to 25% of the marine species are endemic to the Hawaiian Archipelago, one of the largest proportions of marine endemism for any island chain in the world (Randall 2007, DLNR 2015). Of the 612 known nearshore fish species in Hawai'i, 25% are endemic to the Hawaiian Archipelago (Randall 2007). Yet because of the isolation, Hawaiʻi has relatively low marine species richness (i.e., diversity), with approximately 580 shallow reef fish species in contrast to areas of the Pacific further west with thousands of species. In total though, Hawaiʻi still has over 6,000 marine species (DLNR 2015).

Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, including a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI). Conversely, there is connectivity around the island of Hawai'i, with fish from protected FRAs being documented to seed unprotected areas, highlighting the effectiveness of protected areas (Christie et al. 2010).

4.4.1 White List Species

Concerns over continued expansion of the commercial aquarium fishery and its effects in the Open Areas prompted DLNR in 2013 to establish a 'White List' of 40 species which can be taken by aquarium fishers in the WHRFMA (Table 4-3). All other species of fish and invertebrates are off limits within the WHRFMA. Although other aquatic life is allowed to be collected from the eastern side of the island of Hawai'i, these 40 species represent the majority of fish that are collected in East Hawai'i.

Table 4-3. White List Species (DAR 2019, Appendix A).

Common Name(s)	Scientific Name	Hawaiian Name(s)	Hawaiian Status[1]
Yellow Tang	*Zebrasoma flavescens*	*lāʻī pala, lauʻī pala*	Indigenous
Achilles Tang	*Acanthurus achilles*	*pākukui, pākuikui, pākuʻikuʻi*	Indigenous
Black Surgeonfish (chevron tang)	*Ctenochaetus hawaiiensis*	species of *kole*	Indigenous
Shortnose (Geoffroy's) Wrasse	*Macropharyngodon geoffroy*	species of *hīnālea*	Endemic
Goldrim Tang	*Acanthurus nigricans*	unknown	Indigenous
Fourspot Butterflyfish	*Chaetodon quadrimaculatus*	*lauhau*	Indigenous
Orangeband (Shoulder) Surgeonfish	*Acanthurus olivaceus*	*naʻenaʻe*	Indigenous
Orangespine Unicornfish (Clown Tang)	*Naso lituratus*	*umaumalei, kala umaumalei*	Indigenous
Forcepsfish	*Forcipiger flavissimus*	*lauwiliwili nukunuku ʻoiʻoi*	Indigenous
Spotted Boxfish (Boxfish)	*Ostracion meleagris*	*pahu, moa*	Indigenous
Yellowtail Coris (Clown Wrasse)	*Coris gaimard*	*hīnālea ʻakilolo*	Indigenous
Milletseed (Lemon) Butterflyfish	*Chaetodon miliaris*	*kīkākapu*	Endemic

Common Name(s)	Scientific Name	Hawaiian Name(s)	Hawaiian Status[1]
Kole (Goldring Surgeonfish, Yelloweye, Goldring)	*Ctenochaetus strigosus*	*kole, kole makaonaona*	Endemic
Pencil Wrasse	*Pseudojuloides cerasinus*	species of *hīnālea*	Indigenous
Bird Wrasse	*Gomphosus varius*	*hīnālea ʻiʻiwi*	Indigenous
Blacklip Butterflyfish (Coral Butterflyfish)	*Chaetodon kleinii*	*kīkākapu, kapuhili, lauhau, lauwiliwili*	Indigenous
Potter's Angelfish	*Centropyge potteri*	unknown	Endemic
Ornate Wrasse (Pinkface)	*Halichoeres ornatissimus*	*lāʻō*	Endemic
Black Durgon	*Melichthys niger*	*humuhumu ʻeleʻele*	Indigenous
Gilded Triggerfish (Blue-throat Triggerfish)	*Xanthichthys auromarginatus*	species of *humuhumu*	Indigenous
Lei Triggerfish	*Sufflamen bursa*	*humuhumu lei, humuhumu umaumalei*	Indigenous
(Forster's) Blackside Hawkfish	*Paracirrhites forsteri*	*hilu, hilu pilikoʻa*	Indigenous
'Thompson's Surgeonfish	*Acanthurus thompsoni*	species of *kala*	Indigenous
Pyramid Butterflyfish	*Hemitaurichthys polylepis*	*kapuhili*	Indigenous
Multiband (Pebbled) Butterflyfish	*Chaetodon multicinctus*	*kīkākapu*	Endemic
Hawaiian Dascyllus (Domino)	*Dascyllus albisella*	*ʻāloʻiloʻi*	Endemic
Saddle Wrasse	*Thalassoma duperrey*	*hīnālea lauwili*	Endemic
Redbarred Hawkfish	*Cirrhitops fasciatus*	*pilikoʻa*	Endemic
Eightline Wrasse	*Pseudocheilinus octotaenia*	species of *hīnālea*	Indigenous
Fourlined Wrasse	*Pseudocheilinus tetrataenia*	species of *hīnālea*	Indigenous
Brown Surgeonfish (Lavender, Forktail Tang)	*Acanthurus nigrofuscus*	*māʻiʻiʻi, māʻiʻi*	Indigenous
Hawaiian Whitespotted Toby (Puffer)	*Canthigaster jactator*	unknown	Endemic
Bluestripe Snapper (Taape)	*Lutjanus kasmira*	unknown	Invasive
Peacock Grouper (Roi, bluespot Peacock Grouper)	*Cephalopholis argus*	unknown	Invasive
Psychedelic Wrasse	*Anampses chrysocephalus*	species of *hīnālea*	Endemic
Tinker's Butterflyfish	*Chaetodon tinkeri*	*kīkākapu, kapuhili, lauhau, lauwiliwili*	Indigenous
Longfin Anthias	*Pseudanthias hawaiiensis*	unknown	Endemic
Flame Wrasse	*Cirrhilabrus jordani*	species of *hīnālea*	Endemic
Fisher's Angelfish	*Centropyge fisheri*	unknown	Indigenous
Eyestripe Surgeonfish (Palani)	*Acanthurus dussumieri*	*palani*	Indigenous

[1]Indigenous species are species that are native to Hawaii (but may also be found elsewhere). Endemic species are found only within the Hawaiian Islands (including Johnston Atoll). Invasive species were introduced due to humans.

The following sections provide a brief overview of the ecology and cultural significance of each White List Species. Further details on the cultural significance can be found in Appendix A. Population estimates presented below are based on the NOAA Coral Reef Ecosystem Program (CREP; now known as the NOAA's Ecosystem Science Division) and the DAR West Hawaii Aquarium Project (WHAP) (see Section 4.4.7 for discussion of CREP and WHAP). Population estimates derived from both data sets have varying degrees of variability (described in Section 4.4.7) and are not a measure of absolute abundance. In addition, the CREP estimates are island-wide in depths of 0-98 feet (0-30 meters). The WHAP population estimates include only the Open (fished) Areas of the WHRFMA in depths of 30-60 feet. The difference in survey methods and area often leads to large differences in population estimates between the two data sets.

4.4.1.1 Yellow Tang (*Zebrasoma flavescens*)

Ecology

The Yellow Tang is one of the most popular aquarium species, growing to 8 inches, oval in shape and laterally compressed, with a small mouth and eyes set high on the head. Adults are bright yellow and have modified scales along the base of the tail which can be exposed when the fish flexes its tail. These modified scales or spines are used for defense from predators and competition for feeding areas. At night, the yellow color darkens, and a white band appears along the lateral line (University of Hawai'i 2016). The Yellow Tang is found from shallow surge zones to a depth of 130 feet and occur in the Pacific Ocean: Ryukyu, Mariana, Marshall, Marcus, Wake, and Hawaiian Islands (Froese and Pauly 2019)

The Yellow Tang is the only solid yellow fish common throughout Hawai'i. This species is found in subtropical waters and is rare on the western extremes of its range. Flexible comb-like teeth are used to pick algae and seaweed that grow along the reefs. Young Yellow Tangs are associated with finger coral (*Porites compressa*) which is abundant in the coastal waters of the island of Hawai'i, but less so on O'ahu (Dr. Bruce Carlson, pers. comm.). They spend a large amount of time feeding and aggressively protect prime feeding territories (University of Hawai'i 2016).

Yellow Tang are broadcast spawners. Many broadcast spawners migrate to the edge of the reef-drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Yellow Tang at the 0-98-foot depth in hardbottom habitats was approximately 8,262,144 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Yellow Tang at the 30-60-foot depth was approximately 1,663,775 individuals and in 2017/2018 was approximately 2,867,048 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The yellow tang, called *lāʻī pala* or *lauʻī pala* in Hawai'i, although small was considered a delicacy and also involved in healing rituals.

4.4.1.2 Achilles Tang (*Acanthurus achilles*)

Ecology

A member of the surgeonfish family, the Achilles Tang grows to 10 inches, is laterally compressed, and has a small mouth and eyes set high on the head. Adults are recognized by the bright orange patch at the base of the tail, where modified scales can be exposed when the fish flexes its tail. These modified scales or spines are used for defense from predators and competition for feeding areas (University of Hawai'i 2016).

The Achilles Tang is known in the West Pacific, Oceanic Islands of Oceania to the Hawaiian Islands and Pitcairn Islands as well as Wake, Marcus, and Mariana Islands. In the Eastern Central Pacific, they are found around the southern tip of Baja, California, Mexico, and other offshore islands (Froese and Pauly 2018). The Achilles Tang is present throughout Hawai'i and found near exposed coral reefs and rocky shores. Flexible comb-like teeth are used to pick algae and seaweed that grow along the reefs. They spend a large amount of time foraging and aggressively protecting prime feeding territories (University of Hawai'i 2016).

Achilles Tang are broadcast spawners. Many broadcast spawners migrate to the edge of the reef-drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Achilles Tang at the 0-98-foot depth in hardbottom habitats was approximately 231,377 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Achilles Tang at the 30-60-foot depth was approximately 21,627 individuals and in 2017/2018 was approximately 13,796 individuals (DAR 2014a, 2019a). As discussed and analyzed in Section 5.0, the WHAP estimate is low because it does not assess the primary habitat and location of the Achilles Tang population on the island of Hawai'i. Since the establishment of the WHRFMA, this species has remained stable in MPAs (though shown a non-significant negative trend) and declined significantly in both FRAs and Open Areas (DAR 2019a).

Cultural Significance

The Achilles Tang is commonly referred to in Hawai'i as *pākuʻikuʻi*. The spelling and pronunciation of the Hawaiian names, which include *pākukui*, *pākuikui*, and *pākuʻikuʻi*, vary. They were considered "good eating" (Pukui and Elbert 1986) and were also noted to be associated with Hawai'i Island and correlated with the *kukui* tree (*Aleurites moluccana*) that grows on land.

4.4.1.3 Black Surgeonfish (Chevron Tang) (*Ctenochaetus hawaiiensis*)

Ecology

The Black Surgeonfish is widespread throughout the tropical waters of the Pacific Ocean. Juveniles have blue and purple patterns on an orange to red background, these colors fade as the individual matures. Modified scales are present along the base of the tail which can be exposed when the fish flexes its tail. These modified scales or spines are used for defense from predators and competition for feeding areas (Randall and Clements 2001). The Black Surgeonfish is the 5th most collected aquarium fish in Hawai'i (DAR 2010).

Black Surgeonfish inhabits high energy shallow surge zones (IUCN 2017). The genus *Ctenochaetus* feed on fine detrital material. They whisk the sand or rocky substratum with their teeth and utilize suction to draw in the detrital material that consists of diatoms, small fragments of algae, organic material, and fine inorganic sediment (Randall and Clements 2001). Species of *Ctenochaetus* share the presence of a thick-walled stomach (Randall and Clements 2001), this character is significant with respect to the nutritional ecology of this genus (Choat et al. 2002.

Black Surgeonfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Black Surgeonfish at the 0-98-foot depth in hardbottom habitat was approximately 549,462 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Black Surgeonfish at the 30-60-foot depth was approximately 34,678 individuals, and in 2017/2018 was approximately 98,067 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The Black Surgeonfish, also called *ukole* or *pākole*, is a species in the *kole* (meaning "raw" or "red") family. Its cultural significance is tied to another surgeonfish commonly known as Kole (see Section 4.4.1.13).

4.4.1.4 Shortnose (Geoffroy's) Wrasse (*Macropharyngodon geoffroy*)

Ecology

The Shortnose Wrasse is endemic throughout the Hawaiian Islands and Johnston Atoll (Lobel 2003) and is found at depths between 20 and 100 feet. It has dark blue spots on a yellow to orange background. Research suggests that the Shortnose Wrasse is common throughout its range (Craig 2010). This species inhabits mixed sand, rubble patches, and coral reefs where it feeds on mollusks (Lieske and Myers 1994). Distinct pairs are formed during breeding (Breder and Rosen 1966).

Shortnose Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Shortnose Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 307,032 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Shortnose Wrasse at the 30-60-foot depth was approximately 3,222 individuals, and that estimate remained the same for 2017/2018 (3,222 individuals; DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

Hīnālea, occasionally shortened to *ālea*, is a name broadly applied to various species known commonly as wrasses and is applied to most of the smaller wrasses that have no known Hawaiian names (Hoover 2007). There are specific traditional fishing methods associated with wrasses. *Melomelo* involved using a carefully curated stick to attract the fish (Kahāʻulelio 2006). They were also caught in basket traps woven from plant-based fibers, including a diving basket known as *hīnaʻi hoʻoluʻuluʻu* which was made from the vines of the *ʻāwikiwiki (Canvalia galeata*). Standing nets known as *kūkulu ʻupena* and 18-foot long fishing poles called *ke kāmākoi* made of bamboo or *hau* (*Hibiscus tiliaceus*) were also used to catch *hīnālea* (Manu et al. 2006). The *ke kāmākoi* were used in the nearshore reefs where the fisher could cast from shore. Yet another traditional method of catching *hīnālea* involved poison, a net called ʻ*upena holahola* was used with certain piscicidal plants (i.e., containing a substance poisonous to fish) that were crushed and placed around a fishing hole, where the toxins from the crushed plants would diffuse into the water and paralyze the trapped fish, causing the *hīnālea* to float to the surface into the *holahola* net (Manu et al. 2006).

The *hīnālea* is considered a popular fish of the Hawaiian diet, and they are referenced in many *moʻolelo*, or stories. They were also considered important for ceremonies, including as offerings for gods responsible for conceiving a child, and were also noted in several accounts of gods and goddesses.

4.4.1.5 Goldrim Tang (*Acanthurus nigricans*)

Ecology

The Goldrim Tang has a black to purplish-blue body with a small white mark on the cheek between the mouth and eyes. The fins are dark blue with lighter blue highlights along the edges. The tail is blue with a yellow vertical bar. A yellow stripe runs along the body, against the anal and dorsal fins, forming a wishbone-shaped marking. This species can be found throughout the eastern Indian Ocean to the Hawaiian Islands. Adults grow to about 8 inches and have a spine along the base of the tail used for defense against predators (Myers 1991). The Goldrim Tang is found along outer reefs at water depths between 6 and 220 feet and feed almost entirely on algae.

Spawning occurs in monogamous pairs during which time they can be alone or in small groups. Initially, larvae develop among plankton and then move to reefs where juveniles develop to adults (Kuiter and Tonozuka 2001). Goldrim Tang are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Goldrim Tang at the 0-98-foot depth in hardbottom habitat was approximately 97,924 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Goldrim Tang at the 30-60-foot depth was approximately 7,517 individuals, and in 2017/2018 was approximately 5,966 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

While the Goldrim Tang is indigenous to Hawai'i, there are no known Hawaiian names or known cultural significance (Appendix A).

4.4.1.6 Fourspot Butterflyfish (*Chaetodon quadrimaculatus*)

Ecology

The upper half of the Fourspot Butterflyfish is black with two white spots. The lower half is yellow with a light blue trim around the dorsal and anal fins. They are sometimes confused with angelfish but lack a cheekspine. This species is found throughout the Indian Ocean.

Individuals are frequently found on exposed reefs between 6 and 140 feet where they feed mainly on coral polyps. Fourspot Butterflyfish are often observed alone; however, they form district pairs during breeding (Breder and Rosen 1966).

Fourspot Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Fourspot Butterflyfish at the 0-98-foot depth in hardbottom habitat was approximately 797,673 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Fourspot Butterflyfish at the 30-60-foot depth was approximately 22,000 individuals, and in 2017/2018 was approximately 15,034 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in FRAs, and has decreased significantly in Open Areas and MPAs (DAR 2019a).

Cultural Significance

The Fourspot Butterflyfish was named *lauhau*, which has been translated as "brightly colored butterfly fish". They are known for a characteristic of creating disturbances in the sea pool, and this can also be used to reference a boisterous person (Pukui 1983). They were traditionally caught using the *kūkulu 'upena* method, or a standing net, which was cast from the shore. Conflicting reports exists as to whether or not this species was valued as a food fish.

4.4.1.7 Orangeband (Shoulder) Surgeonfish (*Acanthurus olivaceus*)

Ecology

The Orangeband Surgeonfish occurs in tropic waters of the Indo-west Pacific. The head and anterior half of the Orangeband Surgeonfish are distinctly paler than that of the dark grayish brown posterior. Juveniles are bright yellow. Orangeband Surgeonfish are commonly found in small groups near reefs at depths of 30 to 150 feet (Randall and Clements 2001) where they feed on detritus, diatoms, and algae (Myers 1991).

Orangeband Surgeonfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Orangeband Surgeonfish at the 0-98-foot depth in hardbottom habitat was approximately 1,319,924 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Orangeband Surgeonfish at the 30-60-foot depth was approximately 26,101 individuals, and in 2017/2018 was approximately 53,694 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas and MPAs and has remained stable in FRAs (and shown a non-significant increasing trend in density; DAR 2019a).

Cultural Significance

The Orangeband Surgeonfish is commonly referred to as *na'ena'e* ("quick, alert") (Pukui and Elbert 1986). The name *na'ena'e* is also applied to a native daisy known for its small yellow, orange, purple, or white flower (Pukui and Elbert 1986). A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Orangeband Surgeonfish.

4.4.1.8 Orangespine Unicornfish (Clown Tang) (*Naso lituratus*)

Ecology

The Orangespine Unicornfish has a black dorsal fin, with the black continuing onto the back as a pointed projection, with a pale blue line at base. The anal fin is mainly orange while the caudal fin is yellow. The caudal peduncle bears two forward-directed spines (Randall and Clements 2001). Orangespine Unicornfish are found at depths of 16 to 100 feet along coral, rock, and rubble of seaward reefs. They feed mostly on leafy brown algae and sometimes in groups (Randall and Clements 2001). Distinct pairs are formed during breeding.

Orangespine Unicornfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

The species is found throughout the Indo-Pacific from the Red Sea (except the Gulf of Oman and Persian Gulf) south to Natal and east to Hawai'i and French Polynesia. In the western Pacific from Suruga Bay to the southern Great Barrier Reef (Randall and Clements 2001).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Orangespine Unicornfish at the 0-98-foot depth in hardbottom habitat was approximately 897,085 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Orangespine Unicornfish at the 30-60-foot depth was approximately 150,642 individuals, and in 2017/2018 was approximately 180,099 individuals (DAR2014a, 2019a). Since the establishment of the WHRFMA, this species has increase significantly in Open Areas and MPAs and has remained stable in FRAs (DAR 2019a).

Cultural Significance

The Orangespine Unicornfish is also known as the *umaumalei*. This species has been paired with its land counterpart the *ʻūlei* (Hawaiian Rose; *Osteomeles anthyllidifolia*) (Beckwith 1951; Liliuokalani 1978). While the *umaumalei* is a specific species within the family Acanthuridae, some traditional accounts classify it under the name *kala* or *kala umaumalei* (Ka Nupepa Kuokoa 1867; Titcomb 1972).

Kala in all of its forms was a popular Hawaiian delicacy, containing white meat and usually eaten broiled over coals and rarely eaten raw. The soft parts of the fish are described as good *palu* (fish bait). *Kala* is very abundant and easy to catch which is why it is eaten often (Titcomb 1972). The skin of the kala was also used to cover the *pūniu*, a small drum that was lashed onto the thigh of a *hula* dancer.

During the spawning seasons, certain fish were prohibited from being caught and consumed, which included *kala* (Titcomb 1972). They were traditionally caught in the *ʻie kala* (lit. *kala* basket), which has been described as the largest type of *hīnaʻi* (basket fish trap) (Manu et al. 2006). Additional methods for catching *kala* included the use of a *holoholo*, a net tied to a 12-foot-long piece of *alaheʻe* (*Canthium odoratum*) wood. The net was lowered down in an area with swift-ebbing tides with one person holding the net and the other corralling fish into it (Manu et al. 2006). *Hinaʻi pai kala*, was a method of using a plaited basket as a net. The basket was filled with *limu kala* (seaweed), *kalo* (taro) and pumpkin and then let down for the fish to feed. This process was continued until the fish became plump and accustomed to feeding in the basket, then a "catching net" was lowered down to collect *kala*.

4.4.1.9 Forcepsfish (*Forcipiger flavissimus*)

Ecology

The Forcepsfish has a long black snout, and the head is dark brown to black above and white below. The body is yellow with a black spot on the anal fin. Adults can grow up to 8 inches. This species is widespread throughout the Hawaiian Islands and the tropical waters of the Indo-Pacific area (University of Hawai'i 2016).

The Forcepsfish typically lives along exposed outer reefs containing abundant coral growth, caves, and ledges, and occasionally within lagoon reefs. This species usually occurs in pairs but may also be encountered as solitary animals or in small groups. It feeds on a variety of small animals including hydroids, fish eggs, and crustaceans, but prefers tube feet of echinoderms, pedicellaria of sea urchins, and polychaete tentacles (Myers 1991).

Forcepsfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Forcepsfish at the 0-98-foot depth in hardbottom habitat was approximately 435,954 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Forcepsfish at the 30-60-foot depth was approximately 43,999 individuals, and in 2017/2018 was approximately 39,734 (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas and MPAs and has increased significantly in FRAs (DAR 2019a).

Cultural Significance

The Forcepsfish is also known as the *lauwiliwili nuku ʻoiʻoi*. A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information related to this species.

4.4.1.10 Spotted Boxfish (Boxfish) (*Ostracion meleagris*)

Ecology

The Spotted Boxfish is Hawai'i's most common boxfish. Juvenile and female Spotted Boxfish are brown to green with white spots while the males have orange bands and spots on the side of the body. They are found throughout the Hawaiian Islands and inhabit clear lagoons and seaward reefs from 3 to 100 feet. Juveniles are often observed among rocky boulders (Myers 1991).

Spotted Boxfish live in small haremic groups, usually one male to several females. They forage alone within their home ranges for sponges, worms, mollusks, copepods, and algae. Males defend territories against other males (Myers 1991).

Spotted Boxfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Spotted Boxfish at the 0-98-foot depth in hardbottom habitat was approximately 94,937 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Spotted Boxfish at the 30-60-foot depth was approximately 9,322 individuals, and in 2017/2018 was approximately 12,877 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The Spotted Boxfish, commonly known as *pahu*, meaning “box” or moa (a Proto Polynesian word; Pakui and Elbert 1986) were traditionally *kapu* (forbidden) for women to eat (Kent 1986). Titcomb (1972) adds that there was little flesh on this fish and that they were not eaten.

4.4.1.11 Yellowtail Coris (Clown Wrasse) (*Coris gaimard*)

Ecology

Juvenile Yellowtail Coris are bright red with white spots, as individuals mature into females they fade to orange with blue spots and a bright yellow tail. Like other wrasses (Family Labridae) adults may undergo a sex change from female to male. Males are distinguished by a green bar on the side of the body and a dark band on the upper and lower fins and numerous blue spots (University of Hawai’i 2016).

The Yellowtail Coris is a solitary species that is found in mixed coral, sand and rubble of outer reefs, lagoons, and seaward reefs. They feed primarily on mollusks, crabs, and tunicates (Myers 1991). Prominent canine teeth help this fish pick small crustaceans and mollusks from the reef. Active during the day, they take shelter in reef crevices or bury in sand at night (University of Hawai’i 2016).

Distribution ranges are from Western Australia, Cocos – Keelings Islands, Christmas Island in the eastern Indian Ocean, Southern Japan to New South Wales, Lord Howe Island and east to Hawaiian Islands (Randall 2007). Phylogeographic analyses show that the Hawaiian population is genetically distinct from elsewhere in the Pacific (Ahti et al. 2016).

Yellowtail Coris are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai’i population of Yellowtail Coris at the 0-98-foot depth in hardbottom habitat was approximately 391,507 individuals. WHAP data indicate the 2104 WHRFMA Open Area population of Yellowtail Coris at the 30-60-foot depth was approximately 19,762 individuals, and in 2017/2018 was approximately 18,256 (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The Yellowtail Coris is also known as the *hinālea ‘akilolo,* which were noted for their medicinal value. The word *‘akilolo* means “brain biting,” (Pukui and Elbert 1986), and this species was used by *kahuna* (priests) as a *pani*, or closing medicine, for someone suffering from a head sickness or disease. This variety was also a highly favored delicacy for eating because of its sweet taste. It was traditionally “eaten with salt, dried, broiled over coals or wrapped in *ti* leaves and then baked or broiled” (Titcomb 1972). See also Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which include Yellowtail Coris.

4.4.1.12 Milletseed (Lemon) Butterflyfish (*Chaetodon miliaris*)

Ecology

The Milletseed Butterfly fish is endemic to Hawai'i and the most common species of butterflyfish in Hawai'i including the Johnston Atoll (Lobel 2003). The species is named for the seed-sized black specks that are distributed in vertical rows on its lemon-yellow body. Other distinctive features are a black mask through the eye and a black spot near the tail. Adults reach lengths of 6.5 inches (University of Hawai'i 2016).

Habitat for this species includes coastal fringing reefs, lagoons, and outer reefs, with juveniles found on shallow inner reefs from April to June (IUCN 2017). The Milletseed Butterflyfish feeds primarily on zooplankton above the reef, but sometimes cleans other fishes and is also known to feed on nests of damselfish eggs if left unprotected.

Milletseed Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Milletseed Butterflyfish at the 0-98-foot depth in hardbottom habitat was approximately 122,588 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Milletseed Butterflyfish at the 30-60-foot depth was approximately 7,085 individuals. However, much of the Milletseed Butterflyfish population occurs below the 60-foot depth surveyed by the WHAP and below the 98-foot depth surveyed by the CREP, and therefore the population is underestimated by both surveys.

Cultural Significance

The name *kīkākapu* is used to describe a number of butterflyfish species and were considered sacred (Titcomb 1972). Fornander (1916) reported the name is used in many chants. The Milletseed Butterflyfish is called *lau wiliwili* or *lauhau wiliwili*, meaning "*wiliwili* leaf," because its shape is believed to resemble the endemic *wiliwili* tree (*Erythrina sandwicensis*).

4.4.1.13 Kole (Goldring Surgeonfish, Yelloweye, Goldring) (*Ctenochaetus strigosus*)

Ecology

The Kole is endemic to the Hawaiian Islands (Randall and Clements 2001) and Johnston Atoll (Lobel 2003). It is brown with light blue to yellow horizontal stripes over its body which change into spots towards the face. It also has a yellow ring surrounding the eye.

Individuals are usually solitary and mainly found in shallow water, although it has been recorded at depths of 370 feet. This species is herbivorous, grazing on diatoms and algae from the sand or reef (Randall and Clements 2001), and has also been commonly observed to clean algal growths from the shells of sea turtles (Work and Aeby 2014).

Kole are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Kole at the 0-98-foot depth in hardbottom habitat was approximately 11,697,561 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Kole at the 30-60-foot depth was approximately 3,616,529 individuals and in 2017/2018 was approximately 5,312,745 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

Kole, meaning "raw" or "red" (Pakui and Elbert 1986), are also known as *ukole* or *pākole*. The *kole makaonaona* (specifically, *Ctenochaetus strigosus),* is the more popular eating variety of *Kole*. Pukui (1983) explains that the English word "story" was Hawaiianized to "*kole*," and that this proverbial saying uses *kole* as a metaphor for describing the excitement of getting together to share stories.

Although the *kole* is known as being tough-skinned, it is considered a favorite fish to eat raw. *Kole* was also important for traditional practices and customs relating to the home, as it was believed to *hole*, or strip, the house of unwanted spiritual energy (Titcomb 1972).

4.4.1.14 Pencil Wrasse (*Pseudojuloides cerasinus*)

Ecology

Body color and pigmentation has been shown to vary geographically in the Pencil Wrasse; however, the most common coloration is a salmon pink body with yellowish fins. A blue to yellow double stripe extends from the head to the tail. Adults can grow up to 5 inches (Myers 1991). This species is found throughout Indian and Pacific oceans from east Africa to the Hawaiian Islands.

The Pencil Wrasse is found in clear lagoons, outer reef faces, and coral rubble at depths of 7 to 200 feet. They are also common among live coral and areas with large algae clumps (Myers 1991). When threatened, they will hide among the rubble, bury in the sand, or try to out-swim predators. Pencil Wrasses feed on small, benthic invertebrates, mainly fan worms and small crustaceans that they pluck from the substrate. The Pencil Wrasse is found in areas with abundance of sand and gradual bathymetric relief; typically, north western region of the Big Island (BIAAF pers. comm.).

Pencil Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Pencil Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 169,025 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Pencil Wrasse at the 30-60-foot depth was approximately 19,390 individuals, and in 2017/2018 was approximately 17,182 (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in FRAs and MPAs, and has increased significantly in Open Areas (DAR 2019a).

Cultural Significance

See Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which includes the Pencil Wrasse.

4.4.1.15 Bird Wrasse (*Gomphosus varius*)

Ecology

The Bird Wrasse has an elongated body and is laterally compressed. Adults can reach 12 inches and are easily recognized by their long snout; juveniles lack the snout and are thus difficult to identify. The first third of the body is lightly colored and the posterior is grayish with a dark border. Males tend to be more uniformly colored (Myers 1999).

The Bird Wrasse is commonly found along external slopes, reefs, and lagoons at depths of 6 to 100 feet (Myers 1991). This wrasse feeds mainly on small benthic crustaceans, and sometimes on small fishes, brittle stars, and mollusks. The Bird Wrasse is a sequential hermaphrodite, meaning juveniles develop first into females and then change to males based on external stimuli (Randall et al 1990).

Bird Wrasse are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Bird Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 877,224 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Bird Wrasse at the 30-60-foot depth was approximately 43,254 individuals, and in 2017/2018 was approximately 66,581 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas and has increased significantly in MPAs and FRAs (DAR 2019a).

Cultural Significance

See Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which includes the Bird Wrasse.

4.4.1.16 Blacklip Butterflyfish (Coral Butterflyfish) (*Chaetodon kleinii*)

Ecology

The body of the Blacklip Butterflyfish is yellow/brown with one or two broad lighter vertical bars, one running from the dorsal spine to the belly, and one from the middle of the back to the center of the body. A black bar runs vertically across the eye, the part before this is whitish, with a black snout. The color varies somewhat across its range (Burgess 1978).

The Blacklip Butterflyfish is found along rocky reefs and coral-rich areas of lagoons, channels, and outer reef slopes at depths of 6-200 feet. This species is mostly solitary but has been observed in pairs, and occasionally in large groups of up to about 30 individuals, sometimes high in the water column. It is a facultative corallivore, feeding on hard and soft corals, as well as algae, hydroids, and zooplankton (Myers 1991). Distinct pairing has been observed during breeding (Breder and Rosen 1966). Its range includes the east coast of Africa to the Hawaiian Islands and South Wales (Randall 2007).

Blacklip Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Blacklip Butterflyfish at the 0-98-foot depth in hardbottom habitat was approximately 131,260 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Blacklip Butterflyfish at the 30-60-foot depth was approximately 5,593 individuals, and in 2017/2018 was approximately 39,734 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas and FRAs and has remained stable in MPAs (DAR 2019a).

Cultural Significance

The Blacklip Butterflyfish is a member of the butterflyfish genus, which were sometimes eaten, but more commonly caught and used for certain rituals and ceremonies. The Blacklip Butterflyfish, along with Tinker's Butterflyfish, were commonly referred to as *kīkākapu, kapuhili, lauhau*, or *lauwiliwili*. The term *kapuhili* translates as "…many taboos inherited from chiefly ancestors or from the gods; person with many taboos" (Elbert and Pukui 1986). The name *kīkākapu* is used to describe a variety of butterflyfish species which were considered sacred (Titcomb 1972). Fornander (1916) reported the name is used in many chants.

4.4.1.17 Potter's Angelfish (*Centropyge potteri*)

Ecology

The bright orange and blue Potter's Angelfish is an endemic species found along Hawaiian reefs and the Johnston Atoll (Lobel 2003). Like other angelfishes, this species is recognized by a heavy, curved spine on its "cheek" near the edge of the gill cover. However, because it generally only reaches approximately 5 inches, it is considered a 'pygmy' angelfish. Its slender, disc-shaped body is well-suited to life on a coral reef.

Individuals limit their movements to a well-defined area close to the shelter of finger coral branches, usually at depths of at least 15 feet. Active by day, it feeds on algae and detritus on dead coral surfaces. At night, it remains alert but inactive, protected within the coral. Angelfishes are very dependent upon the protection of coral caves and crevices and are rarely seen over sandy stretches or other areas that offer little cover. They are often territorial and spend most of their time near the bottom in search of food. They have small mouths and many flexible, comb-like teeth used for plucking or scraping food from the rocks (University of Hawai'i 2016).

Peak reproductive activity occurs from mid-December through May. They spawn at dusk during the week before full moon (Allen 1985a). Among angelfishes, a sex reversal from female to male can be part of the life history. Most small individuals are female and larger, more colorful individuals are male. Larger, brighter males are usually accompanied by smaller, drabber females, forming a harem. A dominant female Potter's Angelfish changes sex to become the harem master if the male is removed (University of Hawai'i 2016).

Potter's Angelfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Potter's Angelfish at the 0-98-foot depth in hardbottom habitat was approximately 1,087,709 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Potter's Angelfish at the 30-60-foot depth was approximately 237,149 individuals, and in 2017/2018 was approximately 265,488 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The Potter's Angelfish is named after Frederick A. Potter, who was the first Director of the Honolulu Aquarium. The species is endemic, but a review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or any specific cultural information related to this species.

4.4.1.18 Ornate Wrasse (Pinkface) (*Halichoeres ornatissimus*)

Ecology

This small wrasse has a pinkish head that is marked with horizontal green lines. The throat and belly are blue; scales on the sides are marked by a vertical, crescent-shaped stripe followed by blue. The dorsal fin is dark red with green spots and is traced by green and blue lines. A large dark spot on the dorsal fin and one just behind the eye are common identifiers. Males usually have more intense coloration than females (University of Hawai'i 2016). The Ornate Wrasse range extends from the Philippines to the Great Barrier Reef, New Caledonia, and east to the Hawaiian Islands (Randall 2007).

The Ornate Wrasse has an elongate soft body that is tapered and spindle-shaped. The dorsal fin is continuous, rounded, and soft. The pectoral fins are used extensively for swimming with up and down motions. The snout has a pointed mouth, fleshy lips, and canine teeth used in plucking small crustaceans and mollusks from the reef. Special bones in the gill area called pharyngeal bones help the wrasse crush the shells of their prey. The Ornate Wrasse is diurnal, feeding during the day, and sheltering in reef crevices or burying in sand patches at night. The Ornate Wrasse, like others within this family (Labridae) undergo sex changes as they develop (University of Hawai'i 2016).

Ornate Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Ornate Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 1,630,224 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Ornate Wrasse at the 30-60-foot depth was approximately 192,404 individuals, and in 2017/2018 was approximately 196,879 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has significantly declined in Open Areas and FRAs and has increased significantly in MPAs (DAR 2019a).

Cultural Significance

The Ornate Wrasse is also referred to as *lā'ō* (Titcomb 1972). A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Ornate Wrasse.

4.4.1.19 Black Durgon (*Melichthys niger*)

Ecology

The Black Durgon is a triggerfish with bright white lines running along its dorsal and anal fins. The body is mottled dark blue or green with an orange head (Hoover 2008).

The habitat preference of the Black Durgon includes open waters and shallow exposed reefs at water depths of 15 to 115 feet. The diet consists primarily of calcareous algae and zooplankton. A study conducted in the Fernando de Noronha Archipelago showed the feces and vomit of Spinner dolphins (*Stenella longirostris*) formed part of the diet of Black Durgon. The study showed individuals could discern the postures dolphins assumed prior to voiding and would position themselves for effective feeding (Sazima et al. 2003). The Black Durgon has a circumtropical distribution (Randall 2007).

The Black Durgon produce demersal eggs that may or may not be tended by a parent, usually the female. Unlike most other families of reef fishes, the balistids (i.e., triggerfish) exhibit extensive maternal care of eggs. Eggs are typically deposited in shallow pits excavated by the parents as an adhesive egg mass containing bits of sand and rubble. Triggerfish eggs hatch in as little as 12 hours and no more than 24 hours (WPRFMC 2005).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Black Durgon at the 0-98-foot depth in hardbottom habitat was approximately 1,354,454 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Black Durgon at the 30-60-foot depth was approximately 38,033 individuals, and in 2017/2018 was approximately 92,354 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The *humuhumu*, meaning "to sew, stitch," is a general name used to refer to many different varieties of trigger fish, including, but not limited to, the *humuhumu 'ele'ele* or the Black Durgeon (Titcomb 1972). The species was historically eaten, using a variety of methods, and with varying reports on its tastiness or popularity. If *humuhumu* were caught in large numbers, then the remains, particularly the head, would be tossed into the fire to help keep the fire burning because of its oils.

Titcomb (1972) documents a gathering method for these fish that involved lowering a basket with cooked pumpkins or sweet potatoes as bait onto a school of fish. While the fish attacked the bait in a frenzy the basket would be hoisted up and the fish caught.

4.4.1.20 Gilded Triggerfish (Bluethroat Triggerfish) (*Xanthichthys auromarginatus*)

Ecology

The Gilded Triggerfish is found throughout the Indian and Pacific oceans from east Africa to the Hawaiian Islands. The female Gilded Triggerfish lacks the blue patch on the throat and yellow tail of the male. Both sexes have a blue ring around the eye and a lavender/gray blue body with gray to white spots that make a linear pattern. Adults can grow up to 12 inches.

This species is found along drop-offs and ledges at water depths of 75 to 480 feet. This species prefers current-swept areas with abundant invertebrate growth. Small groups have been observed at 10-20 feet above the bottom feeding on zooplankton, specifically copepods (Breder and Rosen 1966).

The Gilded Triggerfish produce demersal eggs that may or may not be tended by a parent, usually the female. Unlike most other families of reef fishes, the balistids (i.e., triggerfish) exhibit extensive maternal care of eggs. Eggs are typically deposited in shallow pits excavated by the parents as an adhesive egg mass containing bits of sand and rubble. Triggerfish eggs hatch in as little as 12 hours and no more than 24 hours (WPRFMC 2005).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Gilded Triggerfish at the 0-98-foot depth in hardbottom habitat was approximately 129,089 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Gilded Triggerfish at the 30-60-foot depth was approximately 11,186 individuals, and in 2017/2018 was approximately 3,222 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has decreased significantly in Open Areas, MPAs, and FRAs (DAR 2019a).

Cultural Significance

The Gilded Triggerfish is a species of *humuhumu.* See Section 4.4.1.19 for a discussion of the cultural significance.

4.4.1.21 Lei Triggerfish (*Sufflamen bursa*)

Ecology

The Lei Triggerfish is found throughout the Indian and Pacific oceans from east Africa to the Hawaiian Islands. This species is also known as the boomerang triggerfish for the characteristic V-shaped mark behind the eye which is yellow-orange or brown-green. Adults can grow up to 9.5 inches.

This species is common on clear inner and outer reefs and drop-offs from 10 to 300 feet, where they feed on crabs, bivalves, gastropods, algae, echinoids, tunicates, worms, eggs, and detritus. Lei Triggerfish have been shown to form distinct pairing during breeding (Breder and Rosen 1966).

The Lei Triggerfish produce demersal eggs that may or may not be tended by a parent, usually the female. Unlike most other families of reef fishes, the balistids (i.e., triggerfish) exhibit extensive maternal care of eggs. Eggs are typically deposited in shallow pits excavated by the parents as an adhesive egg mass containing bits of sand and rubble. Triggerfish eggs hatch in as little as 12 hours and no more than 24 hours (WPRFMC 2005).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Lei Triggerfish at the 0-98-foot depth in hardbottom habitat was approximately 1,299,027 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Lei Triggerfish at the 30-60-foot depth was approximately 76,440 individuals, and in 2017/2018 was approximately 92,354 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas and FRAs and has increased significantly in MPAs (DAR 2019a).

Cultural Significance

The *humuhumu lei or humuhumu umaumalei*, or the Lei Triggerfish (Titcomb 1972) is a species of *humuhumu.* See Section 4.4.1.19 for a discussion of the cultural significance.

4.4.1.22 (Forster's) Blackside Hawkfish (*Paracirrhites forsteri*)

Ecology

The Blackside Hawkfish is yellow with a broad black or dark brown lateral band on the rear half of the body. The sides of the head and the front of the body are whitish or grey, with red speckles but there is considerable color variation among adults (Randall 1986). Geographical differences in color have also been recorded in juveniles (Myers 1999). This species ranges throughout the Indian and Pacific oceans. Adults can grow up to 8 inches.

The Blackside Hawkfish is commonly found in clear lagoons or seaward reefs at a depth of 15 to 115 feet (Lieske and Myers 1994). To hunt, the hawkfish perches on branches of coral and ambushes small fish, crustaceans, and shrimp. This species is a sequential hermaphrodite, meaning juveniles develop into females and then change to males based on external stimuli (Myers 1999).

Blackside Hawkfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Blackside Hawkfish at the 0-98-foot depth in hardbottom habitat was approximately 246,727 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Blackside Hawkfish at the 30-60-foot depth was approximately 20,508 individuals, and in 2017/2018 was approximately 23,625 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in MPAs and FRAs, and has decreased significantly in Open Areas (DAR 2019a).

Cultural Significance

The Blackside Hawkfish is known by many names, including *hilu, ʻeleʻele, lauwili, melemele, moelola, pano, pāniʻo, pilikoʻa, ʻula* and *uli,* but is most commonly referred to as *hilu* (Pukui and Elbert 1986). Considered an "excellent eating" fish, *hilu* was traditionally either eaten raw, dried or salted and baked or broiled (Malo 1951). Because of the quiet demeanor of the species, it was associated with quiet children or ladylike behavior (Titcomb 1972; Handy and Pukui 1998).

4.4.1.23 Thompson's Surgeonfish (*Acanthurus thompsoni*)

Ecology

The body of the Thompson's Surgeonfish is uniformly black to dark brown. The caudal fin is pale with a small dark spot below the pectoral fin. This species ranges throughout the Indian and Pacific Oceans.

This species inhabits steep outer reef slopes and drop-offs of 16 to 230 feet deep. Thompson's Surgeonfish have been observed schooling in groups feeding on zooplankton, fish eggs and crustaceans (Randall 1956).

Thompson's Surgeonfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Thompson's Surgeonfish at the 0-98-foot depth in hardbottom habitat was approximately 405,776 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Thompson's Surgeonfish at the 30-60-foot depth was approximately 91,728 individuals, and in 2017/2018 was approximately 271,693 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, FRAs, and MPAs (DAR 2019a).

Cultural Significance

The Thompson's Surgeonfish is a species of *Kala* (Pukui and Elbert 1986). See Section 4.4.1.8 for more information on *kala.*

4.4.1.24 Pyramid Butterflyfish (*Hemitaurichthys polylepis*)

Ecology

The Pyramid Butterflyfish has a dark brown-yellow area that fully masks the head and extends to a line from the first rays of the dorsal fin to the start of the pelvic fins. The rest of its body is white. Large yellow-orange areas at the top of the side form a characteristic pyramidal pattern, giving this species its name.

This species is found throughout the tropical and subtropical waters of the Indian and Pacific oceans (Myers 1999).

This fish aggregates in large schools in open water at the edges of steep outer reef slopes at depths of 10 to 200 feet (Lieske and Myers 1994). The Pyramid Butterflyfish feeds mostly on plankton and forms pairs during breeding (Breder and Rosen 1966).

Pyramid Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Pyramid Butterflyfish at the 0-98-foot depth in hardbottom habitat was approximately 23,217 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Pyramid Butterflyfish at the 30-60-foot depth was approximately 56,677 individuals, and in 2017/2018 was approximately 37,586 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has decreased significantly in Open Areas and MPAs and has remained stable in FRAs (DAR 2019a).

Cultural Significance

Butterflyfish, while sometimes eaten, appear to have been more commonly caught and used for certain rituals and ceremonies. The Pyramid Butterflyfish, along with other species of butterflyfish, were known as *kapuhili,* which translates as "…many taboos inherited from chiefly ancestors or from the gods; person with many taboos" (Elbert and Pukui 1986, as cited in Appendix A).

4.4.1.25 Multiband (Pebbled) Butterflyfish (*Chaetodon multicinctus*)

Ecology

The Multiband Butterflyfish is endemic to the Hawaiian Islands and Johnston Atoll (Lobel 2003). The body is white with five or six brown vertical bands. A dark vertical bar runs along the eye and a black band along the tail fin. The distinguishing feature is an overall covering of small spots which create a pattern of horizontal and vertical lines along the body.

The Multiband Butterflyfish inhabits heavy coral areas of lagoon and seaward reefs at depths of 15 to 100 feet. This species mainly feeds on the polyps of small corals but also supplement their diet with worms, shrimps, hydroids, and algae fragments. This species is often seen in monogamous pairs and defending an established territory (Breder and Rosen 1966).

Multiband Butterflyfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Multiband Butterflyfish at the 0-98-foot depth in hardbottom habitat was approximately 1,788,604 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Multiband Butterflyfish at the 30-60-foot depth was approximately 580,196 individuals, and in 2017/2018 was approximately 378,843 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species declined significantly in Open Areas, FRAs, and MPAs (DAR 2019a).

Cultural Significance

The name *kīkākapu* is used to describe a number of butterflyfish species and were considered sacred (Titcomb 1972). See also Section 4.4.1.16 for a discussion of the cultural significance of *kīkākapu,* which includes the Multiband Butterflyfish.

4.4.1.26 Hawaiian Dascyllus (Domino) (*Dascyllus albisella*)

Ecology

The Hawaiian Dascyllus is endemic to shallow, protected coral reefs around the Hawaiian Islands and Johnston Atoll (Lobel 2003). The center of the body is pale white, and the edges are dark gray to black.

This species feeds on zooplankton, invertebrates, and algae at water depths of 3 to 160 feet. Adults are most often observed in protected areas of shallow water with coral or rocky bottoms (Lieske and Myers 1994). Breeding occurs in pairs with eggs deposited in substrate and the males guarding and aerating (Breder and Rosen 1966).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Hawaiian Dascyllus at the 0-98-foot depth in hardbottom habitat was approximately 225,153 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Hawaiian Dascyllus at the 30-60-foot depth was approximately 57,796 individuals, and in 2017/2018 was approximately 63,359 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas and MPAs and has increased significantly in FRAs (DAR 2019a).

Cultural Significance

The Hawaiian Dascyllus is also known as the *ʻāloʻiloʻi.* The young stages of the fish are called *ʻa*, or *ʻaʻa* and also referred to as "*ʻaʻakimakau* (bait nibbling) which "is a term for a variety or perhaps an alternative name" (Malo 1951). The *ʻāloʻiloʻi* is referenced in the *ʻōlelo noʻeau*, "*he ʻāloʻiloʻi, ka iʻa waha iki o ke kai*," literally translated as "an ʻāloʻiloʻi, a fish of the sea that has a small mouth" (Pukui 1983). Pukui (1983) relates that this was "said of one who always has little to say." *ʻĀloʻiloʻi* were considered "a tasty fish," and were preferred "eaten raw or cooked on hot ashes" (Titcomb 1972). A method of collecting *ʻāloʻiloʻi* for consumption was the *kūkulu ʻupena*, or a standing net, which was cast from shore.

4.4.1.27 Saddle Wrasse (*Thalassoma duperrey*)

Ecology

The Saddle Wrasse is a common and endemic reef fish of Hawai'i and Johnston Atoll (Lobel 2003). It is found at depths ranging from 16 to 98 feet. This species has a blue head, green body with a prominent red saddle and purple highlights around the edges of the fins (University of Hawai'i 2016).

This species is commonly observed alone, in pairs, or in small groups close to the reef where they forage for small crustaceans, mollusks, worms, urchins, and brittlestars. Canine teeth are used to pick these invertebrates from the reef. Most individuals begin life as females, when older they show the typical blue, red, and green pattern. Females that change to males, which is common in the wrasse family (Labridae) and have a white bar behind the red saddle. These sex-changed males are called "terminal phase" males and become dominant territory holders that maintain a harem of females (University of Hawai'i 2016).

Saddle Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Saddle Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 6,396,052 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Saddle Wrasse at the 30-60-foot depth was approximately 537,688 individuals, and in 2017/2018 was approximately 140,947 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has declined significantly in Open Areas and FRAs and has remained stable in MPAs (DAR 2019a).

Cultural Significance

The Saddle Wrasse is also known as *hinālea lauwili*, which is believed to have been named in reference to the *wiliwili* tree which has bright orange flowers. The species is often mentioned in *mo'olelo* (stories) and is referenced in traditional fishing practices as well. The fish was historically eaten, though the hard scales on the fish meant that it was usually skinned, and it was often eaten raw. See also Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which include the Saddle Wrasse.

4.4.1.28 Redbarred Hawkfish (*Cirrhitops fasciatus*)

Ecology

The Redbarred Hawkfish is found throughout the Hawaiian Islands and Indo-Pacific oceans in a variety of reef habitats at depths of 3 to 170 feet. Primary habitats include seaward reefs and areas with abundant coral growth (Lieske and Myers 1994). Bright red bands and speckles are found on the body, adults grow to 5 inches. This species feeds primarily on small fish, shrimp, and crab and occasionally on zooplankton (Randall 1985). The name hawkfish comes from their habit of "swooping" down on prey or invaders from "perches".

Redbarred Hawkfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Redbarred Hawkfish at the 0-98-foot depth in hardbottom habitat was approximately 231,580 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Redbarred Hawkfish at the 30-60-foot depth was approximately 9,665 individuals, and in 2017/2018 was approximately 6,443 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, FRAs, and MPAs (DAR 2019a).

Cultural Significance

The Redbarred Hawkfish is also known as *piliko'a,* which means "clinging to coral" (Titcomb 1972). A review of cultural-historical literature (see Appendix A) did not reveal any additional cultural information for the Redbarred Hawkfish.

4.4.1.29 Eightline Wrasse (*Pseudocheilinus octotaenia*)

Ecology

The Eightline Wrasse is widespread from east Africa to the Hawaiian Islands. This species has variable color patterns from yellowish/orange to a pink/reddish body. The distinguishing feature of this species are the eight horizontal stripes, ranging from orange to a maroon red. They have a pointed head and mouth which enable them to feed on coral reef invertebrates such as, mollusks, sea urchins, fish eggs, and crab larvae (Myers 1991, 1999).

The Eightline Wrasse inhabits corals and seaward reefs at depths of 6 to 164 feet (Myers 1991) and forms distinct mating pairs (Breder and Rosen 1966). This species is diurnal, feeding during the day and resting at night.

Eightline Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Eightline Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 689,221 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Eightline Wrasse at the 30-60-foot depth was approximately 187,557 individuals, and in 2017/2018 was approximately 187,930 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has declined significantly in Open Areas, FRAs, and MPAs (DAR 2019a).

Cultural Significance

See Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which include the Eightline Wrasse.

4.4.1.30 Fourline Wrasse (*Pseudocheilinus tetrataenia*)

Ecology

The Fourline Wrasse is found in the tropical waters of the north and south Pacific. This species has a green body with blue and purple fins and four horizontal stripes that run across the upper half of the body. Each stripe is made up of three smaller stripes: one black, one blue and one red stripe. The eye is red with two white lines on it.

This species is secretive and inhabits seaward reefs, among coral or rubble at depths of 20 to 144 feet. This species uses the small heads of live coral to hide from predators (Myers 1991) and is thought to mainly feed on demersal eggs, copepods, amphipods, alpheid shrimp, crabs, larval shrimp, and gastropods (Myers 1999). The Fourline Wrasse forms distinct pairing during breeding (Breder and Rosen 1966).

Fourline Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Fourline Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 1,253,164 individuals. WHAP data indicate the 2104 WHRFMA Open Area population of Fourline Wrasse at the 30-60-foot depth was approximately 327,758 individuals, and in 2017/2018 was approximately 227,663 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas and FRAs and has decreased significantly in MPAs (DAR 2019a). Due to this species' secretive behavior, visual counts usually underestimate its numbers,

Cultural Significance

See Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which includes the Fourline Wrasse.

4.4.1.31 Brown Surgeonfish (Lavender, Forktail Tang) (*Acanthurus nigrofuscus*)

Ecology

The Brown Surgeonfish is one of the 10 most collected aquarium fish in West Hawai'i (DAR 2018a). This species is common throughout the Indo-Pacific oceans and is one of the most abundant surgeon fishes (Randall 2002). It is a small but aggressive fish with bluish gray vertical stripes along the body. The pectoral fins are pale with the upper edge narrow and black; pelvic fins are brown. Lips blackish brown, and the dorsal fin base has a prominent black spot larger than 1/2 the eye diameter; a smaller spot is present on base of the anal fin.

The Brown Surgeonfish is often found on hard substrates of lagoons and seaward reefs at depths of 6 to 82 feet (Domeier and Colin 1997) where it feeds exclusively on filamentous algae. Adults are usually observed in small groups but can also form large schools in open water. Juveniles are often associated with mixed species aggregations (Kuiter and Tonozuka 2001) and forms large spawning groups of up to several thousand individuals (Domeier and Colin 1997). Phylogeographic analyses reveal that the Hawaiian population is genetically connected to other locations in the Central Pacific, comprising a very large management unit in terms of both geography and numbers of individuals (Eble et al. 2011).

Brown Surgeonfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Brown Surgeonfish at the 0-98-foot depth in hardbottom habitat was approximately 14,439,543 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Brown Surgeonfish at the 30-60-foot depth was approximately 1,646,996 individuals, and in 2017/2018 was approximately 2,980,402 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas, FRAs, and MPAs (DAR 2019a).

Cultural Significance

The Brown Surgeonfish is also known as the *māʻiʻi*. The name *māʻiʻiʻi* is also applied to a taro variety (*Colocasia* spp.) and has sometimes been used to refer to other species of surgeonfish (Pukui and Elbert 1986). Traditionally, the *māʻiʻi* was considered a good eating fish that could be eaten both raw and cooked but was best when broiled (Titcomb 1972).

4.4.1.32 Hawaiian Whitespotted Toby (Puffer) (*Canthigaster jactator*)

Ecology

The Hawaiian Whitespotted Toby is endemic to Hawai'i and the Johnston Atoll (Lobel 2003). This species belongs to the pufferfish family (Tetraodontidae) and reaches lengths of 4 inches. The body is brown with white spots, the eye is green.

Hawaiian Whitespotted Toby are common in lagoon and seaward reefs at depth of 3 to 290 feet (Mundy 2005). This species has also been found to utilize man-made structures (Brock 1981) and has been shown to feed on sponges, algae, detritus, tunicates, polychaetas, bryozoans, sea urchins, brittle stars, crabs, peanut worms, shrimps, zoanthids, fishes, amphipods and foraminiferans (Randall 1985). It often is afflicted with parasitic worms (nematodes), causing it to become inflated (Deardorff and Stanton 1983).

Breeding behavior has not been documented for the Hawaiian Whitespotted Toby; however, the eastern pacific white-spotted toby (*Canthigaster punctatissima*) has been found to be sexually dimorphic. It is likely that the toby's breeding behavior is similar. Males and females guard their territories against others of the same sex. Male areas include the smaller territories of multiple females. Males mate with a female from their harem one at a time.

The Hawaiian Whitespotted Toby is a broadcast spawner, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Hawaiian Whitespotted Toby at the 0-98-foot depth in hardbottom habitat was approximately 685,517 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Hawaiian Whitespotted Toby at the 30-60-foot depth was approximately 250,573 individuals, and in 2017/2018 was approximately 249,141 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has decreased significantly in Open Areas and MPAs and has remained stable in FRAs (DAR 2019a).

Cultural Significance

The Hawaiian Whitespotted Toby is one of three endemic pufferfish that inhabit Hawai'i's waters (Hoover 2007). The common name "Toby" originated in Australia. A review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information related to the Hawaiian Whitespotted Toby; however, tobies are sometimes referred to generally as *makimaki* (Hoover 2007). Other names traditionally used for pufferfish include *'o'opu hue*, possibly an alteration of *ōpūhue (*calabash, gourd*),* and *kēkē* (potbelly).

4.4.1.33 Bluestripe Snapper (Taape) (*Lutjanus kasmira*)

Ecology

The Bluestripe Snapper is an introduced species in Hawai'i. It has a bright yellow body and fins with four horizontal blue stripes. The yellow fades to white in the lower third of the body. The body is moderately compressed laterally, with an average length of 13.5 inches (Allen 1985b). This species is found throughout the Indo-Pacific oceans.

The Bluestripe Snapper inhabits shallow-water reefs (100 to 500 feet) where it feeds on shrimp, cephalopods, gastropods, crabs, and small fish. This species also utilizes artificial structures in shallow bays throughout its range. Juveniles have been found to use seagrass beds until reaching maturity (Lieske and Myers 1994). The introduction of this fish into Hawai'i included at least one non-native parasite that has spread to local fishes (Gaither et al. 2013).

Bluestripe Snapper are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Allen 1985b, Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Bluestripe Snapper at the 0-98-foot depth in hardbottom habitat was approximately 7,092,851 individuals. However, this is a low estimate because much of the Bluestripe Snapper population occurs below the 98-foot depth surveyed by the CREP (2018) and is not observable by the methods of the survey. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Bluestripe Snapper at the 30-60-foot depth was approximately 7,830 individuals, and in 2017/2018 was approximately 33,290 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas and FRAs and remained stable in MPAs (DAR 2019a). The large difference in these estimates results from the larger survey area of the CREP survey which samples more of the population.

Cultural Significance

Introduced initially from the Marquesas to the Hawaiian Islands in 1958 for commercial fishing purposes, the Bluestripe Snapper, more commonly known by its Tahitian name *ta'ape*, has not fared well in Hawai'i's fish consumer market. These fish, which tend to school in great numbers, are often regarded by local fishermen as a pest. Given that it arrived in Hawaiian waters so recently, there are currently no known Hawaiian names for this fish or any traditional cultural uses.

4.4.1.34 Peacock Grouper (Roi, Bluespot Peacock Grouper) (*Cephalopholis argus*)

Ecology

The Peacock Grouper is widely distributed throughout the Indo-Pacific oceans and has been introduced to the Hawaiian Islands. Individuals can reach a length of up to 24 inches and are identified by white vertical stripes on the back half of a brown colored body. Peacock Grouper was thought to present a risk to native species of Hawai'i (Dierking 2007). However, a recently completed 5.5-year study found that removal of the Peacock Grouper did not translate into sustained increases in prey, nor to increases in total fish biomass (Giddens et al. 2017).

This Peacock Grouper prefers exposed reef front habitats with a water depth of 3 to 30 feet, while juveniles utilize thick pockets of coral (Myers 1999). Individuals use a variety of hunting techniques to capture prey. They may hover and wait, stalk prey, and follow larger predators such as eels and attack missed prey (Hoover 2008). Dierking et al. (2009) found reef fishes were the principal diet component (97.7% by % Index of Relative Importance [IRI]) of Peacock Grouper, with all 10 of the most abundant species on West Hawai'i reefs found in the stomachs of Peacock Grouper. Some fishes that were rare in the reef environment in West Hawai'i were found to be important components of the diet, while others, although highly abundant on West Hawai'i reefs, had low dietary importance. Crustaceans were the only other higher taxonomic group in the diet but were of minor importance (2.3% by %IRI) (Dierking et al. 2009).

Peacock Grouper are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984). Males defend territories and their harem of up to six females from other males.

CREP (2018) data indicate that the 2016 island of Hawai'i population of Peacock Grouper at the 0-98-foot depth in hardbottom habitat was approximately 476,556 individuals. WHAP data indicate the 2012/2013 WHRFMA Open Area population of Peacock Grouper at the 30-60-foot depth was approximately 24,610 individuals, and in 2017/2018 was approximately 51,546 individuals (DAR 2014a, 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, FRAs, and MPAs (DAR 2019a).

Cultural Significance

The Peacock Grouper, more commonly known as the roi, and was introduced to Hawai'i from French Polynesia in 1956 to enhance the local fisheries. Because this species was so recently introduced to

Hawaiian waters, a review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information related to it.

4.4.1.35 Psychedelic Wrasse (*Anampses chrysocephalus*)

Ecology

The Psychedelic Wrasse is endemic to the Hawaiian Islands and is found among seaweed coral reefs at depths from 40 to 450 feet (Lieske and Myers 1994). This species is dark brown with white spots and a red tail. However, like others in the wrasse family, as the females mature they undergo a color and sexual transition to the “terminal phase” male. These males have a bright orange head covered in blue spots and radiating lines. Psychedelic Wrasse terminal phase males are usually only found in depths greater than 50 feet (DLNR 2015). The main prey for the Psychedelic Wrasse are macro-invertebrates found among the rocks and corals it inhabits. Females usually form small groups with a single male (Lieske and Myers 1994).

Psychedelic Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai’i population of Psychedelic Wrasse at the 0-98-foot depth in hardbottom habitat was approximately 36,770 individuals. However, the Psychedelic Wrasse occupies habitat below the 98-foot depth surveyed by the CREP (2018) study. As such, this is likely a low estimate, because much of the population is not observable by the methods of the study. WHAP estimated a population size of 1,071 in 2017/2018 but noted that this is a deeper water species that is only occasionally recorded on surveys, and thus the population is underestimated (DAR 2019a). Since the establishment of the WHRFMA, this species has remained stable in Open Areas, FRAs, and MPAs (DAR 2019a).

The Psychedelic Wrasse is a DLNR Species of Greatest Conservation Need (SGCN, Section 4.4.3), but is considered a species of ‘Least Concern’ by the International Union for the Conservation of Nature and Natural Resources (IUCN; 2017).

Cultural Significance

See Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which includes the Psychedelic Wrasse.

4.4.1.36 Tinker's Butterflyfish (*Chaetodon tinkeri*)

Ecology

The Tinker’s butterflyfish is identified by a gold mask over the eye, with a diagonal demarcation separating a white lower/front part of the body and head from a black upper rear portion. Tinker’s Butterflyfish is found from Hawai‘i Island through O‘ahu (DLNR 2015), and the Johnston Atoll to the Marshall Islands (Lobel 2003). Tinker’s Butterflyfish can be found at least as deep as 400 feet on O’ahu and Hawai’i (Pyle pers. comm.) on coral reef slopes. Common prey species for Tinker’s Butterflyfish include small invertebrates, crabs, and worms (Pyle 2001).

Tinker's Butterflyfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Tinker's Butterflyfish at the 0-98-foot depth in hardbottom habitat was approximately 18,475 individuals. However, the vast majority of the population occurs well below the 98-foot depth surveyed by the CREP and is not observable by the methods of the survey. WHAP could not produce estimates of this species because the species occurs in habitats not adequately surveyed by WHAP transects (DAR 2014a, 2019a).

The Tinker's Butterflyfish is a DLNR SGCN (Section 4.4.3) but is considered a species of 'Least Concern' by the IUCN (2017).

Cultural Significance

See Section 4.4.1.16 for a discussion of the cultural significance of *kīkākapu,* which includes the Tinker's Butterflyfish.

4.4.1.37 Longfin Anthias (*Pseudanthias hawaiiensis*)

Ecology

The Longfin Anthias can grow up to 4 inches and is bright yellow to orange with red and purple along the fins. It is endemic to Hawai'i and the Johnston Atoll (Lobel 2003) and is found in caves or coral rubble along steep drop-offs from 85 to 400 feet deep (Randall 2007). This species feeds primarily on larvae of crustaceans and fish eggs (Bachhet et al. 2006).

Longfin Anthias are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

Most of the Longfin Anthias population occurs below the 98-foot depth surveyed by the CREP and the 60-foot depth surveyed by the WHAP, and therefore the species is not observable by the methods of either survey. As such, data are not available to produce a reliable WHRFMA or island-wide population estimate.

Cultural Significance

Although endemic to the islands, a review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information for the Longfin Anthias.

4.4.1.38 Flame Wrasse (*Cirrhilabrus jordani*)

Ecology

The Flame Wrasse is endemic to the Hawaiian Islands and the Johnston Atoll (Lobel 2003, Lieske and Myers 1994). Females are bright red on the dorsal part of the body fading to a light pink on the ventral side. The fins are opaque with some yellow features on the face. Females grow to about 3 inches before they begin to transform into a male. As the male matures the dorsal remains bright red fading into a vibrant yellow orange.

The Flame Wrasse utilizes seaward reefs and forms groups above large drop-offs at a depth of 15 to 600 feet, where it feeds exclusively on zooplankton along the ocean floor (Lieske and Myers 1994). Prime Flame Wrasse habitat became an FRA when Act 306 was implemented (BIAAF, pers. comm.). During breeding males and females form pairs for mating (Breder and Rosen 1966).

Flame Wrasse are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

Most of the Flame Wrasse population occurs below the 60-foot depth surveyed by the WHAP and below the 98-foot depth surveyed by the CREP, and therefore the species is not observable by the methods of either survey. As such, data are not available to produce a reliable WHRFMA or island-wide population estimate.

Cultural Significance

See Section 4.4.1.4 for a discussion of the cultural significance of *hinālea,* which includes the Flame Wrasse.

4.4.1.39 Fisher's Angelfish (*Centropyge fisheri*)

Ecology

The Fisher’s Angelfish is mostly orange with a thin blue outline highlighting the belly and anal fin, the caudal fin is pale yellow. Adults attain a length of only 2 inches. This angelfish is found throughout Hawai’i and the Johnston Atoll (Lobel 2003). Small groups have been observed feeding on algae and small shrimp associated with coral along outer reef slopes at depths between 10 and 200 feet (Pyle 2001). This species is hermaphroditic and changes sex as it matures. It is distributed from the east coast of Africa to the islands of French Polynesia and Hawaiian Islands and in the western Pacific from southern Japan to New South Wales (Randall 2007).

Fisher’s Angelfish are broadcast spawners, with males and females simultaneously releasing eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai’i population of Fisher’s Angelfish at the 0-98-foot depth in hardbottom habitat was approximately 666,209 individuals. WHAP estimated the Open Area population of this species in 2017/2018 at 59,064 individuals but noted that the species typically occurs at deeper depths, and is only occasionally encountered during surveys, and the population is thus underestimated (DAR 2019a). Since the establishment of the WHRFMA, this species has increased significantly in Open Areas and remained stable in FRAs and MPAs (DAR 2019a)

The Fisher's Angelfish is a DLNR SGCN (Section 4.4.3) but is considered a species of 'Least Concern' by the IUCN (2017).

Cultural Significance

A review of cultural-historical literature (see Appendix A) did not reveal any specific Hawaiian names or cultural information for the Fisher's Angelfish.

4.4.1.40 Eyestripe Surgeonfish (Palani) (*Acanthurus dussumieri*)

Ecology

The Eyestripe Surgeonfish is found throughout the Indo-Pacific region. This large surgeon fish can reach lengths of 21 inches with a body that is mostly yellow with purple highlights. A characteristic bright yellow band goes behind each eye to the gill cover (Myers 1991). The tail is blue to dark purple.

The Eyestripe Surgeonfish feeds on both green and brown algae and detritus from the ocean floor (Myers 1991), and are commonly found along clear corals, lagoons, and outer reefs at depths of 13 to 430 feet. Adults are usually observed alone and pair only for mating (Myers 1999).

Eyestripe Surgeonfish are broadcast spawners. Many broadcast spawners migrate to the edge of the reef drop off to spawn at dusk or dawn (Thresher 1984). Males and females simultaneously release eggs and sperm into the water column where the eggs are fertilized before floating to the surface until they hatch 20-30 hours later (Thresher 1984).

CREP (2018) data indicate that the 2016 island of Hawai'i population of Eyestripe Surgeonfish at the 0-98-foot depth in hardbottom habitat was approximately 578,835 individuals. WHAP could not produce estimates of this species because the species occurs in habitats not adequately surveyed by WHAP transects.

Cultural Significance

The Eyestripe Surgeonfish is also known as *palani*. *Palani*, meaning "to stink, smell sour or rancid" (Pukui and Elbert 1986), is a well-recognized trait of this fish that is documented in *mo'olelo* and *'ōlelo no'eau*. *Palani* were commonly raised in fishponds, particularly for ceremonial uses or were reserved for the *ali'i* and were kept for breeding, while the offspring were raised tame so that they could be easily removed by hand (Handy and Handy 1972). *Palani* were considered *kapu* (taboo) to men (Titcomb 1972).

4.4.2 Non-White List Wildlife Species

Marine species in Hawai‘i include over 1,200 species of fishes, with around 500 species adapted to live on coral reefs, and the rest adapted to the pelagic open surface waters, mesopelagic, or bathypelagic zones (middle or deep waters), estuaries, or sandy bottoms (DLNR 2015). At the top of the food chain are the apex predators such as the many sharks and large predatory reef and pelagic fishes of Hawai‘i. Over 5,000 marine invertebrates are known from Hawai‘i and include over 100 species of hard, soft, and precious corals as well as hundreds of types of snails, crabs, shrimps and small numbers of worms, jellyfish, sponges, starfish, and tunicates (DLNR 2015). Five marine turtles occur in Hawai‘i; two are common residents that nest on Hawai‘i's beaches and three others are more occasional visitors. All sea turtles are listed as threatened or endangered under the federal Endangered Species Act (ESA) of 1973, as amended. Federal- and state-listed species are discussed in Section 4.4.4.

Approximately 26 species of marine mammals, mostly cetaceans, are considered resident or occasional visitors to Hawai‘i. These include the Humpback Whale or *koholā* (*Megaptera noveangliae*), which migrates during the winter months to Hawaiian waters to breed and give birth each year before returning to feed in Alaskan waters during spring and summer, False Killer Whale (*Pseudorca crassidens*), and the Spinner Dolphin (*Stenella longirostris*) and Bottlenose Dolphin (*Tursiops truncatus*). Humpback Whales and Hawaiian Monk Seals (*Monachus schauinslandi*) are common marine mammals in Hawai‘i and are listed as endangered under the ESA (DLNR 2015). All marine mammals are protected by the Marine Mammal Protection Act. Many of the resident whales and dolphins feed on fishes and squids that occur in the moderately deep waters off Hawai‘i's coasts.

Approximately 4,100 species of marine invertebrates are known from Hawai'i. Marine invertebrates collected under Aquarium Permits generally include those species that are colorful or aesthetically pleasing. Between 2000 and 2017 over 93% (2,066,025 individuals) of all invertebrates collected under Aquarium Permits were collected from the island of O'ahu, based on data provided by the DAR (2014a). This is likely due to White List restrictions in West Hawai'i. In East Hawai'i, non-White List Species may be collected, and invertebrates made up approximately 58% of the total catch of White List and non-White List Species combined.

Of the approximately 249,000 invertebrates collected in East Hawai'i since 2000, over 73% (182,710 individuals) were Red Pond Shrimp (species not specified). Red Pond Shrimp (primarily *Halocaridina rubra*) also make up 42.5% of all species collected in East Hawai'i. Other common species of invertebrates captured in East Hawai'i include hermit crabs (species not specified), Feather Dusters Worms (*Sabellastarte spectabilis*), and Zebra Hermit Crabs (*Calcinus laevimanus*).

4.4.2.1 Red Pond Shrimp

This group of species live in underground (hypogeal) environments and in anchialine ponds (landlocked ponds with a mix of freshwater and seawater through underground connections to the sea). Of the eight known species to occur in Hawai'i, all are endemic to the Hawaiian Archipelago (including Johnston Atoll) except *Antecaridina lauensis*, *Calliasmata pholidota*, and *Metabetaeus lohena* which are found throughout Hawai'i and also in Chile (US Fish and Wildlife Ecos Environmental Conservation 12/2015). *Halocaridina rubra* (‘*Ōpae ‘ula*, an endemic shrimp species known to be ideal *‘ōpelu* bai) reaches 0.5 inch in length and is an herbivore that grazes on algal, bacterial, and diatom films growing on rocks and other hard substrates. They can also filter feed in mid-water and at the surface. The other species are all larger (up to two inches long) and some are predatory. All have red color and reduced appendages. *'Ōpae 'ula* carry about 12 fertilized eggs under their abdomen for a brood period of about 38 days. They reproduce 1-2 times per year. Lifespan of *'Ōpae 'ula* is long, up to 20 years in captivity. Less is known about the life history of the other species, but they are relatively long-lived for species in their taxa.

No population estimates are available for Red Pond Shrimp.

4.4.2.2 Hermit Crab (various species)

Because specific species of hermit crabs are not reported on Aquarium Permit reporting forms, it is not possible to know which species are collected, with the exception of zebra hermit crabs (Section 4.4.2.3). However, hermit crabs are one of the most common types of tide pool animals. They rely on empty snail shells for protection. Most species will scavenge the reefs consuming fish, other invertebrates, or algae. Some will display a variety of coloration and elaborate eye colors. Approximately 23 species of hermit crabs are known from Hawai'i shorelines.

No population estimates are available for hermit crabs.

4.4.2.3 Zebra Hermit Crab (*Calcinus laevimanus*)

This species of hermit crab is found in a large area of the Indo-Pacific, extending from Africa to Australia and Japan to Hawai'i. The common name comes from the coloration, black and white pincers, and white bands on dark legs. They also have orange and sky-blue eyestalks. They prefer to inhabit gastropod shells in intertidal flats, reef flats, and rock platforms, and may also be found in mangrove areas on sand mud bottoms and on rocky shores (Rahayu 2000).

No population estimates are available for Zebra Hermit Crabs.

4.4.3 Hawai'i Species of Greatest Conservation Need

Species of Greatest Conservation Need (SGCN) are identified in Hawai'i's State Wildlife Action Plan (SWAP) but are not threatened, endangered, or otherwise legislatively protected species. In fact, all three SGCN species noted below (and further discussed in Section 5.0) are listed as species of 'Least Concern' by the IUCN (2017). However, recognizing the need to act to protect endemic species, the DLNR identified Hawai'i's indigenous SGCN in Exhibit 1 of Hawai'i Administrative Rules Chapter 124. This list includes terrestrial mammals, marine mammals, and marine reptiles only. Additional native species were identified and added based on their presence on the following lists (DLNR 2018):

- The Federal list of threatened, endangered, candidate and concern species;
- Species protected by the U.S. Marine Mammal Protection Act;
- The State list of threatened and endangered species;

- The Checklist of the Birds of Hawai‘i; and
- Species identified as present in Hawai‘i by groups or organizations with significant experience or expertise (e.g., Audubon Watch List; national and regional Bird Plans, such as the U.S. Shorebird Conservation Plan, Waterbird Conservation for the Americas; Regional Seabird Conservation Plan).

In addition to the above lists, for any terrestrial indigenous species not represented by any of the lists, their status as indigenous automatically included them as Hawai‘i’s SGCN. For aquatic fishes and invertebrates, endemic species were added to the list (DLNR 2018). The DAR also included native species on the IUCN Threatened Red List, and the Convention on International Trade in Endangered Species (CITES) list. A Statewide Aquatic Wildlife Conservation Strategy (SAWCS) Advisory Council was developed to advise on additional species that were at risk due to specific threats. The SAWCS Advisory Council is a panel with representatives from federal and state agencies, resource user groups, and non-profit organizations that helps the DAR develop its CWCS (DLNR 2018).

Additional species considered must meet one or more of the following biological criteria (DLNR 2018):

- Species with low or declining populations;
- Species indicative of the diversity and health of the state’s wildlife;
- Species with small, localized “at-risk” populations;
- Keystone species;
- Indicator species;
- Species with limited dispersal;
- Disjunct species;
- Vulnerable species;
- Species of conservation concern;
- “Responsibility” species, (i.e., species that have their center of range within a state); and,
- Species with fragmented or isolated populations.

Currently 25% of fish, 20% of mollusks, 18% of algae, and 20% of the corals are considered endemic to Hawai’i and listed as SGCN species (Randall 2007, DLNR 2015).

Based on these parameters, three White List Species occur on Hawai’i’s SGCN list:

1. Psychedelic Wrasse
2. Tinker’s Butterflyfish

3. Fisher's Angelfish.

The DLNR SWAP (2015) addresses these species and identifies the following actions to ensure the species conservation and sustainability:

1. Conservation Actions: The goals of conservation actions are to not only protect current populations, but to also establish further populations to reduce the risk of extinction. Commercial licenses are required for aquarium collectors. In addition to common statewide and island conservation actions, specific actions include:
   - Restoration of habitat; and,
   - Maintaining healthy populations with appropriate fishing regulations and education.
2. Monitoring:
   - Continue to survey for populations and distribution in known and likely habitats.
3. Research Priorities:
   - Improve understanding of factors affecting the species population size and distribution; and,
   - Support aquaculture research to develop captive breeding for species used in the aquarium trade.

4.4.4 Threatened and Endangered Wildlife Species

A total of 8 federal and 10 state-listed threatened or endangered marine species, consisting of one seal, four whales, and five sea turtles, occur in Hawai'i (Table 4-4). Federal endangered species are those species that the US Fish and Wildlife Service (USFWS) define as being in danger of becoming extinct, while threatened species are those likely to become endangered in the foreseeable future. State endangered species are those defined by the DLNR as in danger of becoming extinct at a state level, while threatened species are those likely to become endangered in the foreseeable future at the state level. No species collected by aquarium fishers occur on the state or federal list of threatened and endangered species.

Table 4-4. Threatened and endangered marine species of Hawai'i.

Common Name	Scientific Name	State Status	Federal Status
Mammals			
Hawaiian Monk Seal	*Neomonachus schauinslandi*	E	E
Fin Whale	*Balaenoptera physalus*	E	NA
Humpback Whale	*Megaptera novaeangliae*	E	E
Sperm Whale	*Physeter catodon*	E	E
False Killer Whale	*Pseudorca crassidens*	E	NA
Reptiles			
Pacific Leatherback Sea Turtle	*Dermochelys coriacea schlegelii*	E	E

Common Name	Scientific Name	State Status	Federal Status
Pacific Hawksbill Sea Turtle	*Eretmochelys imbricata bissa*	E	E
Loggerhead Sea Turtle	*Caretta*	T	T
Green Sea Turtle	*Chelonia mydas*	T	T
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	T	T

4.4.5 Reef Habitat

Stretching for more than 1,200 miles in the Central Pacific, Hawaiian coral reefs account for about 85% of all coral reefs in the United States. More than 500 species of algae also live in Hawai'i's coral reefs providing food for fish and oxygen for all marine life. The oceans' algae provide more oxygen than all land plants worldwide combined. There are 78 species of endemic marine algae, 24 species of endemic freshwater algae, and two aquatic plants included on Hawai'i's list of SGCN (DLNR 2015).

Hawai'i's reefs are unique among the world's reef ecosystems. Compared to coral reefs in the Indo-Pacific or Caribbean, Hawaiian reefs are relatively young. Hawai'i reefs are therefore dominated by hard corals (as opposed to sponges, tunicates, and soft corals) and are inhabited by distinctive reef fish and other marine life. Most stony corals grow very slowly. Hawai'i hosts about 40 species of hard, reef building corals (MRC 2017). Due to Hawai'i's extreme isolation, an estimated 25% of the coral reef species are found nowhere else.

Stony corals are defined by Hawai'i Administrative Rule 13-95 as any species belonging to the Order Scleractinia (marine corals which generate a hard skeleton). All reef corals, including mushroom corals, belong to this order (DAR 2014b). The animals which form stony corals belong to the same major group as jellyfish and anemones. Most of them are colonial, and all secrete a hard skeleton made of calcium carbonate. The animals themselves, called polyps, form the outer living layer of a coral colony. Each polyp sits in a cup-like depression called a calyx. Most stony corals grow very slowly and can take hundreds of years to recover from damage (DAR 2014b).

The characteristic color of many living corals is due to the presence of single-celled algae, called zooxanthellae, which live inside the coral polyp. The coral and algae have a symbiotic relationship. Most stony corals produce colonial forms that are attached to the substrate, but a few are solitary and unattached (DAR 2014b).

Ecosystem indicators related to benthic reef community integrity indicate a shift in West Hawai'i towards lowered reef accretion and reduced structural complexity. Hard coral cover, an indicator of reef topographic complexity, habitat structure, and reef accretion, decreased from an average of 44% to 31% cover in the North from 2003 to 2014, a decline of roughly one-third in just 12 years (Gove et al. 2016). However, over the same time period, hard coral cover remained relatively constant in the South (Gove et al. 2016). The ratio between the cover of calcifying to non-calcifying organisms – an indicator of coral reef community dynamics and the extent to which a given system is dominated by organisms that contribute to coral reef development and persistence – declined across West Hawai'i since 2003 (Gove et al. 2016). The North experienced the biggest change in this indicator, with the a calcified: non-calcified ratio decreasing by approximately half to a present value of <1, indicating the benthic community is currently dominated by non-calcifying benthic organisms (Gove et al. 2016).

4.4.5.1 Corals Common to Hawai'i (DAR 2014b)

Rose or Cauliflower Coral (*Pocillopora meandrina*)

The most common *Pocillopora* in Hawai'i, this coral prefers wave-agitated environments, and is found at depths to about 150 feet. Commonly called "rose coral" or "cauliflower coral," the colonies form cauliflower-shaped heads about 10 to 20 inches in diameter. Branches are heavy and leaf-like and fork bluntly near the ends. All branches have wart-like projections called verrucae that are covered with calices. Color of living colonies ranges from brown to pink.

Lace Coral (*Pocillopora damicornis*)

This delicate and fragile coral forms small bushy clumps up to about 6 inches in diameter. Colonies consist of fine branches covered with calices. These branches range from long and slender in calm waters to more robust forms in areas of wave action. Sometimes the skeleton will create pocket formations around a crab that lives among the branches. Usually found in protected areas and inner portions of large reef flats, this species appears to strongly depend on sunlight, as it is rarely found below about 30 feet. Colonies range in color from light brown in shallow waters to dark brown in deeper waters.

Antler Coral (*Pocillopora eydouxi*)

Colonies consist of thick pipe-like branches that resemble moose antlers. This species also possesses verrucae and is usually found in depths of 35 to 150 feet. Live colonies are brown in color and usually darker than other Pocilloporid corals.

Lobe Coral (*Porites lobata*)

This coral produces many encrusting or massive forms on the reef from the intertidal zone to depths of over 180 feet. Long narrow cracks found on the coral heads are produced by a type of alpheid shrimp. Calices have a snowflake-like appearance and are shallow and flush to the surface. Living colonies range in color from yellowish-green to brown and sometimes blue.

Finger Coral (*Porites compressa*)

Distinguishing features are the finger-like branching and shallow snowflake-shaped calices. This species is most common in wave-protected areas like bays or deeper reef slopes to depths of about 150 feet. It has many growth forms, but all of them show some sort of fingerlike branching. Color of live colonies ranges from light brown to light yellowish-green.

Rice Coral (*Montipora capitata*)

The most obvious characteristic of this coral is the nipple-like projections (papillae) that cover the surface. These papillae are smooth with no calices on them. Calices are found on the upper surface of the coral between the papillae. The image of the calices and papillae create a "rice & pepper" appearance. This species is found at depths up to about 150 feet. It has a number of growth forms ranging from plate-like to branchlike and encrusting types. Color of living colonies is usually brown. If the colony is growing in a plate form, the edges may be white.

Mushroom or Razor Coral (*Fungia scutaria*)

This solitary (single polyp), free-living (unattached) coral is most commonly found on reef flats, frequently between cracks and crevices. It has also been found at depths of over 75 feet. Its disk-like, elliptical shape resembles a mushroom cap and ranges from 1.5 to 7 inches in diameter. Some adults may form a high arch in the middle. Immature forms are attached to the substrate or an adult mushroom coral by a stalk. It grows into a disk and, when large enough, breaks off the stalk and becomes free-living. The color of live specimens ranges from pale brown in bright sunlight to dark brown in shady areas or deeper water.

Cup or Tube Coral (*Tubastraea coccinea*)

This is a common non-reef building coral found in shallow Hawaiian waters. This species forms large calices and occurs in clumps that are 2 to 4 inches in diameter. Living tissue is usually bright orange in color but may also appear pink or even black. The bright coloration is not produced by zooxanthellae. This coral is usually found on steep ledges, in caves and in shady tidepools.

4.4.6 Invasive Species

From *A Guidebook of Introduced Marine Species in Hawai'i* (DeFelice et al. 2001):

> *Through the Hawai'i Biological Survey at Bishop Museum, a count of the total number of species in the Hawai'i Archipelago has been compiled. In 1999, there were 23,150 known species of terrestrial and aquatic algae, plants, and animals, including 5,047 nonindigenous species (~ 20%). The total number of marine and brackish water alien species in the Hawaiian Islands was 343, including 287 invertebrates, 24 algae, 20 fish, and 12 flowering plants.*
>
> *The 287 alien marine invertebrate species make up about 7% of the known marine and brackish water invertebrate fauna in the Hawaiian Islands (4,099 species). Arthropods have been the most successful marine invaders, with 71 suspected alien crustacean species, while 53 alien mollusks have made it to Hawai'i. Limited information exists for these invasive species.*
>
> *The greatest number of introduced marine invertebrates have arrived to Hawai'i through hull fouling, but many have also arrived with solid ballast and in ballast water. DeFelice et al. (2001) considered 201 species (70%) to be introduced, and 86 species (30%) cryptogenic (not demonstratively native or introduced). Two hundred forty-eight (87%) have become established, 15 (5%) arrived but failed to become established, 6 (2%) were intercepted, and the population status of 18 species (6%) is unknown.*
>
> *The nonindigenous invertebrate species in the Hawaiian Islands are primarily of Indo-Pacific/Philippines Islands region origin. A surprising number of species from the tropical western Atlantic/Caribbean region have invaded Hawai'i as well.*

Invasive algae pose the largest threat to Hawai'i's reef ecosystem. The five most common algae species posing the largest threat include Smothering Seaweed (*Kappaphycus* and *Euchema* spp.), Gorilla Ogo (*Gracilaria salicornia*), Leather Mudweed (*Avrainvillea amadelpha*), Hook Weed (*Hypnea musciformis*), and

Prickly Seaweed (*Acanthophora spicifera*). Marine debris arriving from other countries and regions and ballast water/biofouling are the primary threat for invasion in the Hawaiian Islands.

Invasive fish species of concern in Hawai'i include two White List Species, the Bluestripe Snapper (Taape), and Peacock Grouper (= Roi, Bluespot Peacock Grouper), and a non-White List Species, the Blacktail Snapper (*Lutjanus fulvus*). All three species were introduced between 1956-1961, mostly as game fish (IUCN 2017).

The Peacock Grouper (Section 4.4.1.34) is a known carrier of Ciguatera (a foodborne illness), which is well known by the local fishermen and therefore its use as a food fish is intentionally very limited (BIAAF, pers. comm., also reviewed in Appendix A). It has become a dominant predator species in the Main Hawaiian Islands and is known to have negative ecological impacts on other endemic and culturally valued species (Dierking 2007). In recent years, efforts to minimize populations of this species have led to statewide events often dubbed "roi round-ups," where local spear fishers are encouraged to catch and remove as many roi from the reefs as possible. However, a recently completed 5.5-year study found that removal of the Peacock Grouper did not translate into sustained increases in prey, nor to increases in total fish biomass (Giddens et al. 2017).

The Bluestripe Snapper (Section 4.4.1.33) and Peacock Grouper (Section 4.4.1.34) are well established in Hawai'i. The Blacktail Snapper occurs at low densities only in the lower Hawaiian Islands (Randall 1987, Gaither et al. 2010 as cited in IUCN 2017). From 2008 through 2014, regional estimates of the density of Blacktail Snapper ranged from 1.8 to 14.1 individuals per 2.5 acres over hard bottoms to 98.5 feet depth in Pacific coral reef areas surveyed by NOAA (NOAA unpublished data as described in Heenan et al. 2014 as cited in IUCN 2017). The highest recorded density was in the MHI region (0.3 to 45.1 individuals per 2.5 acres) as compared to the lowest in the Southern Mariana Islands region (0 to 4.3 individuals; IUCN 2017).

4.4.7 Biological Aspects of the Commercial Aquarium Fishery

4.4.7.1 West Hawai'i Aquarium Project (WHAP) Surveys

To monitor and gauge the effects of the aquarium fishing industry, the West Hawai'i Aquarium Project (WHAP) established 25 study sites (Figure 4) along the West Hawai'i coastline in early 1999 at 9 FRA sites, 8 Open Area sites (aquarium fish collection areas) and 6 previously established MPAs to collect baseline data both prior to and after the closure of the FRAs. The MPAs are MLCDs and FMAs, which have been closed to aquarium collecting for at least 9 years and were presumed to have close to "natural" levels of aquarium fish abundances (DAR 2019a). They serve as a reference or 'control' to compare with the FRAs and Open Areas. It should be noted that after several years of study and observation, one of the MPA sites (Lapakahi MLCD – subzone B), was found not to be closed to aquarium collecting due to its remoteness and poorly defined seaward boundaries (i.e., 500 feet offshore). As such, the Lapakahi survey site was considered an Open Area for data analysis purposes (DAR 2014a, 2019a).

The overall goals of the WHAP were two-fold: 1) To evaluate the effectiveness of the FRA network by comparing targeted aquarium fishes in FRAs and Open Areas relative to adjacent control sites and, 2) To evaluate the impact of the FRA network on the commercial aquarium fishery (DAR 2019a).

Detailed explanations of the study sites and survey methods are found in Tissot et al. (2004) and Walsh (2013). To briefly summarize: Densities of all fish and selected invertebrate species were visually estimated along four 82x13 foot strip transects at each of 25 permanent sites located at depths between 30-60 feet in the three types of management areas. All survey divers either had extensive experience in conducting underwater fish surveys in Hawai'i or received training through the UH’s Quantitative Underwater Ecological Survey Techniques (QUEST) training course prior to collecting data (Hallacher and Tissot 1999). In addition to the transect surveys, a 10 minute ‘free-swim’ survey is also conducted by two divers in the areas surrounding the actual transects. The purpose of this survey is to better census uncommon or rare species and species of particular ecological interest such as Bluestripe Snapper, Peacock Grouper, terminal phase parrotfish (Family Scaridae), cleaner wrasses (*Labroides* spp.) and Crown-of-Thorns Starfish (*Acanthaster solaris*). All sites are presently surveyed four times per year. Through 2018 (the most recent year for which data are available), a total of 8,712 transects had been completed (DAR 2019a). Six rounds were conducted prior to FRA closure in 1999 (DAR 2014a).

Table 4-5 provides West Hawai’i Open Area population estimates of those species on the White List based on the WHAP data. It is important to note that population estimates provided in the table and previous life histories sections, only include West Hawai’i estimates of fish from Open Areas at depths of 30-60 feet (the depth at which WHAP surveys are conducted); thus, the actual population size of each species is likely greater due to individuals at other depths, or in unsurveyed areas. Island-wide population estimates for each species are described in Section 4.4.1 and summarized in Table 4-5.

Table 4-5. West Hawai'i Open Area population estimates of all White List Species based on average WHAP data from 2012/2013 and 2017/2018 and percent of that population collected annually by aquarium fishers at the 30'-60' depth in 2013/2014 (DAR 2014a) and 2017/2018 (DAR 2019a). Data in this table (recreated from DAR 2014a, 2019a) may differ from other publications due to the time of year data were analyzed, number of monthly reports available to the DAR at that time, and Hawai'i's confidentiality laws.

	2013-2014			2017-2018		
Common Name	Catch[1]	30'- 60' Open Area Population[2]	Catch as % of 30'-60' Open Area Population	Catch[1]	30'- 60' Open Area Population[2]	Catch as % of 30'-60' Open Area Population
Achilles Tang	7,073	21,627	32.70%	5,437	13,796	39.67%
Yellow Tang	273,778	1,663,775	17.26%	264,870	2,867,048	9.24%
Black Surgeonfish (chevron tang)	4,045	34,678	11.66%	3,878	98,067	3.95%
Shortnose (Geoffroy's) Wrasse	258	3,222	8.01%	582	3,222	18.07%
Goldrim Tang	439	7,517	5.83%	1,324	5,966	22.19%
Fourspot Butterflyfish	699	22,000	3.18%	319	15,034	2.12%
Orangeband (Shoulder) Surgeonfish	698	26,101	2.67%	1,293	53,694	2.41%
Orangespine Unicornfish (Clown Tang)	4,026	150,642	2.67%	6,078	180,099	3.37%
Forcepsfish	1,045	43,999	2.38%	840	39,734	2.11%
Spotted Boxfish (Boxfish)	175	9,322	1.88%	57	12,887	0.44%
Yellowtail Coris (Clown Wrasse)	288	19,762	1.45%	623	18,256	3.41%
Milletseed (Lemon) Butterflyfish	61	7,085	0.85%	98	2,148	4.56%
Kole (Goldring Surgeonfish, Yelloweye, Goldring)	28,407	3,616,529	0.79%	30,901	5,312,745	0.58%
Pencil Wrasse	108	19,390	0.56%	278	17,182	1.62%
Bird Wrasse	180	43,254	0.42%	265	66,581	0.40%
Blacklip Butterflyfish (Coral Butterflyfish)	23	5,593	0.40%	81	39,734	0.20%
Potter's Angelfish	945	237,149	0.40%	2,245	265,488	0.85%
Ornate Wrasse (Pinkface)	724	192,404	0.38%	1,602	196,879	0.81%
Black Durgon	71	38,033	0.19%	11	92,354	0.01%
Gilded Triggerfish (Blue-throat Triggerfish)	19	11,186	0.17%	20	3,222	0.62%
Lei Triggerfish	128	76,440	0.17%	78	92,354	0.08%
(Forster's) Blackside Hawkfish	31	20,508	0.15%	30	23,625	0.13%
'Thompson's Surgeonfish	130	91,728	0.14%	148	271,693	0.05%
Pyramid Butterflyfish	73	56,677	0.13%	42	37,586	0.11%
Multiband (Pebbled) Butterflyfish	670	580,196	0.12%	470	378,843	0.09%
Hawaiian Dascyllus (Domino)	43	57,796	0.07%	89	63,359	0.14%
Saddle Wrasse	327	537,688	0.06%	538	140,947	0.10%

Common Name	2013-2014 Catch[1]	2013-2014 30'- 60' Open Area Population[2]	2013-2014 Catch as % of 30'-60' Open Area Population	2017-2018 Catch[1]	2017-2018 30'- 60' Open Area Population[2]	2017-2018 Catch as % of 30'-60' Open Area Population
Redbarred Hawkfish	6	9,665	0.06%	21	6,443	0.33%
Eightline Wrasse	35	187,557	0.02%	97	187,930	0.05%
Fourlined Wrasse	47	327,758	0.01%	54	227,663	0.02%
Brown Surgeonfish (Lavender, Forktail Tang)	180	1,646,996	0.01%	957	2,980,402	0.03%
Hawaiian Whitespotted Toby (Puffer)	20	250,573	0.01%	26	249,141	0.01%
Bluestripe Snapper (Taape)	0	7,830	0.00%	0	33,290	0.00%
Peacock Grouper (Roi, Bluespot Peacock Grouper)	0	24,610	0.00%	0	51,546	0.00%
Psychedelic (Redtail) Wrasse	236	N/A	N/A	599	1,071	55.78%[3]
Tinker's Butterflyfish	206	N/A	N/A	290	N/A	N/A
Longfin Anthias	130	N/A	N/A	0	N/A	N/A
Flame Wrasse	67	N/A	N/A	0	N/A	N/A
Fisher's Angelfish	58	N/A	N/A	288	59,064	0.49%[3]
Eyestripe Surgeonfish (Palani)	1	N/A	N/A	0	N/A	N/A

A summary of the DAR 1999 to 2019 study findings is presented below (DAR 2019a):

- Of the 40 collected aquarium species, prior to the closure of aquarium collecting, Yellow Tang made up 81.6% of the total and Kole 9.5% (2017).
- In the 20 years since FRA establishment, the population of Yellow Tang has increased 165% in the FRAs, 74% in existing MRAs, and 101% in the Open Areas where fishing effort has been concentrated, with a current population estimate of approximately 5.7 million fish in the 30-60-foot depth range in the WHRFMA.
- Outward movement of adult Yellow Tang from protected areas into surrounding areas (‘spillover’) augments adult stocks in Open Areas up to a 0.6 mile or more away.
- Overall Kole abundance in the 30-60-foot depth range over the entire West Hawai′i coast increased by almost 5.2 million fish (118%) since FRA establishment (1999/2000), with a current population of about 9.6 million fish.
- Commercial aquarium landings of Achilles Tang have declined in West Hawai′i over the past two decades in association with a recent dramatic increase in its value (192% since 2008). This is strongly suggestive of declining availability (i.e., abundance). (Addressed in Section 5.4.1.2 – Achilles Tang).
- Achilles Tang have declined significantly in FRAs and Open Areas over the last 20 years. Open Area populations have usually been higher than FRA populations in the past decade. Achilles Tang has had low levels of recruitment over the past two decades, and because of its popularity as a food fish as well as an aquarium fish, this species is harvested both as juveniles and adults.
- Of the remaining 7 of the top 10 collected aquarium species, 1 species (Goldrim Surgeonfish) had no significant change in population, 6 species (Orangespine Unicornfish, Chevron Tang, Orangeband Surgeonfish, Brown Surgeonfish, and Potter’s Angelfish) increased significantly in one or more of the management areas, and 1 species (Ornate Wrasse (Pinkface)) declined significantly in both FRA and Open areas. These results suggest that factors other than aquarium collecting are also affecting populations of these fish.
- For 26 other species on the White List, 10 showed a significant population increase in one or more of the management areas while 11 decreased. Of the species which declined (11), only a single one, Blackside Hawkfish, declined exclusively in the Open Areas, indicating that factors other than aquarium collecting were also affecting the populations of these species.
- For most of the species on the White List, collecting impact, in terms of the percentage of the population being removed annually, is relatively low with 9 species having single digit percent catch and 21 species having catch values <1%.
- Survey data are lacking for four species which typically occur in deep water (Tinker’s Butterflyfish, Psychedelic Wrasse, Flame Wrasse and Hawai’i Longfin Anthias), as well as the Eyestripe Surgeonfish (which is typically found over sand during the day, a habitat not surveyed by WHAP).

- In terms of reef fish biomass caught by the different fisheries in West Hawai'i, considerably more biomass is taken by the combined recreational and commercial (non-aquarium) fisheries either including Yellow Tang (2.8 times) or excluding it (8.6 times). The total take of reef fish by commercial and non-commercial ('recreational') fishers on other Main Hawai'i Islands greatly exceeds the numbers and biomass of the fish collected by aquarium collectors.

- The 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors.

The Psychedelic Wrasse, Tinker's Butterflyfish, and Fisher's Angelfish are all listed as SGCN in Hawai'i (Section 4.4.3). They are not federal- or state-listed as threatened or endangered species (Section 4.4.4) and are not currently afforded any protection from collection. The Psychedelic Wrasse is endemic to the Hawaiian Islands and is found among seaweed coral reefs at depths from 40-450 feet (Lieske and Myers 1994) and are the most abundant on the Northwestern side of the island (BIAAF, pers. comm.); Tinker's Butterflyfish is found deeper than 100 feet on coral reef slopes (Pyle 2001); and, Fisher's Angelfish have been observed feeding on algae and small shrimp associated with coral along outer reef slopes at depths between 10 and 200 feet (Pyle and Myers 2010). Adequate population estimates based on WHAP data (30-60 feet depth) are not available to assess the impact of continued aquarium collection on these three species due to their deeper water habitats. However, based on deep diver observations, Tinker's Butterflyfish and Psychedelic Wrasse are substantially more common in the long term protected areas (MPAs). Commercial aquarium fishers generally do not fish in the deeper waters in which these species occur. In 2017, there were 599 Psychedelic Wrasse, approximately 290 Tinker's Butterflyfish (n.d. in East Hawai'i), and 288 Fisher's Angelfish collected by aquarium fishers on the island of Hawai'i (DAR 2018a).

4.4.7.2 Coral Reef Ecosystems Program (CREP; now known as the Ecosystem Sciences Division) Surveys

The NOAA has been involved in a large-scale monitoring program that surveys coral reef fish assemblages and habitats, including White List Species, encompassing the bulk of the US-affiliated tropical Pacific. This effort, formerly known as the Coral Reef Ecosystem Program (CREP), has included over 5,500 surveys around 39 islands, including the island of Hawai'i. The dataset was developed as a resource that could be used to understand how human, environmental, and oceanographic conditions influence coral reef fish community structure, providing a basis for research to support effective management outcomes (CREP 2018).

In 2010, the Pacific Reef Assessment and Monitoring Program (RAMP) developed and implemented a standardized survey methodology focusing on reef fish and paired benthic habitat-monitoring using monitoring methods specified in the National Coral Reef Monitoring Plan (NCRMP). The aim of the current systematic sampling design is to maximize survey site replication, while the overarching goal was to generate data representative of coral reef hardbottom substrate at the islands-scale (CREP 2018).

Surveys were conducted around the island of Hawai'i in 2010 and 2013–2016 at 257 stationary point count locations (Figure 4) with a randomized depth-stratified design, at depths from 0-98 feet (approximately 0-30 meters). At each point count location, divers conducted fish counts, estimated benthic cover, and habitat structural complexity. Typically, 3–5 days were spent at each island during each visit (generally once every

3 years), conducting 30–50 fish surveys during that time. Detailed explanations of the study sites and survey methods are found in Heenan et. al (2017). To establish survey points, an approximately 98-foot (30-meter) transect is measured out along the substrate. For each point count, a pair of divers conducts simultaneous counts in adjacent 49.2 foot (15 meter) cylindrical plots along the transect (i.e., diver 1 surveys from the 7.5 meter mark along the transect and diver 2 surveys from the 22.5 meter mark) extending from the substrate to the limits of vertical visibility (Heenan et. al 2017).

Each fish count consists of two parts, a 5-minute species enumeration in which divers generate a list of taxa observed within their cylinder to species when possible; and, a tally portion in which divers systematically work through their species list recording the number and estimated size of fish present within the cylinder. Tallying is done by conducting a series of rapid visual sweeps of the plot with one species-group (e.g., mid-water, surgeonfish, benthic butterflyfish) counted per sweep. At the end of the sweeps, divers carefully search for small, site-attached, and semi-cryptic species. Surveys were not conducted if horizontal visibility was <25 feet (Heenan et. al 2017).

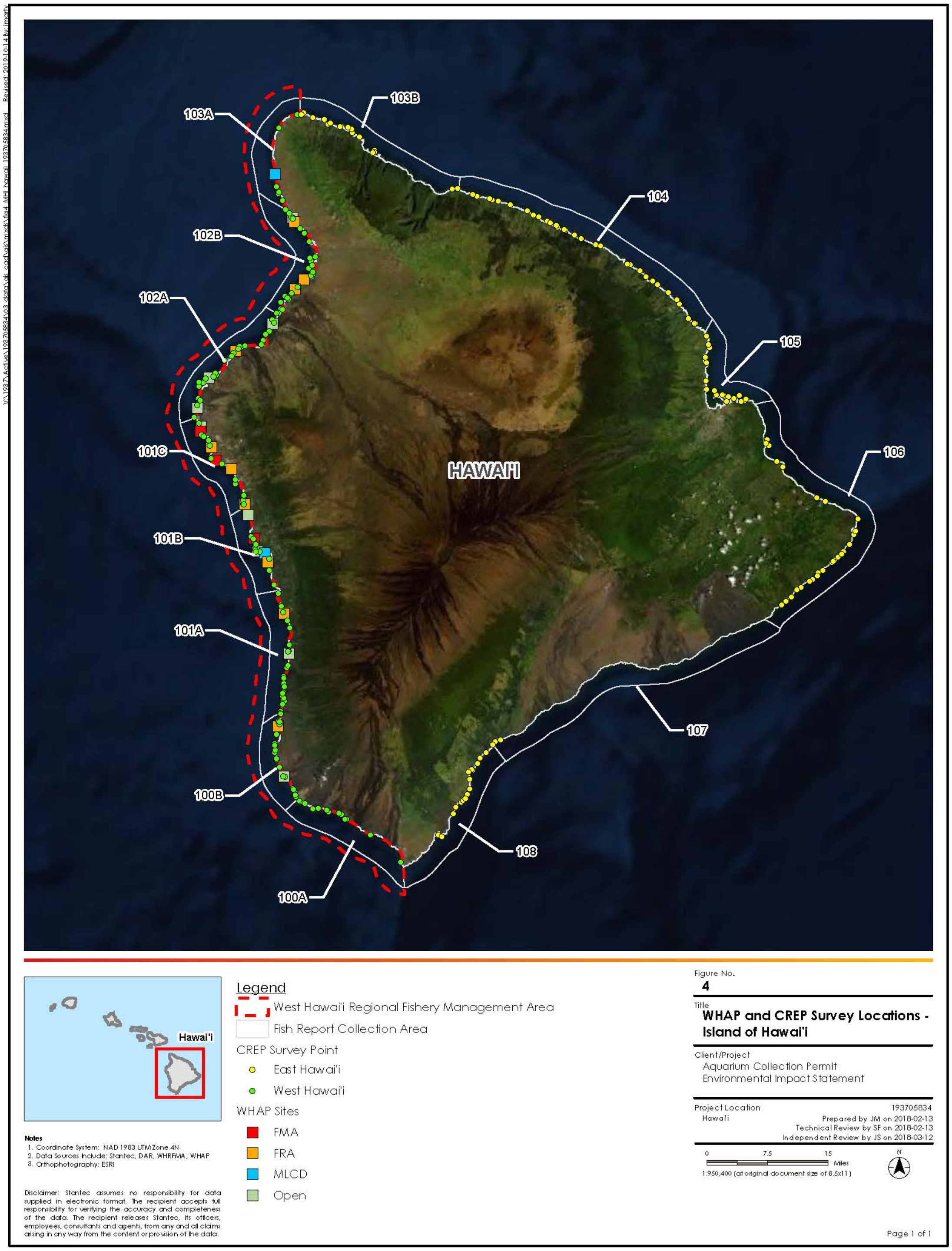


Figure 4. WHAP and CREP survey locations – Island of Hawai'i.

To facilitate analysis in this DEIS, estimated population size for each White List Species for the island of Hawai'i was calculated using CREP data by converting survey counts to abundance per unit area, and then multiplying by the estimated area of hardbottom habitat in <30 meters of water (16,840 Ha).

Although CREP data are the most comprehensive data publicly available for the island of Hawai'i, certain limitations of the surveys may lead to an underestimate of some populations of aquarium fish. Specifically, surveys are concentrated into a short period of survey effort (about one month each year) located in different locations from one year to the next, allowing for a larger coverage of the entire island, but over five years during a seven-year period. Also, population estimates may be an underestimate for certain species as surveys were only conducted at depths <30 meters (approximately 98 feet) in areas of hardbottom habitat. No data were collected from softbottom habitat, as these tend to not be important habitats for most aquarium species, but certain species may utilize these areas, and therefore are not represented in the population estimate. No data were collected from depths greater than 30 meters (approximately 98 feet), but certain species may utilize these areas as well, and are therefore not represented in the population estimate. In addition, divers are trained in the identification of aquarium fish; however, certain species may be cryptic, skittish, or difficult to identify in the field, which may lead to underestimates of the population of those species. All data collection methods have a range of variation, or uncertainty. For the CREP data, this results in a high and low range for population estimates (Table 5-11). For the purposes of this DEIS, we used the median of those ranges to assess impacts.

4.4.7.3 WHAP and CREP Survey Comparison

Both the WHAP and CREP collect data on fish populations in nearshore waters of the island of Hawai'i that are available and appropriate for estimating population size, within the limitations of each survey (e.g., spatial coverage, depth range), and for analysis of the impact of fish collection under Aquarium Permits. In addition, both surveys collect data on the physical conditions at each survey site. The following provides a side by side comparison of some of the parameters of each survey method.

WHAP	CREP
• 25 survey sites with 4 transects (82x13 foot long) each (100 transects total), in specific areas (FRAs, MPAs, Open Areas) along west coast of Hawai'i	• 257 point counts covering entire island of Hawai'i except collection zone 107
• 30-60-foot depth survey area	• 0-98-foot depth survey area
• 4-6 survey rounds per year	• 30-50 surveys once every 3 years
• 8,712 transects completed (1999-2018)	• Surveys conducted in 2010, 2013, 2014, 2015, and 2016
• Visually estimated fish density, benthic cover, and habitat structural complexity	• Fish counts, estimated benthic cover, and habitat structural complexity

The WHAP data are collected from 25 transect survey sites located within the WHRFMA (Figure 4) and are designed to estimate fish densities over time within the WHRFMA between depths of 30-60 feet. By design, the WHAP focuses on the WHRFMA and does not have full spatial coverage of the island of Hawai'i;

therefore, data generated by the WHAP cannot be used to develop population estimates for East Hawai'i. In addition, because WHAP estimates population size at depths from 30-60 feet, shallow- and deep-water species (or life phases of species) that spend time outside the 30-60-foot depth range are not adequately surveyed by WHAP transects.

The CREP data are collected on all reef fish species for the Pacific islands, including from 257 stationary point count locations located around the island of Hawai'i, with the exception of collection zone 107 (Figure 4), from depths of 0-98 feet, providing an assessment of fish populations in both shallow and some deep-water habitats. Deep-water species (or life phases of species) that spend time below the 98-foot depth range are not adequately surveyed by CREP.

Differences in study design between the two surveys result in differences in how data are collected and analyzed. However, when CREP data collected at a similar depth as those collected by the WHAP are compared, the population estimates collected by the two surveys are more similar. Both data sets are presented and analyzed in this DEIS. However, due to the larger spatial coverage and greater range of depths surveyed by the CREP, CREP data were considered to be a better estimator of island-wide fish populations, and therefore serve as the primary basis for the impact analysis found in Section 5.0.

5.0 ENVIRONMENTAL CONSEQUENCES

This section discusses the impacts of implementing the No Action Alternative, the Pre-Aquarium Collection Ban Alternative, the WHRFMA-only Programmatic Permit Alternative, the Achilles Tang Conservation Alternative, and the Limited Permit Issuance Alternative on resources retained for further analysis. Aspects of the environment that may be affected by the alternatives are discussed to the level of detail commensurate with the potential effect. Those aspects of the environment that would not be affected are discussed briefly. The content, intensity, and likelihood of the impact were taken into consideration in the making of these ratings.

Direct, indirect, and cumulative impacts are evaluated for each resource. The temporal scope of the impacts analysis is five years, because the WHRFMA management plan is reviewed every five years by the DLNR in cooperation with the University of Hawai'i (DAR 2019a). Reviews have been completed for the 2010 and 2015 Legislatures, the 2020 Legislature review is drafted (DAR 2019a), and the next review will occur for the 2025 Legislature.

The HEPA does not specifically define direct and indirect impacts. As such, for the purposes of this DEIS, the National Environmental Policy Act (NEPA) definitions are used. The NEPA defines direct effects as those effects that are caused by the action and occur at the same time and place (40 C.F.R. § 1508.8(a)). Indirect effects include effects later in time or farther removed in distance but are still reasonably foreseeable (40 C.F.R. § 1508.8(b)). Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 C.F.R. § 1508.8).

The HEPA does not specifically define mitigation. As such, for the purposes of this DEIS, the NEPA definition is used. According to the CEQ regulations (40 CFR 15008.20), mitigation means:

- Avoiding impact altogether
- Minimizing impact
- Limiting the degree or magnitude of action
- Rectifying impact
- Repairing, rehabilitating, restoring
- Reducing or eliminating impact over time
- Preservation and maintenance activities
- Compensating for the impact
- Replacing or providing substitutes

However, the HEPA Guide (OEQC 2014) indicates that an EIS needs to consider all mitigation measures to avoid, minimize, rectify, or reduce adverse impacts. Therefore, mitigation is only considered for alternatives with a significant adverse impact.

The HEPA defines cumulative impacts as the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (HAR Section 11-200-2).

Cumulative impacts were analyzed according to a tiered approach, which allows for a resource-specific analysis of regional and local actions and narrows the focus to those impacts with direct influence on the proposed action and agency decision-making. Following this approach, the cumulative impacts analysis focused on potential impacts to White List Species, non-White List Species, SGCN, and reef habitat as these are the resources with the potential for on-going impacts due to commercial aquarium fish collection. The spatial analysis area for cumulative impacts is the nearshore waters of the island of Hawai'i down to 600 feet (100 fathoms), with emphasis on the WHRFMA. As stated in Section 4.4, there is evidence that reef fish around the island of Hawai'i are genetically separated from the rest of the MHI, therefore, the spatial extent of cumulative impacts was limited to the island of Hawai'i.

Conclusions of significance are based on the best available data as analyzed in this DEIS. The HEPA standards for a significant impact are described in Section 1.2.2. For the purposes of this DEIS, impacts were assessed on a descending scale:

1. Significant impact (HEPA standards);
2. Significant impact that is mitigable to less than significant;
3. Less than significant impact;

4. No impact; and
5. Beneficial impact.

5.1 HRS §189-3 AND DATA ANALYSIS

HRS §189-3 states:

> *(a) Upon the demand of the department, every commercial marine licensee shall furnish to the department a report or reports with respect to the marine life taken and any other information the department may require for the purposes of this section.*
>
> *(b), "Any information submitted to the department by any person in compliance with any requirement under this section shall be confidential and shall not be disclosed, except when required under court order or pursuant to subpoena issued by the department of the attorney general, or with the prior written consent of the person submitting the information, or under cooperative agreements with government agencies of the United States for exchange and use of the information specifically to manage marine life. The department, by rule, may establish procedures necessary to preserve the confidentiality, except that the department may release or make public any of the information in the aggregate or summary form which does not directly or indirectly disclose the identity of any person who submits information."*

The DAR complies with this statute by keeping confidential any catch data when less than three collectors report from an individual collection zone (Figure 1). Collection zones depicted in Figure 1 correspond to areas defined by the monthly report fishers are required to provide to DAR. Confidential data are identified as *n.d.* (not disclosed) in the tables in Section 5.0. The impact of this statute on data analysis is minimal but can cause confusion when numbers in the text or in the tables do not exactly match up, or do not match previously published reports for which the *n.d.* data were available (i.e., DAR reports). Although it is possible for 1-2 aquarium fishers to collect large numbers of fish and skew the data, this concern was minimized by the manner in which data were analyzed. Data provided by the DAR for this DEIS were evaluated using many parameters, thereby minimizing bias due to confidentiality. The data were also viewed in aggregate and over extended time periods (i.e., 2000-2017) to further minimize confidentiality issues. Additionally, the 14 fishers requesting the Proposed Action waived their right to confidentiality, so all data from these 14 fishers were released for analysis in the EIS for the WHRFMA and East Hawai'i from 2000 through 2017.

5.2 SOCIOECONOMIC RESOURCES

5.2.1 Direct Impacts

As noted in Section 4.1.1, the East Hawai'i aquarium fishery represents only a small portion (4.5%) of the overall value of the fishery on the island of Hawai'i and an even smaller portion of the overall value of the fishery in the state of Hawai'i. Table 4-2 (Section 4.1.1) shows the annual average of the East Hawai'i fishery for the period from 2000-2017 was approximately $72,671 (inflation-adjusted 2019 dollars), as compared to the $1.4 million (inflation-adjusted 2019 dollars) of the WHRFMA. Since the closure of the WHRFMA to commercial aquarium collection in October 2017, data disclosed from fishers in East Hawai'i reported sales of $366,434 of finfish during the 2018 calendar year (DAR 2019b), which is 5 times the historic average value and 2.6 times the maximum reported value from 2000 to 2017 (Table 5-1). Therefore, while the focus of this section is on the WHRFMA and its socioeconomic impacts, East Hawai'i data are included due to their importance for the No Action Alternative, under which no commercial aquarium collection would be allowed to occur within the WHRFMA, as well as other alternatives which would include collection in East Hawai'i either with or without the use of fine mesh nets.

Total ex-vessel value (i.e., price received by a fisher for the catch) for the 14 fishers in the WHRFMA ranged from a low of $164,040 in 2001 to a high of $1,162,964 in 2016, with an average of $793,352 (inflation-adjusted 2019 dollars; Table 5-1). During the period from 2000 – 2017, the 14 fishers made up from 22.3% to 69.1% of the total economic value of the WHRFMA aquarium fishery (Table 5-1). Total ex-vessel value for all aquarium collectors in the WHRFMA ranged from a low of $731,828 in 2000 to a high of $1,862,185 in 2010, with an average of $1,417,300 (inflation-adjusted 2019 dollars; Table 5-1). Total ex-vessel value for the state of Hawai'i ranged from a low of $1,333,497 in 2002 to a high of $2,708,609 in 2015, with an average of $2,172,028 (inflation-adjusted 2019 dollars) (Table 5-1). The 2017 ex-vessel inflation-adjusted value for the 14 fishers within the WHRFMA was $932,735; all aquarium fish collection in the WHRFMA was $1,350,592; and aquarium fish collection in the state of Hawai'i was $2,023,037 (Table 4-1).

Table 5-1. Minimum, maximum and average market values of the commercial aquarium fishery from 2000 through 2017 (inflation-adjusted 2019 values). See Table 4-2 for additional data by year.

		Minimum	Maximum	Average
East Hawai'i	All Fishers	$17,629	$142,069	$72,671
WHRFMA	All Fishers	$731,828	$1,862,185	$1,417,300
	14 Fishers	$164,040	$1,162,964	$793,352
State of Hawai'i	All Fishers	$1,333,497	$2,708,609	$2,172,028

It should be noted that the dollar value of these fisheries represents only the ex-vessel value, what the fishers are paid for their catch, and does not include the value which would be generated by additional dealer and retail sales. The actual economic value of the catch is thus substantially greater than the ex-vessel value and is discussed in further detail in the indirect impacts section below.

According to data presented in DAR (2019a), the market value of the WHRFMA has increased by 143% between 2000 and 2017, growing from a value of $530,842 in 2000 to a value of $1,290,316 in 2017 (DAR 2019a)[5],representing a 5.36% annual growth rate[6].

All commercial aquarium collectors must obtain a state Aquarium Permit and a CML, which allows them to offer the fish for sale. The Aquarium Fish Catch Report requirement is triggered by the CML. Some

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[5] This value does not match our reported value from 2000, likely due to confidentiality rules (see Section 5.1).

[6] $Annual\ Percent\ Growth = \left[\frac{2017\ value}{2000\ Value}^{1/17} - 1\right] * 100$

collectors participate in a dive team. To avoid duplicate fish catch reporting, only a principal diver is required to report the catch and effort for the dive team (DAR, pers. comm., 2018). This process ensures that reported catch data are not duplicated in the State's system. However, this reporting mechanism can lead to confusion by outside observers, as the total number of permit holders is higher than the number of permit holders reporting data (Table 4-1), giving the appearance of under reporting. Analysis by the DAR (2019a) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality. The number of non-reporting permit holders is actually an indicator of industry growth and direct socioeconomic benefits. For the period 2000 to 2017, the total number of permit holders for the WHRFMA ranged from 24 to 63 (average = 46), while the number of permit holders reporting ranged from 19 to 42 (average = 28). In 2017, it is estimated that up to 57 individuals were directly employed in the commercial aquarium fishery in the WHRFMA (up to 226 employed in the state of Hawai'i).

5.2.1.1 No Action Alternative

Under the No Action Alternative, commercial collection of aquarium fish would not occur in the WHRFMA. In East Hawai'i, aquarium collection using legal gear or methods other than fine-mesh nets would continue. Commercial aquarium fishers may no longer find it feasible to target aquarium fish and may begin to participate in other fisheries, but this is not possible to quantify at this time.

Under the No Action Alternative, some aquarium collection may continue using legal gear or methods other than fine mesh nets. Since the closure of the WHRFMA to commercial aquarium collection in October 2017, based on data disclosed by the DAR, East Hawai'i reported sales of $366,434 during the 2018 calendar year (DAR 2019b), which is 5 times the historic average value and 2.6 times the maximum reported from 2000 to 2017 (Table 5-1).

In East Hawai'i, under the No Action Alternative, it is estimated that the commercial aquarium fishery would add approximately $366,434 to the state of Hawai'i's economy in the first year of the 5-year analysis period based on what occurred in 2018 (DAR 2019b). Assuming a 5.36% annual growth rate, this would total approximately $2 million over the 5-year analysis period (average of $407,878 per year) and an unknown number of jobs (assumed to be <57) under the No Action Alternative. This would represent an increase in East Hawai'i of over $1.6 million compared to the Pre-Aquarium Collection Ban Alternative, though there would also be a loss of approximately $7.9 million in the WHRFMA when compared to the Pre-Aquarium Collection Ban Alternative.

An increase in the East Hawai'i commercial aquarium fishery value may offset some of the loss from the WHRFMA fishery under the No Action Alternative, but the fishery as a whole would still add approximately $6.3 million less to the economy over the 5-year analysis period than under the Pre-Aquarium Collection Ban Alternative, or $1,250,611 less per year (on average). This represents an annual loss of approximately 0.01% of the $8.6 billion ocean economy in Hawai'i, and an even lesser percentage of the overall Hawai'i economy.

The No Action Alternative would have a ***less than significant impact*** on Hawai'i's overall and ocean socioeconomic, and a ***less than significant impact*** compared to the Pre-Aquarium Collection Ban Alternative.

5.2.1.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative, an unlimited number of Aquarium Permits would be issued for the use of fine-mesh nets within the WHRFMA and East Hawai'i, and it is assumed for this analysis that fishing trends, including the value and sales of fish, would follow historic trends (see Table 4-2). Based on historic data collected prior to the October 2017 ban on commercial aquarium collection, under the Pre-Aquarium Collection Ban Alternative the commercial aquarium fishery is estimated to create approximately 57 jobs, and add an average of approximately $1,485,429 (inflation-adjusted 2019 dollars, based on $1,417,300 from the WHRFMA and $72,671 from East Hawai'i) to the state of Hawai'i's economy during the first year of the 5-year analysis period. Assuming an annual growth rate of 5.36%, this would total over $8.2 million over the 5-year analysis period (average of $1.65 million per year). This represents less than 0.02% of the $8.6 billion ocean economy in Hawai'i, and even less of Hawai'i economy overall.

The Pre-Aquarium Collection Ban Alternative would have a minimal, but ***beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources.

5.2.1.3 WHRFMA-only Programmatic Issuance of Permits Alternative

Under the WHRFMA-only Programmatic Issuance of Permits Alternative, an unlimited number of Aquarium Permits would be issued for the use of fine-mesh nets within the WHRFMA, but fine-mesh nets would not be allowed in East Hawai'i. The impact on socioeconomics within the WHRFMA would be creation of an estimated 57 jobs, as well as the addition of approximately $1,417,300 (inflation-adjusted 2019 dollars) to the state of Hawai'i's economy during the first year of the 5-year analysis period. This value would likely grow by approximately 5.36% each year, for a total value of $7.9 million over the 5-year analysis period (average of $1,577,599 per year).

In East Hawai'i, given that the WHRFMA would be open to fishing with the use of fine mesh nets, impacts to the economy would be anticipated to be similar to the Pre-Aquarium Collection Ban Alternative, or even potentially decrease since fishing in the WHRFMA may provide more favorable given the use of fine mesh nets. Therefore, it is anticipated that aquarium fish collection in East Hawai'i would add, at most, $72,671 in the first year, and given an annual growth rate of 5.36%, a total of $404,451 over the 5-year analysis period (average of $80,890 per year), or less. Thus, this alternative overall would add $7.9 to $8.3 million to the economy over the 5-year analysis period.

Assuming an average of $1,577,599 per year from the WHRFMA, and $80,890 per year from East Hawai'i, the total of $1.65 million represents less than 0.02% of the $8.6 billion ocean economy in Hawai'i, and even less of Hawai'i economy overall.

The WHRFMA-only Programmatic Issuance of Permits Alternative would have a minimal, but ***beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources, and would have a ***less than significant direct impact*** compared to the Pre-Aquarium Collection Ban Alternative.

5.2.1.4 Achilles Tang Conservation Alternative

The Achilles Tang Conservation Alternative would include issuance of an unlimited number of Aquarium Permits for the WHRFMA and East Hawai'i, and implementation of a bag limit of 5 Achilles Tang per day, resulting in an estimated 50% reduction in the number of Achilles Tang collected by the commercial aquarium fishery (due to a 50% reduction in the current bag limit of 10 Achilles Tang). Estimated value of the Achilles Tang catch in the WHRFMA since the 2014 bag limit was imposed has been $135,627 (2015), $129,876 (2016), and $130,853 (2017). The worst-case scenario under the Achilles Tang Conservation Alternative would be that the income from Achilles Tang would be cut in approximately half (average of $66,059 decrease in income based upon the past three years). This represents approximately 4.7% of the average economic value of the WHRFMA ($1,417,300 per year).

This impact may be buffered however, as the cost per fish may increase as the supply of Achilles Tang decreases, negating any socioeconomic impact to the fishers. If this were to be case, the socioeconomic impact of the bag limit would be seen on the consumer side (i.e., those purchasing aquarium fish, who would have to pay a higher premium due to decreased supply).

However, assuming that the impact is 4.7% of the WHRFMA value, the Achilles Tang Conservation Alternative would add approximately $1,350,687 in the first year of analysis, and assuming an annual growth rate of approximately 5.36%, the WHRFMA would add approximately $7.5 million over the 5-year analysis period (average of $1,503,452 per year).

Impacts in East Hawai'i would remain the same as the Pre-Aquarium Collection Ban Alternative (as no bag limit would be implemented there), for a total of $404,451 over the 5-year analysis period (average of $80,890 per year). Combined, the WHRFMA and East Hawai'i would add approximately $7.9 million to the economy over the 5-year analysis period (average of $1,584,342 per year). The represents less than 0.02% of the $8.6 billion ocean economy in Hawai'i, and even less of Hawai'i economy overall.

The Achilles Tang Conservation Alternative would have a minimal, but ***beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources, and a ***less than significant impact*** on Hawai'i's overall and ocean socioeconomic resources compared to the Pre-Aquarium Collection Ban Alternative.

5.2.1.5 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued to 14 fishers for the use of fine-mesh nets within the WHRFMA. No fine mesh nets would be allowed in East Hawai'i, though collection of aquarium fish would still be permitted using other legal means. This would create a minimum of 14 jobs for the 14 fishers who would have permits.

The 14 fishers requesting permits averaged $793,352 per year in the WHRFMA between 2000 and 2017, up to a maximum of $1,162,964 (based on the maximum from 2016) (inflation-adjusted 2019 dollars; see Table 4-1). Assuming that the first year of the 5-year analysis period would have a market value of $793,352 to $1,162,964, and applying a 5.36% annual growth rate, the Limited Permit Issuance (Preferred) Alternative would add from $4.4 to $6.5 million over the 5-year analysis period (average of $883,081 to $1,294,497 per year). Therefore, under this alternative, the commercial aquarium fishery in the WHRFMA would represent up to approximately 0.01% of the $8.6 billion ocean economy in Hawai'i, and an even smaller percentage of the overall economy in the State (see Section 4.1).

The Limited Permit Issuance (Preferred) Alternative would have a minimal, but ***beneficial direct impact*** on Hawai'i's overall and ocean socioeconomic resources compared to the No Action Alternative, and a ***less than significant impact*** compared to the Pre-Aquarium Collection Ban Alternative.

5.2.2 Indirect Impacts

Indirect socioeconomic impacts of the commercial aquarium fishery would primarily involve the additional profits from the aquarium fish market (including freight and packaging), as well as other tourist businesses such as snorkel and dive operations that rely on seeing and interacting with a healthy reef ecosystem. The presence of a healthy reef ecosystem may also impact overall land/home values on the island of Hawai'i.

As described in Section 4.1.1, the total sales of the Hawaiian aquarium fishery (including freight and packaging) is nearly six times the ex-vessel value (Walsh et al. 2003). Therefore, it is estimated that the commercial aquarium fishery indirectly adds approximately five times the direct socioeconomic costs described in Section 5.2.1 to the economy.

5.2.2.1 No Action Alternative

Under the No Action Alternative, no commercial aquarium fishing would occur in the WHRFMA, but aquarium fishing in East Hawai'i would continue using methods other than fine-mesh nets.

The commercial aquarium industry in East Hawai'i is expected to add approximately $2 million over the 5-year analysis period to the economy under the No Action Alternative, for an indirect economic benefit of approximately $10 million over the 5-year analysis period, or an average of $2 million per year, representing approximately 0.2% of the annual $84.9 billion gross domestic product of Hawai'i.

Based on the direct economic loss of approximately $6.3 million over the 5-year analysis period under the No Action Alternative when compared to the Pre-Aquarium Collection Ban Alternative (this loss is described in Section 5.2.1.2), approximately $31 million in indirect economic benefits of this fishery would not occur over the 5-year analysis period, or an average of $6.3 million per year, representing <0.01% of the annual $84.9 billion gross domestic product of Hawai'i.

Under the No Action Alternative, no interaction between other tourist operations and commercial aquarium fishers would occur in the WHRFMA; however, interactions in East Hawai'i would continue and may increase due to increased use of the area by aquarium fishers.

No scientific data exist to suggest that in the absence of aquarium fishers an increase in other tourist operations would occur. The loss of funding for reef fish conservation likely would impact the ability of the DAR to monitor and protect reef fish. Nevertheless, the No Action Alternative would have a ***less than significant impact*** on Hawai'i's overall and ocean socioeconomic resources.

5.2.2.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative, commercial aquarium fishing would occur in the WHRFMA and East Hawai'i using fine mesh nets, and it is assumed for this analysis that fishing trends, including the value and sales of fish, would follow those prior to the October 2017 commercial aquarium collection ban (see Table 4-3). Based on the direct economic value of $8.2 million over the 5-year analysis period, the commercial aquarium fishery would indirectly add an additional $41 million under the Pre-Aquarium Collection Ban Alternative to the economy of Hawai'i, or an average of $8.2 million per year, representing <0.01% of the annual $84.9 billion gross domestic product of Hawai'i.

Indirect socioeconomic impacts between commercial aquarium fishers, dive tour operators and subsistence/cultural fishers are possible if the commercial aquarium fishing leads to a decrease in demand for snorkel and scuba tours or a decrease in availability of species of fish targeted for subsistence/cultural fishing activities. As the number of commercial aquarium collectors in West Hawai'i began to rise in the 1980s conflicts between dive tour operators and commercial aquarium collectors began to increase. A short-lived informal "Gentleperson's Agreement" was reached in 1987 whereby aquarium collectors agreed to refrain from collecting in certain areas. In return, charter operators agreed not to initiate legislation opposing collecting and to cease harassment. In 1991, four of the areas from the Gentleperson's Agreement were established as the Kona Coast Fisheries Management Area (FMA) within which aquarium collecting is prohibited (Walsh et al. 2003; HAR §13-58). This, in part, led to the development of the WHRFWG and the WHRFMA, minimizing indirect impacts to other, tourist related industries (e.g., dive and snorkel operations), and subsistence and/or cultural fishing. In addition, the average collection of 37 of the 40 White List Species is below 1% of their overall island of Hawai'i populations and collection of the remaining three species would be less than 5% of their overall population (Section 5.4.1.2). The small percentage of fish collected over multiple areas would be imperceptible to the average observer.

Available data do not suggest that the Pre-Aquarium Collection Ban Alternative has impacted the tourism industry or land values in Hawai'i. Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. Total spending by visitors to the Hawaiian Islands increased 5.6% to a new high of $16.81 billion (HTA 2018). When adjusted for inflation, total visitor spending was up 3.5% from 2016 (Figure 3). A total of 9,404,346 visitors came by air or by cruise ship to the state, up 5.3% from the previous record of 8,934,277 visitors in 2016. Total visitor days rose 4.8% compared to 2016. The average spending per day by these visitors ($198 per person) was also higher than 2016 ($197 per person; HTA 2018).

Despite the housing crisis and recent recession, the average sale price of homes steadily increased in Hawai'i from 2011 to 2014 after a few years of year-to-year fluctuation. The average sale price of homes in 2014 was $594,440, which was 26.4%higher than the average sale price in 2011. A rapid price increase was observed particularly in 2013 and 2014. The average sale price in 2013 and 2014 was about 10%higher than the price in the prior year. In 2015, the total number of home sales increased by 9.3%, but the average sale price was 0.3% lower than the previous year (HDBEDT 2016).

Under the Pre-Aquarium Collection Ban Alternative, a portion of the direct and indirect income from this fishery (total of $49.2 million over the 5-year analysis period) would continue to be put back into Hawai'i's economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel.

In addition, while the aquarium fishery directly employs permitted collectors, these collectors hire staff/assistants, sell their catch to wholesalers, who in turn get the fish to the market, which includes pet stores and their customers (Dierking 2002). This economic value is represented in the $41 million indirect economic benefit, but there are also jobs, which cannot be quantified at this time.

The Pre-Aquarium Collection Ban Alternative would have a ***less than significant impact*** on Hawai'i's tourist industry, and a minimal, but ***beneficial indirect impact*** on Hawai'i's overall economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel.

5.2.2.3 WHRFMA-only Programmatic Issuance of Permits Alternative

Under the WHRFMA-only Programmatic Issuance of Permits Alternative, it is assumed that the indirect socioeconomic impacts in the WHRFMA would be similar to the Pre-Aquarium Collection Ban Alternative (Section 5.2.2.2). In East Hawai'i, the impacts may be similar to the No Action Alternative, though with the WHRFMA open to fishing with the use of fine mesh nets, aquarium fish collection in East Hawai'i may return to levels seen under the Pre-Aquarium Collection Ban Alternative, or even decrease since fishing in the WHRFMA may prove more favorable given the use of fine mesh nets. Based on the $7.9 to $8.2 million in direct economic benefits under the WRFMA-only Programmatic Issuance of Permits Alternative, the indirect economic benefits would range from $39.5 to $41 million ($7.9 to $8.2 million per year), representing <0.01% of the annual $84.9 billion gross domestic product of Hawai'i.

The WHRFMA-only Programmatic Issuance of Permits Alternative would have a ***less than significant impact*** on Hawai'i's tourist industry, and a minimal, but ***beneficial indirect impact*** on Hawai'i's overall economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel.

5.2.2.4 Achilles Tang Conservation Alternative

The indirect impacts of the Achilles Tang Conservation (Preferred) Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative (Section 5.2.2.2), though the indirect economic benefits may decrease to $39.5 million in line with the direct economic decrease, representing <0.01% of the $84.9 billion annual gross domestic product of Hawai'i. The reduction in the Achilles Tang bag limit may make the species more visible to divers and snorkelers, but the impact would be ***less than significant***. A minimal, but ***beneficial indirect impact*** on Hawai'i's overall economy would occur under the Achilles Tang Conservation Alternative through re-investment efforts in terms of equipment, maintenance, supplies, and personnel.

5.2.2.5 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued for 14 fishers for the use of fine-mesh nets within the WHRFMA. Based on the direct economic benefit of $4.4 to $6.5 million over the 5-year analysis period, an indirect economic benefit of $22 to $32.5 million would be added to the economy, representing <0.01% of the $84.9 billion annual gross domestic product of Hawai'i.

No fine mesh nets would be allowed in East Hawai'i, though collection of aquarium fish would still be permitted using other legal means. It is anticipated that indirect impacts in East Hawai'i would be similar to the No Action Alternative, though with the WHRFMA open to fishing with the use of fine mesh nets for the 14 fishers, who represented nearly 70% of the fishery in 2017, aquarium fish collection in East Hawai'i may return to levels seen under the Pre-Aquarium Collection Ban Alternative, or even decrease since fishing in the WHRFMA may prove more favorable given the use of fine mesh nets.

Other indirect impacts of the Limited Permit Issuance (Preferred) Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative (Section 5.2.2.2).

The Limited Permit Issuance (Preferred) Alternative would have a ***less than significant impact*** on Hawai'i's tourist industry, and a minimal, but ***beneficial indirect impact*** on Hawai'i's overall economy through re-investment efforts in terms of equipment, maintenance, supplies, and personnel.

5.2.3 Cumulative Impacts

For the period 2000 to 2017, the commercial aquarium fishery within the WHRFMA added an average of $1,417,300 (inflation-adjusted 2019 dollars) annually to the state of Hawai'i's economy, while the overall aquarium fishery within the state of Hawai'i added an average of $2,172,028 (inflation-adjusted 2019 dollars) (Table 4-3). Thus, the WHRFMA aquarium fishery accounts for approximately 65% of the overall aquarium fishery within Hawai'i. In 2016, the overall Gross Domestic Product (GDP) of Hawai'i was $84.9 billion, of which, the commercial aquarium fishery contributed $2,257,021 (0.003%), of which $1,582,011 was from the WHRFMA. Over the 5-year analysis period, it is estimated that the aquarium fishery on Hawai'i would directly add $404,000 (under the No Action Alternative) to $8.2 million (under the Pre-Aquarium Collection Ban Alternative) to the state's economy.

All alternatives under consideration would have a minimal, but beneficial cumulative impact on Hawai'i's overall and ocean socioeconomic resources. The reduction in Achilles Tang bag limit under the Achilles Tang Conservation Alternative and the Limited Permit Issuance (Preferred) Alternative may have an effect on the non-aquarium commercial fishery; however, given that known catch of Achilles Tang made up less than 1.5% of the White List Species collected by commercial fishers on the island of Hawai'i, and average only 222 per year on the Island (or 592 state-wide) (see Section 5.4.3.2, Table 5-12), the impact is anticipated to be ***less than significant***.

5.2.4 Mitigation

No significant adverse socioeconomic impacts are anticipated under any of the five alternatives under consideration. Therefore, no mitigation is required or proposed.

5.3 CULTURAL RESOURCES

5.3.1 Direct and Indirect Impacts

A full analysis of the cultural impacts of commercial aquarium collection is found in the Cultural Impact Assessment (CIA) located in Appendix A. As discussed in Section 4.2 and detailed in the CIA, many of the 40 White List Species have a cultural significance in Hawai'i, and there are distinct differences between the traditional Native Hawaiian approach to fish harvest and management and the western model approach.

As concluded in the CIA, cultural impacts would occur if issuance of Aquarium Permits under an alternative would cause a significant decline in the population of a White List Species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. Table 4-3 lists the 40 White List Species, and Section 4.4 includes a brief summary of known cultural significance by species. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the 33 species on the White List identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted.

As detailed in Section 5.4, populations of the White List Species are not anticipated to significantly decline under any of the five alternatives under consideration. Therefore, direct and indirect impacts to cultural resources as a result of commercial aquarium collection under any of the five alternatives under consideration would be ***less than significant***.

5.3.2 Cumulative Impacts

It is acknowledged that cultural resources, including traditional practices specific to both species and places, have been impacted by past and current actions, and will continue to be impacted by reasonably foreseeable future actions. The cumulative impacts of the five alternatives under consideration are addressed in this section.

It is not possible to fully quantify the cumulative effects of past and ongoing actions on cultural practices and beliefs. Many users and user groups have collected fish in the waters around the island of Hawai'i for various purposes for centuries. The commercial aquarium fishery has existed in Hawai'i since the late 1940s and in the past the fishery has impacted cultural resources by virtue of the fact that commercial aquarium collection occurs in a culturally significant area (the ocean), and in some instances involves culturally significant species. However, commercial aquarium collection is not the only fishery occurring in the ocean and affecting some of the White List Species, including those with cultural significance (e.g., Achilles Tang) (see Section 5.4.3). Harvest of some of the White List Species by other non-regulated users (e.g., subsistence fishers, non-aquarium commercial and recreational fishers) occurs and is anticipated to continue under any of the five alternatives under consideration. In addition, other ocean users may indirectly affect reef fish and the reefs they depend on, such as beachgoers using sunscreen, scuba divers and snorkelers affecting fish behavior, and boaters anchoring on top of reefs (see Section 5.4.3.4). Beach and shoreline development may also have effects on reefs and reef fish. In addition to effects on culturally significant White List Species by the various user groups discussed above, climate change resulting in warming ocean temperatures and habitat loss due coral bleaching also affects reef fishes including population effects (see Section 5.4.3.5).

As concluded in the CIA (Appendix A), cultural impacts would occur if a significant decline in the population of a White List Species considered to be a cultural resource occurs. The DAR (2019a) has noted significantly declining populations in one or more management area for 12 of the White List Species, and cumulatively, all of the factors discussed above likely contribute to the declines. Therefore, cumulative cultural resource impacts to these 12 White List Species would occur under any of the five alternatives under consideration and would be **significant** (including the No Action Alternative). No cumulative cultural resource impacts to the remaining 28 White List Species are anticipated, given that populations have remained stable or increased for 24 of those species, and population trend data is not available for the other four species[7].

However, as noted above and in Section 5.4.3, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019a). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. In addition, for the 12 species that have shown a significant decline in population size in one or more management area since establishment of the WHRFMA in 1999, commercial aquarium collection under any of the five alternatives would collect less than 1% of the island-wide population estimates for 10 of the species (Table 5-14). For the remaining two species, Achilles Tang and the Pyramid Butterflyfish, commercial aquarium collection would collect less than 4% of the island-wide population (Table 5-14). Based on this, while commercial aquarium collection does contribute to the cumulative impact, it is a **less than significant** factor in the observed declines.

Additionally, measures included in the Preferred Alternative (e.g., limited permit issuance, reduced Achilles Tang bag limit) may mitigate potential impacts to cultural resources by limiting the number of Aquarium Permits issued as well as the number of Achilles Tang that can be collected by commercial aquarium collectors each day. These measures may increase the number of Achilles Tang available for cultural practices and traditional subsistence fishers, and potentially decrease user conflict between commercial collectors and subsistence fishers or cultural practitioners.

5.3.3 Mitigation

No significant adverse direct or indirect cultural resource impacts are anticipated under any of the five alternatives under consideration. Significant cumulative impacts are anticipated; however, commercial aquarium collection is a less than significant factor in the cumulative impact. Therefore, no mitigation is required or proposed.

Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of Aquarium Permits that would be issued, limiting collection using fine mesh nets to the WHRFMA, and reducing the bag limit for the Achilles Tang, all of which would minimize impacts to cultural resources.

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[7] Species not adequately surveyed by WHAP include Tinker’s Butterflyfish, Longfin Anthias, Flame Wrasse, and Eyestripe Surgeonfish. Tinker’s Butterflyfish have a CREP (2018) population estimate of 18,475, and collection under any of the alternatives would be less than 5% of the island-wide population (though it should be noted that the vast majority of the population occurs well below the 98-foot depth surveyed by the CREP and thus the population estimate is likely low). Eyestripe Surgeonfish has a CREP (2018) population estimate of 578,835, and collection under any of the alternatives would be less than 0.3% of the island-wide population. Flame Wrasse do not have a CREP population estimate, but collection has been less than 175 individuals per year for the island of Hawai’i between 2000 and 2017. Longfin Anthias also do not have a CREP population estimate, but collection has been less than 150 individuals per year for the island of Hawai’i.

5.4 BIOLOGICAL RESOURCES

5.4.1 Direct Impacts

According to data presented in DAR (2019a), the number of collected fish in the WHRFMA has increased by 29% between 2000 and 2017, growing from a collection of 252,290 in 2000 to a collection of 324,565 in 2017 (DAR 2019a)[8], representing an annual growth rate of 1.49%[9].

Table 5-2 summarizes the historic collection data for East Hawai'i and the WHRFMA by year for all commercial aquarium collectors, as well as for the 14 fishers requesting Aquarium Permits under the Preferred Alternative.

Table 5-2. Total fish and invertebrates collected under Aquarium Permits from East Hawai'i and total White List Species collected from the WHRFMA annually from 2000-2017 (DAR 2018a). Also included for comparison are data from collection of fish within East Hawai'i in 2018.

Fiscal Year	East Hawai'i		WHRFMA			Combined	
	14 fishers	All fishers	14 fishers	All fishers	Percent contribution of 14 fishers	14 fishers	All fishers
2000	807	6,685	47,430	241,070	19.7%	48,237	247,755
2001	0	*n.d.*	27,510	243,085	11.3%	27,510	243,085
2002	0	*n.d.*	43,232	192,102	22.5%	43,232	192,102
2003	3,447	*n.d.*	73,780	233,930	31.5%	77,227	233,930
2004	638	*n.d.*	157,836	336,436	46.9%	158,474	336,436
2005	3,390	7,942	168,265	433,270	38.8%	171,655	441,212
2006	1,048	22,371	180,209	478,122	37.7%	181,257	500,493
2007	222	11,036	151,514	337,287	44.9%	151,736	348,323
2008	29	36,924	193,444	342,954	56.4%	193,473	379,878
2009	3,644	21,494	151,264	284,537	53.2%	154,908	306,031
2010	453	9,232	196,710	377,805	52.1%	197,163	387,037
2011	465	39,058	156,312	361,452	43.2%	156,777	400,510
2012	2,483	104,670	213,362	349,971	61.0%	215,845	454,641
2013	1,568	55,945	204,544	362,444	56.4%	206,112	418,389
2014	7,832	52,799	234,488	338,848	69.2%	242,320	391,647
2015	2,739	25,272	254,928	358,671	71.1%	257,667	383,943
2016	3,652	15,504	293,845	377,479	77.8%	297,497	392,983
2017	6,442	22,002	236,022	324,565	72.7%	242,464	346,567

[8] The numbers in 2000 do not match the number presented elsewhere in the text, likely due to confidentiality of data (Section 5.1).

[9] $Annual\ Percent\ Growth = \left[\frac{2017\ value}{2000\ Value}^{1/17} - 1\right] * 100$

Fiscal Year	East Hawai'i		WHRFMA			Combined	
	14 fishers	All fishers	14 fishers	All fishers	Percent contribution of 14 fishers	14 fishers	All fishers
2018[1]	26,775	55,815	N/A, aquarium fishing closed as of October 2017			26,775	55,815
Total (2000-2017)	**38,859**	**430,934**	**2,984,695**	**5,974,028**	50.0%	3,023,554	**6,404,962**
Average (2000-2017)	**2,159**	**30,781**	**165,816**	**331,890**	50.0%	167,975	**355,831**

[1]Data from 2018 were provided for the calendar year for all fishers, and for the fiscal year for the 14 fishers. However, both datasets contain 12 calendar months, and are considered comparable for analysis.

5.4.1.1 No Action Alternative

Under the No Action Alternative issuance of Aquarium Permits would not occur and commercial aquarium fishing would not be permitted in the WHRFMA. Therefore, collection of all White List Species in the WHRFMA would be zero and reef habitat would not be affected.

In East Hawai'i, aquarium collection using legal gear or methods other than fine-mesh nets would continue. Since the closure of the WHRFMA to commercial aquarium collection in October 2017, commercial aquarium collectors in East Hawai'i collected 55,815 fish in the 2018 calendar year (based on data provided by the DAR), and an additional 32,331 fish to-date in 2019 (data provided on October 21, 2019, DAR 2019b). Assuming 55,815 fish are collected in the first year of the 5-year analysis period, and an annual growth rate of 1.49% in collection, a total of 287,516 fish would be collected over the 5-year analysis period (average of 57,503 per year).

Of the 88,146 fish collected in East Hawai'i in 2018 and 2019, nearly 86% were Yellow Tang (Table 5-3). Due to confidentiality laws (Section 5.1), information on species collected is limited, however the species composition for 93% of all collection in provided in Table 5-3. Assuming that similar collection would occur annually over the 5-year analysis period under the No Action Alternative, collection of each species would result in impacts to 1.11% or less of the estimated population per year. Ochavillo and Hodgson (2006) suggest collection of between 5% and 25% is sustainable for various reef species in the Philippines that are similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish), and all 7 species fall below this threshold. See "Impact of Collection on White List Species Populations" in Section 5.4.1.2 for a further discussion on population impacts.

No collection of invertebrates was provided for 2018 or 2019 from East Hawai'i, though this could be due to Hawai'i confidentiality laws (see Section 5.1). Therefore, we assume that the collection of invertebrates would follow historic trends from 2000-2017, and would not increase under the No Action Alternative, as collection of invertebrates has not and would not be allowed in the WHRFMA (i.e., there has been no change in laws/regulations regarding invertebrate collection on the island of Hawai'i). The only invertebrate with catch data provided from 2000-2017 was the Red Pond Shrimp, which had an average collection of 20,301 individuals per year, and a maximum of 97,730 in 2012 (DAR 2018a). Therefore, while still applying a 1.49% annual growth rate for collection, it is anticipated that 20,301 to 97,730 invertebrates (mainly Red Pond Shrimp) would be collected during the first year of the 5-year analysis period, and a total of 104,575 to 503,430 would be collected over the 5-year analysis period (average of 20,915 to 100,686 per year).

Table 5-3. Projected annual and total collection of fish species collected in East Hawai'i over the 5-year analysis period, based on an average collection of 57,503/year total fish, and impact on the CREP (2018) population estimates.

Species	CREP (2018) Population Estimates (lower-upper estimate limit)	% of total catch in East Hawai'i (2018-2019)	Projected Average Annual Collection Under No Action Alternative	% of the CREP population collected annually
Yellow Tang	8,262,144 (6,849,295-9,674,993)	85.7%	49,280	0.60%
Achilles Tang	231,377 (113,989-348,765)	4.5%	2,588	1.11%
Kole, Goldring Surgeonfish	11,697,561 (9,547,971-13,847,152)	2.0%	1,150	<0.01%
Black Surgeonfish (Chevron Tang)	549,462 (355,535-743-388)	0.3%	173	0.03%
Tinker's Butterflyfish	18,475 (1,556-38,505)	0.3%	173	0.94%
Orangespine Unicornfish	897,085 (758,978-1,035,192)	0.2%	115	0.01%
Goldrim Tang	97,924 (10,276-185,573)	<0.1%	58	0.06%
All Others (White List and non-White List)	NA	7.0%	4,025	NA

Without the use of fine mesh nets, the size class of fish collected may increase over that which is caught with fine mesh nets (i.e., the smaller fish would escape the larger mesh), but again this impact cannot be quantified at this time.

The No Action Alternative would have a ***less than significant direct impact*** on reef fish populations and the reefs in which they occur, and a ***minor beneficial impact*** when compared to the Pre-Commercial Aquarium Ban Alternative.

5.4.1.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative issuance of an unlimited number of Aquarium Permits would occur and commercial aquarium fishing would take place in both the WHRFMA and East Hawai'i. Based on historic trends, it is assumed that between 113 and 226 Aquarium Permits would be issued in the State of Hawai'i (minimum and maximum of the last 18 years, Table 4-1), and between 24 and 60 Aquarium Permits would be issued for fishers in the WHRFMA (Table 4-2). Impacts to invertebrates, including the Red Pond Shrimp, would be similar to the No Action Alternative, with a total of 104,575 to 503,430 invertebrates (mostly Red Pond Shrimp) collected over the 5-year analysis period (average of 20,915 to 100,686 per year).

It is likely that fishing pressure on the species collected in the past would remain relatively the same as what occurred prior to the October 2017 ban on commercial aquarium collection, resulting in an estimated 331,890 (18-year average) individual fish collected from the WHRFMA. Prior to October 2017, an average of 30,781 fish and invertebrates were collected from East Hawai'i (Table 5-2). Based on data provided, 42.4% were Red Pond Shrimp, while the rest were fish species or other invertebrates (DAR 2018a). However, no other invertebrate species' catch data were provided due to confidentiality, and therefore, we conservatively assume that the remaining 57.6% of the catch was fish. Therefore, of the 30,781 fish and invertebrates collected in an average year, it is assumed that 57.6% of those are fish (17,730). Assuming a 1.49% annual growth rate on the average collection from the WHRFMA (331,890 per year) and East Hawai'i (17,730 per year), a total of 1.8 million fish would be collected from the Island of Hawai'i over the 5-year analysis period, with 1.7 million of those collected in the WHRFMA and 91,000 from East Hawai'i (average of 341,929 and 18,266 per year).

White List Species

WHRFMA (Only White List Species Collected)

The top 10 collected species in the WHRFMA made up 98.2% of all fishes collected in fiscal year 2017 (DAR 2019a):

- Yellow Tang (81.6% of the total catch)
- Goldring Surgeonfish, Kole (9.5% of the total catch)
- Orangespine Unicornfish (1.9% of the total catch)
- Achilles Tang (1.7% of the total catch)
- Black Surgeonfish (1.2% of the total catch)
- Potter's Angelfish (0.7% of the total catch)
- Ornate Wrasse (0.5% of the total catch)
- Goldrim Surgeonfish (0.4% of the total catch)
- Orangeband Surgeonfish (0.4% of the total catch)
- Brown Surgeonfish (0.3% of the total catch)

The remaining 30 White List Species made up the remaining 1.8% of collected fish (DAR 2019a). Total abundance of nearshore fishes has had a significant positive trend in all management areas (open areas, FRAs and MPAs) since 2003 (DAR 2019a).

WHAP data indicate that establishment of the FRAs has had a significantly positive impact on Yellow Tang and Kole populations in the WHRFMA (DAR 2019a; Table 5-4). Achilles Tang have decreased in both FRAs and Open Areas, suggesting that factors other than aquarium collection are also affecting their population (DAR 2019a; Table 5-4). Of the remaining 7 of the top 10 collected aquarium species, 1 species (Goldrim Surgeonfish) had no significant change in population since establishment of the FRAs in 1999, 6 species (Orangespine Unicornfish, Black Surgeonfish,, Orangeband Surgeonfish, Brown Surgeonfish, and Potter's Angelfish) increased significantly in one or more of the management areas, and 1 species (Ornate Wrasse (Pinkface)) declined significantly in both FRAs and Open areas, suggesting that factors other than aquarium collecting were also affecting the Ornate Wrasse population.

Additionally, a comparison of West Hawai'i with Maui using 2002-2010 WHAP data and CREP data found that for the 10 most collected species in the WHRFMA (not the same 10 species listed above, as this list can vary by year), all were more abundant within the Open Areas of the WHRFMA (where aquarium collection occurs) than in the Maui MPA closed areas, and five of the species were significantly more abundant (DAR 2019a).

Table 5-4. Change in density of the top 10 collected species in the WHRFMA based on WHAP data. 'Before' = Mean of 1999-2000; 'After' = Mean 2017-2018. Young-of-year (YOY) not included. Bold = statistically significant t-test (DAR 2019a).

Common Name	Area	Mean Density (No./100m^2)		Overall% Change in Density	ρ
		Before	After		
Yellow Tang	**FRA**	**12.73**	**33.79**	**+165.4%**	**<0.001**
	Open	**10.24**	**20.53**	**+100.6%**	**<0.001**
	MPA	**23.08**	**40.07**	**+73.6%**	**<0.001**
Kole (Goldring Surgeonfish, Yelloweye, Goldring)	**FRA**	**28.38**	**52.60**	**+85.4%**	**<0.001**
	Open	**21.18**	**41.65**	**+96.6%**	**<0.001**
	MPA	**28.53**	**62.64**	**+119.6%**	**<0.001**
Orangespine Unicornfish	FRA	0.81	0.67	-16.8%	0.26
	Open	**1.12**	**1.59**	**+42.6%**	**<0.001**
	MPA	**1.59**	**2.88**	**+81.4%**	**<0.001**
Achilles Tang	**FRA**	**0.26**	**0.05**	**-82.7%**	**<0.001**
	Open	**0.31**	**0.09**	**-70.5%**	**<0.001**
	MPA	0.42	0.22	-48.3%	0.05
Black Surgeonfish	**FRA**	**0.18**	**0.76**	**+319.2%**	**<0.001**
	Open	**0.17**	**0.84**	**+402.1%**	**<0.001**
	MPA	**0.53**	**0.98**	**+83.7%**	**<0.001**
Potter's Angelfish	**FRA**	**1.38**	**2.28**	**+66.0%**	**<0.001**
	Open	**1.65**	**2.47**	**+49.9%**	**<0.001**
	MPA	**1.54**	**2.39**	**+55.4%**	**<0.001**
Ornate Wrasse	**FRA**	**0.94**	**0.66**	**-30.1%**	**<0.001**
	Open	**2.20**	**1.83**	**-16.6%**	**<0.001**
	MPA	**1.24**	**1.59**	**+28.5%**	**<0.05**
Goldrim Surgeonfish	FRA	0.04	0.09	+156.6%	0.46
	Open	0.01	0.06	+605.9%	0.42
	MPA	0.11	0.21	+102.4%	0.45
Orangeband Surgeonfish	FRA	0.13	0.22	+73.9%	0.24
	Open	**0.31**	**0.50**	**+60.0%**	**<0.01**
	MPA	**0.56**	**0.87**	**+56.3%**	**<0.05**
Brown Surgeonfish	**FRA**	**8.57**	**13.90**	**+62.1%**	**<0.001**
	Open	**11.20**	**25.77**	**+130.1%**	**<0.001**
	MPA	**7.68**	**22.21**	**+189.3%**	**<0.001**

YELLOW TANG

The Yellow Tang has been the most collected species every year since 1976 (DAR 2018a). Since 2000, 5,972,413 individuals of all White List Species have been collected in the WHRFMA; 4,885,736 (81.8%) of those were Yellow Tang. The average number of Yellow Tang captured each year since 2000 was 271,430 individuals, ranging between a minimum catch of 152,047 individuals (2002) and maximum of 386,767 (2006). Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that between 152,047 and 387,767 Yellow Tang would be collected each year, for a total of approximately 760,000 to 1.9 million Yellow Tang over the 5-year analysis period.

Based on data collected between 2010 and 2016 by the CREP (2018), the island of Hawai'i Yellow Tang population is estimated at 8,260,141 individuals (Table 5-5). The WHAP estimates the 2017/2018 Open Area Yellow Tang population in the WHRFMA at 2,867,048 at the 30'-60' depth, an increase of over 1.2 million fish since 2012/2013. Collection of Yellow Tang between 152,047 and 386,767 individuals would remove approximately 2% to 5% of the current estimated population for the island of Hawai'i (Table 5-5). While this collection would occur only within the WHRFMA, there is evidence for connectivity between FRAs and Open Areas around the island of Hawai'i (Christie et al. 2010), therefore, analyzing the impacts on just the Open Area populations is not representative of the impact. See "Impact of Collection on White List Species Populations" below.

Table 5-5. CREP (2018) estimated population of Yellow Tang for the island of Hawai'i and percentage of population collected by commercial aquarium fishers in the WHRFMA (DAR 2018a).

Island of Hawai'i Pop (CREP 2018)	WHAP Open Area Pop. Est. 30'-60' Depth in WHRFMA Only[1]		Minimum WHRFMA Collection per Year[2]	Maximum WHRFMA Collection per Year[2]	Minimum % of Hawai'i Population	Maximum % of Hawai'i Population
	2012/2013	2016/2017				
8,262,144	1,663,775	2,867,048	152,047	386,767	1.84%	4.68%

[1]Include both adults and young-of-the-year. Data for 2012/2013 are from DAR 2014a. Data for 2016/2017 are from DAR 2019a.
[2]From 2000 – 2017

The DAR(2019), stated:

- Since the FRAs were established, the population of Yellow Tang has increased 165% in the FRAs and 101% in the Open Areas (areas fished by commercial aquarium fishers), compared to 74% in the MPAs. Overall Yellow Tang abundance in the 30-60-foot depth range over the entire West Hawai'i coast had increased 150% (over 3.4 million fish) from 1999/2000 to 2017/2018 to a population of approximately 5.7 million fish.

- There were no significant differences in the abundance of adult Yellow Tang in open vs. closed areas in shallow water (10-20-foot depths). Total estimated coastwise population of adult Yellow Tang in this depth range was estimated to be >2.5 million individuals. West Hawai'i had a significantly greater percent change in Yellow Tang density within its planned networked MPAs (and Open Areas) as compared to two non-networked sites on Maui.

Figure 5 illustrates the population trends for Yellow Tang since the FRAs were established, illustrating the upward trend in all areas, even with commercial aquarium collection of 4,885,736 Yellow Tang between 2000 and 2017 in the WHRFMA.

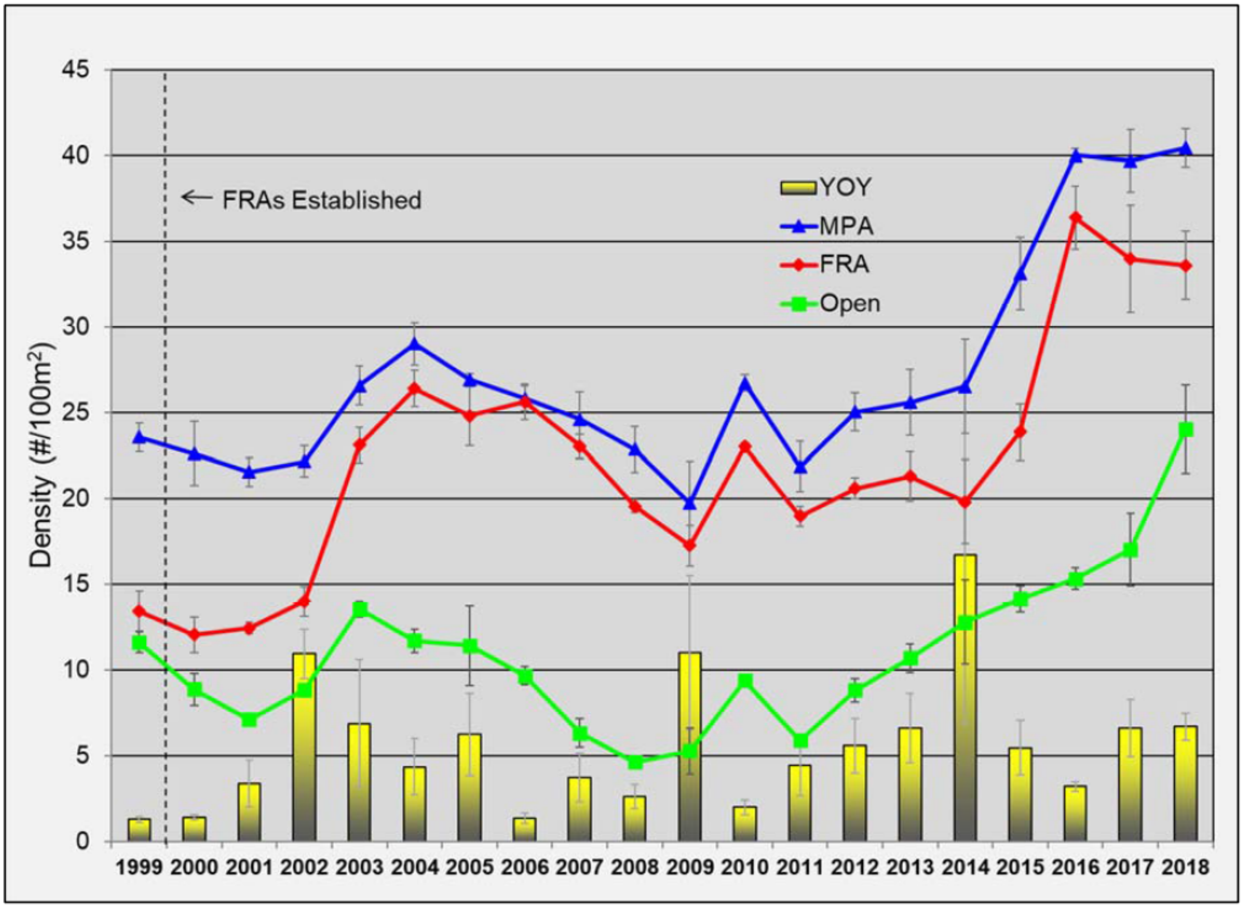

Figure 5. Overall changes in Yellow Tang density (Mean ± SE) in FRAs, MPAs, and Open Areas, 1999-2018. Yellow vertical bars indicate mean density (MAY-NOV) of Yellow Tang YOY. YOY are not included in trend line data (DAR 2019a).

It is important to note that the Yellow Tang breeding population (larger, adult fish), reflected in the trend lines in Figure 5, is not collected by commercial aquarium fishers, nor is this age/size class desired as a food fish. The brood stock is therefore protected and not significantly reduced as a result of aquarium fish collection. The vertical bars (YOY = young of the year) essentially represent the replacement/recruitment rate of the species (i.e., when juvenile fish survive to be added to a population). It is these juveniles up to several years of age that are targeted by the aquarium fishery, as there is no market for the larger fish.

Even with the targeting the smaller fish by the commercial aquarium collectors, juvenile Yellow Tang densities have significantly increased by 60.8% within Open Areas between 2003 and 2017 (DAR 2019a, Gove et al. 2019).

GOLDRING SURGEONFISH, KOLE

The Kole has been the second most collected species every year since 1976 (DAR 2018a). Since 2000, 5,972,413 individuals of all White List Species have been collected in the WHRFMA; 552,603 (9.3%) of those were Kole. The average number of Kole captured each year since 2000 was 30,700 individuals, ranging between a minimum catch of 15,961 (2001) and maximum of 42,112 (2006). Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that between 15,961 and 42,112 Kole would be collected each year, for a total of approximately 80,000 to 210,500 over the 5-year analysis period.

Based on data collected between 2010 and 2016 by the CREP (2018), the island of Hawai'i Kole population is estimated at 11,697,561 individuals (Table 5-6). The WHAP estimates the 2017/2018 Open Area Kole population in WHRFMA at 5,312,745 at the 30-60-foot depth, an increase of nearly 1.7 million fish since 2012/2013. Collection of between 15,961 and 42,112 Kole individuals would remove less than 0.4% of the current estimated population for the island of Hawai'i (Table 5-6). While this collection would occur only within the WHRFMA, there is evidence for connectivity between FRAs and Open Areas around the island of Hawai'i (Christie et al. 2010), therefore, analyzing the impacts on just the Open Area populations is not representative of the impact. See "Impact of Collection on White List Species Populations" below.

Table 5-6. CREP (2018) estimated population of Kole for the island of Hawai'i and percentage of population collected by commercial aquarium fishers in the WHRFMA (DAR 2018b).

Island of Hawai'i Pop (CREP 2018)	WHAP Open Area Pop. Est. 30'-60' Depth in WHRFMA Only[1]		Minimum WHRFMA Collection per Year[2]	Maximum WHRFMA Collection per Year[2]	Minimum % of Hawai'i Population	Maximum % of Hawai'i Population
	2012/2013	2017/2018				
11,697,561	3,616,529	5,312,745	15,961	42,112	0.14%	0.36%

[1]Includes both adults and young-of-the-year
[2]From 2000-2017

The DAR(2019), stated:

- The FRAs have also been very successful in increasing Kole populations. The number of Kole increased significantly in all management areas, including Open Areas, from 1999/2000 to 2012/2013. Overall Kole abundance in 30-60-foot depth range over the entire West Hawai'i coast increased 118% (nearly 5.2 million fish) during this time period with a population of about 9.6 million fish in 2019.

- Long-term West Hawai'i studies have found Kole populations had decreased 14% in South Kona and 71% in South Kohala. Given the length of protection at these sites and the overall decline in habitat quality and fish populations in South Kohala, it seems unlikely that the declines are due primarily to aquarium collecting. Comparative surveys utilizing DAR and NOAA data indicate Kole are substantially more abundant in West Hawai'i over most size ranges than in any of the other islands in the MHI or the Northwestern Hawaiian Islands.

Figure 6 illustrates the population trends for Kole since the FRAs were established, illustrating the upward trend in all areas, even with commercial aquarium collection of 552,603 Kole between 2000 and 2017 in the WHRFMA.

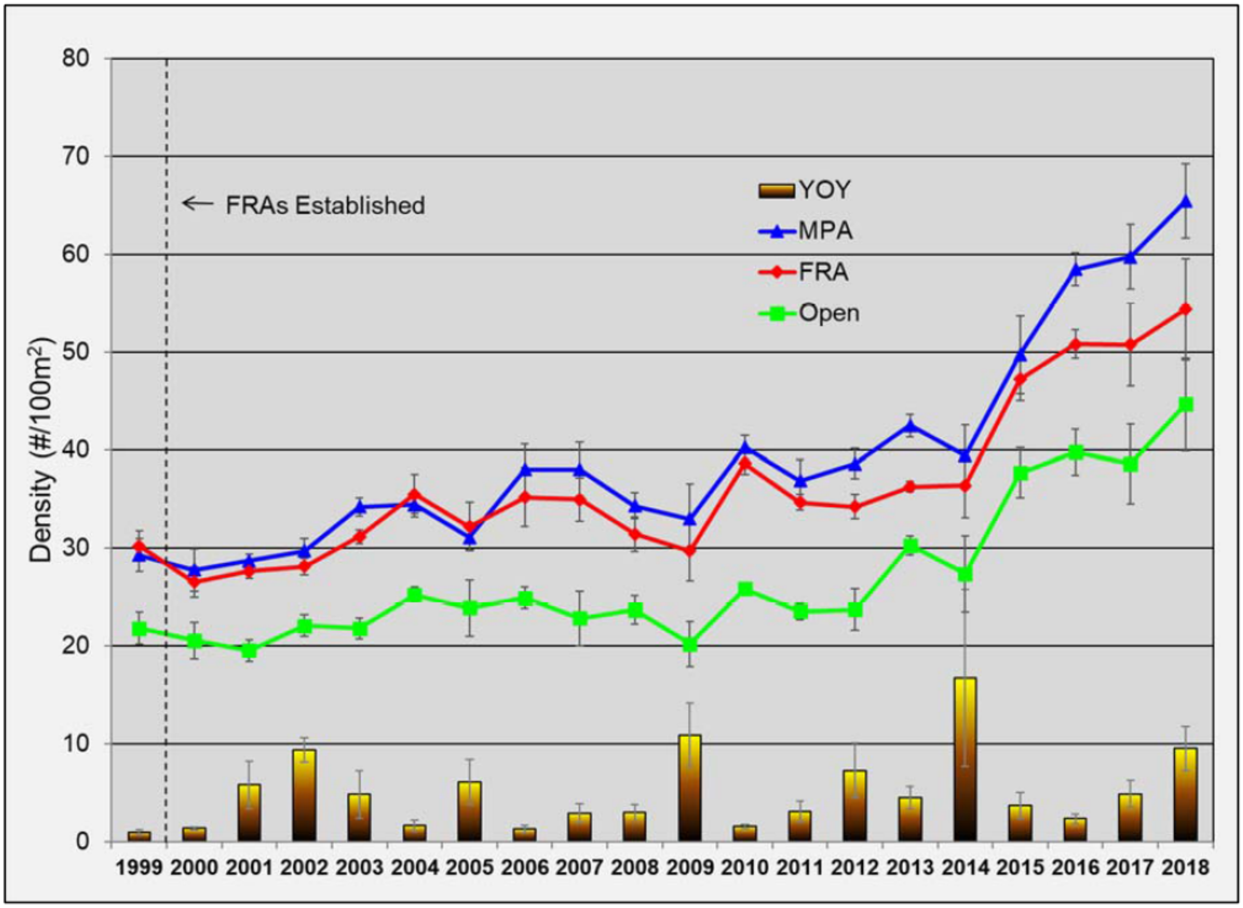

Figure 6. Overall changes in Kole density (Mean ± SE) in FRAs, MPAs, and Open Areas, 1999-2018. Vertical bars indicate mean density (JUN-NOV) of Kole YOY. YOY are not included in trend line data (DAR 2019a).

Trend lines in Figure 6 reflect Kole brood stock, i.e., large sized fish not collected by commercial aquarium fishers. The brood stock is therefore protected and not significantly reduced as a result of aquarium fish collection. The vertical bars (YOY = young of the year) essentially represent the replacement/recruitment rate of the species (i.e., when juvenile fish survive to be added to a population). It is these juveniles up to several years of age that are targeted by the aquarium fishery, as there is no market for the larger fish.

OTHER TOP 10 WHITE LIST SPECIES (CATCH RANKED 3-10)

These 8 species (Orangespine Unicornfish, Achilles Tang, Black Surgeonfish, Potter's Angelfish, Ornate Wrasse, Goldrim Surgeonfish, Orangeband Surgeonfish, and Brown Surgeonfish) made up 7.1% of the catch in fiscal year 2017. When abundances of these eight collected species are combined, they have increased in all management areas since the FRAs were established (Figure 7). Abundances have been consistently higher in Open Areas for five of these species, and no consistent pattern was observed for the other three species (Table 5-4).

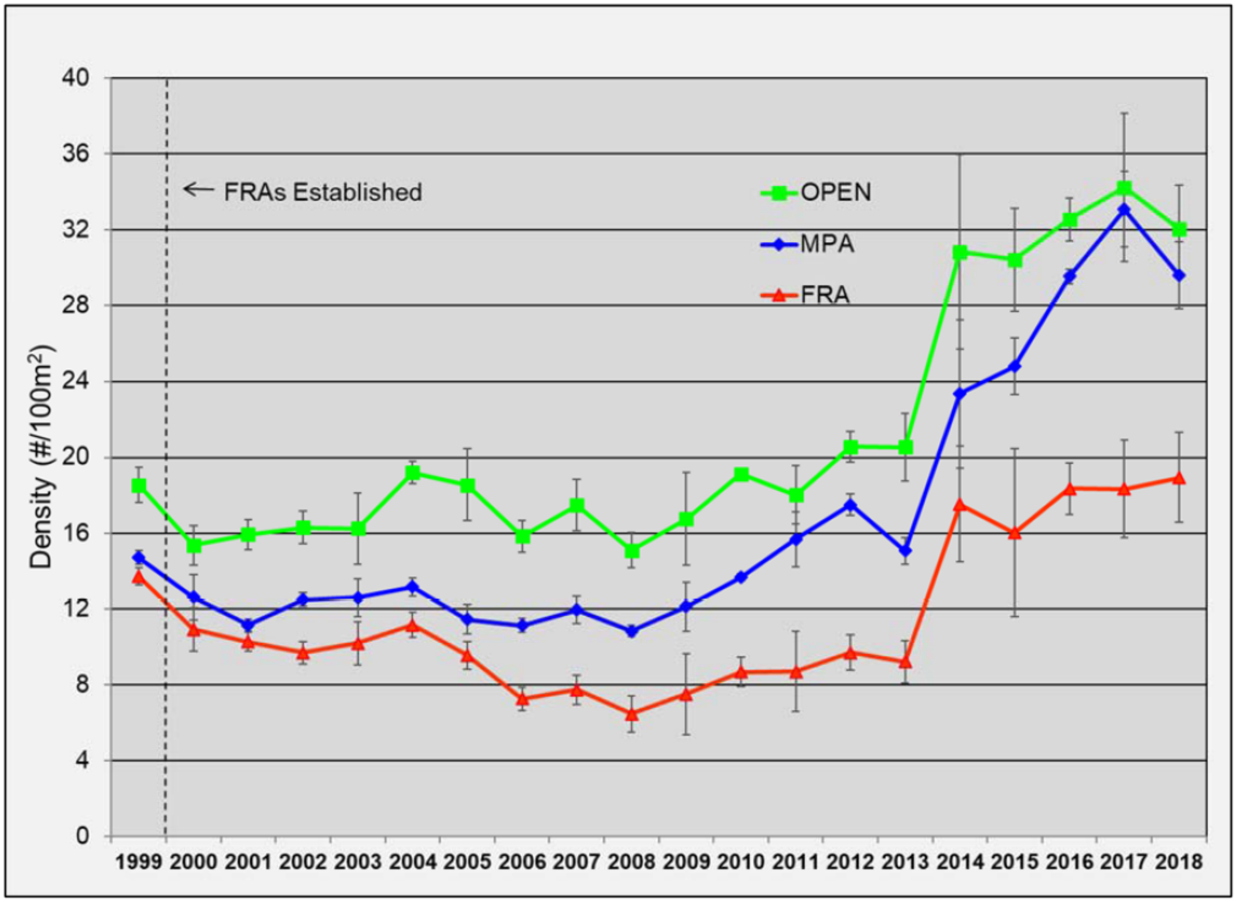

Figure 7. Overall changes in density (Mean ± SE) for the top 3-10 collected aquarium species combined in FRAs, MPAs, and Open Areas, 1999-2018. YOY are not included in trend line data (DAR 2019a).

Six of these species had long-term population increases in one or more of the management areas (Table 5-4). For the other two species, the Ornate Wrasse and the Achilles Tang, there were long-term population declines in both FRAs and Open Areas, with larger declines seen in FRAs than in Open Areas (Table 5-4), suggesting that some factor other than commercial aquarium collection was driving the decline. The Achilles Tang is discussed in more detail below.

ACHILLES TANG

The Achilles Tang has generally been the third most collected species every year since 1976, with a few exceptions (4th most captured fish from 2008-2009 and again 2015-2017; DAR 2018a). Since 2000, 5,972,413 individuals of all White List Species have been collected in the WHRFMA; 132,775 (2.2%) of those were Achilles Tang. The average number of Achilles Tang captured each year since 2014 (when the current bag limit of 10 was implemented) was 5,600 individuals, ranging between a minimum catch of 5,568 (2015) and maximum of 5,757 (2016). Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that approximately 5,600 Achilles Tang would be collected each year.

Based on data collected between 2010-2016 during CREP (2018) surveys, the Achilles Tang population on the island of Hawai'i is estimated at 231,000 individuals (Table 5-7). The WHAP estimates the 2017/2018 Open Area Achilles Tang population in WHRFMA at 13,796 at the 30-60-foot depth, a decrease of 7,831 since 2012/2013 (Table 5-7). Collection of 5,600 Achilles Tang would remove approximately 2.42% of its current estimated population for the island of Hawai'i (Table 5-7). While this collection would occur only within the WHRFMA, there is evidence for connectivity between FRAs and Open Areas around the island of Hawai'i (Christie et al. 2010), therefore, analyzing the impacts on just the Open Area populations is not representative of the impact. See "Impact of Collection on White List Species Populations" below. In addition, as noted below in this section, the WHAP surveys underestimate Achilles Tang population size for a variety of reasons.

Table 5-7. CREP (2018) estimated population of Achilles Tang for the island of Hawai'i and percentage of population collected by commercial aquarium fishers in the WHRFMA (DAR 2018a).

Island of Hawai'i Pop (CREP 2018)	WHAP Open Area Pop. Est. 30'-60' Depth in WHRFMA Only[1]		Average WHRFMA Collection per Year[2]	Average % of Hawai'i Population
	2012/2013	2018/2019		
231,377	21,627	13,796	5,600	2.42%

[1]Inlcudes both adults and young-of-the-year. See discussion below.
[2]From 2015-2017, after the daily bag limit of 10 Achilles Tang was implemented. This data ranges from 5,473 to 5,757, with an average of 5,600. Due to the small range, the average was used.

The DAR(2019a) stated:

- Commercial aquarium landings of Achilles Tang have declined in West Hawai'i over the past two decades in association with a 192% increase in its value since 2008. This is suggestive of declining availability (i.e., abundance). Achilles Tang has declined in FRAs and Open Areas over the last 20 years but have generally been more abundant in Open Areas than protected FRAs. Achilles Tang has had low levels of recruitment over the past two decades (mean Yellow Tang recruitment has been 57 times greater, and Kole recruitment has been 54 times greater).

- An important caveat is that the reef areas where the WHAP transects are located are not the prime habitat for adults of this species. As such the bulk of the population is not adequately surveyed by WHAP monitoring.

- Results from the WHAP monitoring program and long-term studies suggest there should be concern for the sustained abundance of this species. Achilles Tang are a very popular food fish as well as an aquarium fish and thus are being harvested both as juveniles and adults. Low levels of recruitment over the past 11 years appear insufficient to compensate for the existing levels of harvest. In order to address concerns regarding aquarium impacts on this species, the new West Hawai'i Regional Fishery Management Area Rule (HAR § 13-60.4) includes an Achilles Tang bag limit of 10 fish/person/day which applies only to aquarium collectors (2014). (Addressed below in this section).

Although the most recent DAR report (2019a) suggests there should be concern for the sustained abundance of Achilles Tang in the WHRFMA, the report concedes that WHAP transects are not located in prime habitat for adult Achilles Tang (i.e., high energy shallower surge zones), and therefore the bulk of the Achilles Tang population is not adequately surveyed by WHAP monitoring (DAR 2019a). In addition, WHAP transects are not located in all collection zones found within the WHRFMA (Figure 4), including the two zones (100A and 108) with the highest percentage of the Achilles Tang collection, suggesting that the population of Achilles Tang in the WHRFMA is likely higher than estimated by the WHAP. This is supported by CREP (2018) data which show approximately 43% (approximately 79,000 individuals) of the island of Hawai'i Achilles Tang population (approximately 184,000 individuals) resides in collection zones 100 and 108.

The island of Hawai'i is divided into 14 collection zones for reporting purposes (Zones 100-108; Figure 4). The WHAP has survey transects only on the west side of the island as far south as collection zone 100B, but no transects within collection zones 100A and 108 located on the southwest and southeast portions of the island, respectively (Figure 4). Since 2000, 56% of all Achilles Tang catch data provided were from collection zones 100 and 108, and since 2012 when collection zone 100 was subdivided into 100A and 100B, 51% of all Achilles Tang catch data provided have been from collection zones 100A and 108 (DAR 2018a). Since 2000, less than two fishers have reported catch of Achilles Tang in collection zones 104, 105, and 106 (all n.d. data), and only in one year did more than two commercial aquarium fishers report Achilles Tang collection from zone 107 (DAR 2018a).

Because WHAP transects are not located in prime habitat, and no transects are located in areas where the majority of Achilles Tang collection occurs and over 40% of the population occurs, Achilles Tang population estimates based on WHAP data are likely underestimated (this is supported by the DAR [2019] report), which thus results in the impact of the collection being overestimated when based solely on WHAP data. These issues related to the WHAP data support the use of the CREP population estimate for evaluating the impact of the collection (Table 5-7), as CREP surveys have good spatial coverage in all West Hawai'i collection zones and in the shallower water zones occupied by Achilles Tang.

The most recent DAR report (2019a) states that commercial aquarium landings of Achilles Tang have declined in West Hawaiʻi over the past two decades in association with a dramatic increase in its value (DAR 2019a). The results presented by Stevenson et al. (2013) suggest the MPA network significantly displaced fishing effort from the central to the northern and southern coastal regions of the island of Hawai'i farther from ports of entry, and that estimated catch revenues and experimental catch per unit effort were statistically greater as distance from port of entry increased. These findings suggest that commercial aquarium fishers are traveling farther to reach suitable habitat areas open to Achilles Tang collection (e.g., Collection Zones 100A and 108), resulting in increased collection costs due to increased fuel consumption, equipment wear and tear, business expenses, time, etc., which is then passed on to wholesalers (i.e., increased cost per fish). At the same time, the bag limit on Achilles Tang implemented in 2014 has resulted in reduced Achilles Tang catch (average of 5,600 per year since 2014, down from 7,740 in 2014), affecting the number of fish brought to market (i.e., supply), which may also raise the price per fish. Therefore, the conservation measures that have been implemented to manage aquarium fish harvest (i.e., establishment of MPA network, bag limits) are more likely the cause of lower catch and increased value of Achilles Tang than declining availability.

Figure 8 illustrates the population trends for Achilles Tang since the FRAs were established, illustrating the downward trend in all areas. This downward trend has also been document by the Shallow Water Resource Fish Surveys (SWRF), which survey the shallower reef areas utilized by this species and have indicated a significant (90%) decline in Achilles Tang biomass in their primary adult habitat since 2008 (DAR 2019a). However, unlike aquarium collectors in West Hawai'i, there has never been a bag limit on this species for other fisheries. It is also important to note that these surveys only count Achilles Tang larger than 10 cm in size[10].

The catch of Achilles Tang decreased from 7,740 in 2014 to an average of 5,600 per year from 2015-2017. It is important to note that the Achilles Tang bag limit of 10 fish per day began in 2014, which likely accounts for the reduced catch after 2014. Additionally, unlike the Yellow Tang and Kole, Achilles Tang have generally been more abundant over the past decade in Open Areas compared to the protected FRAs, which may reflect habitat differences or differential non-aquarium fishing pressure in various areas (DAR 2019a).

[10] https://nmspapahanaumokuakea.blob.core.windows.net/papahanaumokuakea-prod/media/archive/council/meetings/2018/rac-dar-report-07-19-18.pdf

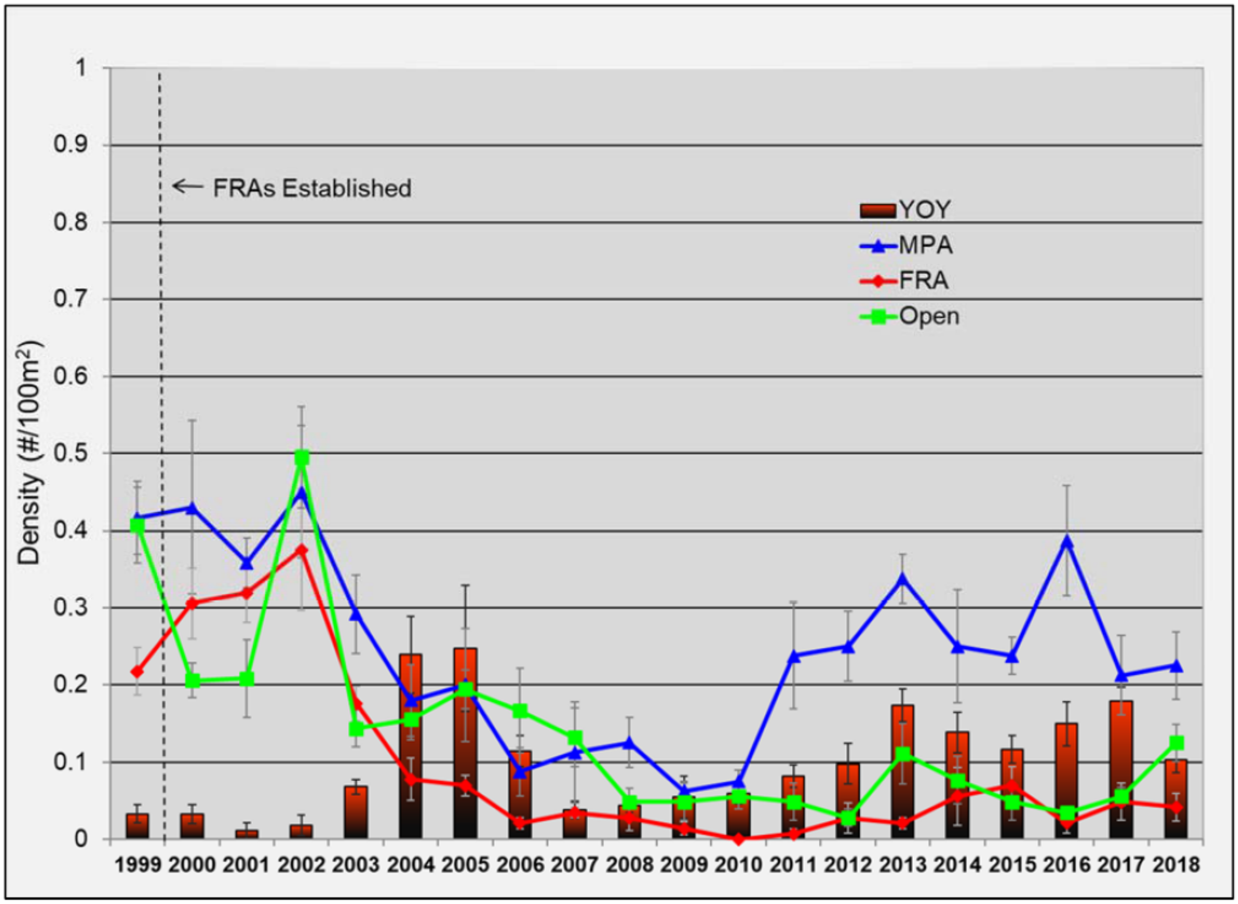

Figure 8. Overall changes in Achilles Tang density in FRAs, MPAs, and Open Areas, 1990-2018. Vertical bars indicate mean density (JUN-NOV) of Achilles Tang YOY. YOY are not included in trend line data (DAR 2019a).

As discussed above, due to WHAP survey locations, Figure 8 is likely an underestimate of the overall WHRFMA Achilles Tang population (DAR 2019a), as it represents only those Achilles Tang observed at a depth of 30-60 feet (not prime adult habitat) and does not include areas where most Achilles Tang are collected (Collection Zones 100A and 108; prime habitat for all sizes, Figure 4).

OTHER 30 WHITE LIST SPECIES

The top 10 collected species made up 98.2% of the collected fish in the WHRFMA in 2017, and the remaining 30 White List Species made up the remaining 1.8% of collected fish.

These each made up less than 1% of the overall catch in the WHRFMA since 2000. Of these species, four do not have WHAP data due to occurring in deeper habitats not surveyed by WHAP (Tinker's Butterflyfish, Hawaiian Longfin Anthias, Flame Wrasse) or being found in different habitat during the daytime which is not surveyed (Eyestripe Surgeonfish). Two additional species, the Psychedelic Wrasse and the Fisher's

Angelfish, tend to be in deeper waters, but are also recorded in WHAP transects (though these estimates are considered to be substantially lower than their actual abundances; DAR 2019a).

Thus, there are good long-term survey data for an additional 26 White List Species (Table 5-8). Of these, 10 showed a significant increase in population size in one or more management area, while 9 showed a decrease, though only one of the decreases was exclusively in the Open Areas, and 1 species had both an increase and a decrease in different management areas. Six species had no significant changes in population in any of the areas. Aquarium collection of the one species that declined exclusively in the Open Areas, the Blackside Hawkfish, is low, and is only 0.13% of the Open Area Population, making it unlikely that aquarium collecting alone is the cause of this species decline in Open Areas (DAR 2019a). In addition, the Open Area population increased from 20,508 in 2012-2013 (DAR 2014a) to 23,625 in 2017-2018 (DAR 2019a), indicating that recruitment of this species is occurring even in the presence of commercial aquarium collection, given that the population estimates include young-of-year, compared to the density estimates which do not.

Table 5-8. Change in density of 26 additional White List Species in the WHRFMA based on WHAP data. 'Before' = Mean of 1999-2000; 'After' = Mean 2017-2018. Young-of-year (YOY) not included. Bold = statistically significant t-test (DAR 2019a).

COMMON NAME	AREA	MEAN DENSITY (NO./100M^2)		OVERALL CHANGE IN DENSITY	ρ
		Before	After		
Forcepsfish	**FRA**	**0.41**	**0.59**	**+0.19**	**<0.05**
	Open	0.41	0.37	-0.04	0.58
	MPA	0.84	0.79	-0.05	0.71
Yellowtail Coris	FRA	0.17	0.20	+0.02	0.61
	Open	0.13	0.17	+0.04	0.53
	MPA	0.30	0.44	+0.14	0.24
Psychedelic Wrasse	FRA	0.01	0.01	0.00	1.00
	Open	0.01	0.01	0.00	1.00
	MPA	0.01	0.03	+0.02	0.63
Shortnose Wrasse	FRA	0.02	0.01	-0.01	0.73
	Open	0.02	0.03	+0.01	0.77
	MPA	0.01	0.08	+0.06	0.31
Saddle Wrasse	**FRA**	**3.66**	**2.91**	**-0.74**	**<0.001**
	Open	**5.93**	**4.23**	**-1.70**	**<0.001**
	MPA	4.39	3.93	-0.46	0.17
Multiband Butterflyfish	**FRA**	**5.20**	**2.69**	**-2.51**	**<0.001**
	Open	**4.00**	**3.28**	**-0.17**	**<0.001**
	MPA	**4.94**	**3.19**	**-1.75**	**<0.001**
Fourspot Butterflyfish	FRA	0.05	0.03	-0.02	0.65
	Open	**0.54**	**0.14**	**-0.40**	**<0.001**
	MPA	**0.43**	**0.20**	**-0.23**	**<0.05**
Fisher's Angelfish	FRA	0.00	0.00	0.00	1.00

COMMON NAME	AREA	MEAN DENSITY (NO./100M^2)		OVERALL CHANGE IN DENSITY	ρ
		Before	After		
	Open	**0.00**	**0.55**	**+0.54**	**<0.001**
	MPA	0.00	0.00	0.00	1.00
Pencil Wrasse	FRA	0.14	0.16	+0.02	0.78
	Open	**0.05**	**0.16**	**+0.11**	**<0.05**
	MPA	0.04	0.08	+0.03	0.82
Bird Wrasse	**FRA**	**0.67**	**0.84**	**+0.17**	**<0.05**
	Open	0.64	0.62	-0.01	0.82
	MPA	**1.04**	**1.53**	**+0.48**	**<0.01**
Thompson's Surgeonfish	**FRA**	**0.72**	**1.64**	**+0.92**	**<0.001**
	Open	**0.69**	**2.53**	**+1.84**	**<0.001**
	MPA	**0.66**	**1.55**	**+0.89**	**<0.01**
Milletseed Butterflyfish	FRA	0.00	0.00	0.00	1.00
	Open	0.04	0.02	-0.02	0.57
	MPA	**0.44**	**0.01**	**-0.43**	**<0.001**
Eightline Wrasse	**FRA**	**2.20**	**1.14**	**-1.05**	**<0.001**
	Open	**3.31**	**1.75**	**-1.56**	**<0.001**
	MPA	**3.17**	**1.83**	**-1.34**	**<0.001**
Hawaiian Dascyllus	**FRA**	**0.02**	**0.33**	**+0.31**	**<0.001**
	Open	0.51	0.59	+0.08	0.41
	MPA	0.12	0.15	+0.04	0.70
Blacklip Butterflyfish	**FRA**	**0.00**	**0.07**	**+0.07**	**<0.05**
	Open	**0.00**	**0.29**	**+0.29**	**<0.001**
	MPA	0.02	0.04	+0.02	0.68
Lei Triggerfish	FRA	0.53	0.69	+0.16	0.07
	Open	0.75	0.86	+0.11	0.24
	MPA	**0.57**	**1.06**	**+0.50**	**<0.001**
Spotted Boxfish	FRA	0.05	0.08	+0.03	0.49
	Open	0.10	0.12	+0.02	0.73
	MPA	0.10	0.19	+0.08	0.25
Fourline Wrasse	**FRA**	**1.36**	**1.81**	**+0.45**	**<0.01**
	Open	**1.66**	**2.12**	**+0.46**	**<0.01**
	MPA	**2.95**	**1.76**	**-1.19**	**<0.001**
Pyramid Butterflyfish	FRA	0.02	0.07	+0.04	0.37
	Open	**0.66**	**0.35**	**-0.31**	**<0.01**
	MPA	**0.59**	**0.10**	**-0.49**	**<0.05**
Blackside Hawkfish	FRA	0.34	0.23	-0.11	0.08
	Open	**0.41**	**0.22**	**-0.19**	**<0.01**
	MPA	0.26	0.26	0.00	1.00
Hawaiian Whitespotted Toby	FRA	1.13	1.00	-0.13	0.34
	Open	**3.48**	**2.32**	**-1.16**	**<0.001**
	MPA	**2.87**	**2.14**	**-0.73**	**<0.01**

COMMON NAME	AREA	MEAN DENSITY (NO./100M^2)		OVERALL CHANGE IN DENSITY	ρ
		Before	After		
Redbarred Hawkfish	FRA	0.03	0.04	+0.01	0.84
	Open	0.16	0.06	-0.09	0.63
	MPA	0.06	0.02	-0.04	0.49
Gilded Triggerfish	**FRA**	**0.14**	**0.03**	**-0.11**	**<0.05**
	Open	**0.31**	**0.03**	**-0.27**	**<0.001**
	MPA	**1.26**	**0.36**	**-0.90**	**<0.001**
Black Durgon	**FRA**	**0.53**	**0.82**	**+0.29**	**<0.05**
	Open	**0.43**	**0.86**	**+0.42**	**<0.01**
	MPA	**2.21**	**4.36**	**+2.14**	**<0.001**
Bluestripe Snapper	**FRA**	**0.07**	**0.80**	**+0.73**	**<0.001**
	Open	**0.12**	**0.31**	**+0.18**	**<0.01**
	MPA	0.19	0.17	-0.02	0.83
Peacock Grouper	FRA	0.57	0.72	+0.16	0.09
	Open	0.57	0.48	-0.09	0.28
	MPA	0.89	0.83	-0.06	0.72

Capture data from 2000-2017 (DAR 2018a), CREP (2018) population estimates, and estimated catch percentages for all White List Species in both West and East Hawai'i can be found in Section 5.4.1.3.

East Hawai'i

Commercial aquarium fish collection in East Hawai'i is significantly less than in the WHRFMA, in both level of effort and number of individuals kept. Between 2000 and 2017, approximately 160,272 White List Species were collected from East Hawai'i (DAR 2018a), compared to the 5,972,413 fish collected in the WHRFMA. The number of commercial aquarium fishers reporting catch is also significantly lower in East Hawai'i with an average of 5 permitted fishers reporting each year since 2000, compared to an average of 28 permitted fishers reporting from the WHRFMA over the same time period (this number does not include any permit reports that fall under the *n.d.* category).

Of the approximately 160,272 White List Species fish collected in East Hawai'i over the past 18 years, approximately 75% (119,959) were Yellow Tang. Seventy-seven percent (77%) of the Yellow Tang were captured from 2000- 2011. From 2011-2014 (the last year for which data are available due to data confidentiality), the average catch of Yellow Tang was 6,836 per year ranging between a minimum of 2,774 (2013) and a maximum of 14,269 (2014) individuals. Kole and Achilles Tang captures in East Hawai'i since 2000 have averaged 1,047 and 703 individuals per year, respectively.

The island of Hawai'i population estimates for Yellow Tang, Kole, and Achilles Tang based on data collected between 2010 and 2016 during CREP (2018) surveys are shown in Table 5-9. Based on these estimates, and the minimum and maximum collection of each species over an 18-year period, the proportion of the overall population removed by the East Hawai'i fishery is less than 1% for each species.

Table 5-9. CREP (2018) estimated populations of Yellow Tang, Kole, and Achilles Tang for the island of Hawai'i and percentage of population collected by commercial aquarium fishers in East Hawai'i (DAR 2018a).

Species	Island of Hawai'i Pop (CREP 2018)	East Hawai'i (DAR2018a)			
		Minimum Collection per Year[1]	Maximum Collection per Year[1]	Minimum % of Hawai'i Population	Maximum % of Hawai'i Population
Yellow Tang	**8,262,144**	2,774	14,269	0.03%	0.17%
Kole	**11,697,561**	76	3,601	<0.001%	0.03%
Achilles Tang	**231,377**	525	1,525	0.23%	0.66%

[1]From 2000-2017

Of the remaining fish species collected in East Hawai'i, none averaged more than 53 individuals collected per year since 2000; most averaged less than 25 individuals per year. Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that the collection of White List Species in any year of the 5-year analysis period would be similar to the 18-year annual average.

Capture data from 2000-2017 (DAR 2018a), CREP (2018) population estimates, and estimated catch percentages for all White List Species in both East and West Hawai'i can be found in Section 5.4.1.3.

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on White List Species.

Non-White List Species

WHRFMA

Only White List Species are allowed to be collected from the WHRFMA and any non-target, non-White List Species captured incidentally during fishing activities are to be immediately released at the capture site (Act 306; Section 1.2.3.1). Incidental captures are limited due to the capture methods implemented by fisherman, which focus on target species. Any incidental captures would therefore be negligible, and no significant direct impacts to non-White List Species in the WHRFMA are anticipated.

East Hawai'i

East Hawai'i is not restricted to the White List Species and many additional forms of aquatic life can be collected. Based on collection data between 2000 and 2017, a single invertebrate species, Red Pond Shrimp (unidentified species), made up the majority of the catch (DAR 2018a). Of the 249,007 non-White List aquatic animals collected in East Hawai'i over the past 18 years, approximately 73% (182,710 individuals) of the provided catch data were Red Pond Shrimp (this value is likely even higher, given the large number of years that could not disclose Red Pond Shrimp numbers due to data confidentiality, and Red Pond Shrimp made up over 99% of the collection when looking only at disclosed data). On average, more than 20,000 Red Pond Shrimp are collected annually from East Hawai'i (DAR 2018a). All remaining 79 non-White List Species collected in East Hawai'i averaged three or less individuals collected per year since 2000 based on the data reviewed. Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that annual collection of non-White List Species over the 5-year analysis period would be similar to the catch from 2000 to 2017.

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on Non-White List Species.

Hawai'i Species of Greatest Conservation Need

WHRFMA

Although listed as a Hawaiian SGCN, the IUCN (2017) provides this assessment of the Psychedelic Wrasse:

> *This species has a relatively restricted distribution in the east-central and north-western Pacific Ocean, being found only around the Hawaiian Islands Chain. Although there is no evidence for any population declines, the species is taken in the marine aquarium fish trade. However, more than two thirds of its range are enclosed by the Papahanaumokuakea Marine National Monument. This species is therefore listed as Least Concern.*

A total of 4,931 Psychedelic Wrasse were collected in the WHRFMA from 2000 to 2017 (DAR 2018a), representing 0.08% of the total White List Species collected over that same period. The average number of Psychedelic Wrasse captured each year since 2000 was 274 individuals, ranging between 97 (2003) and 599 (2017) individuals collected (Table 5-10). Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that between 100 and 600 Psychedelic Wrasse would be collected annually. The population of Psychedelic Wrasse in the WHRFMA has remained relatively stable between 1999/2000 and 2017/2018 (Table 5-8), with no statistically significant changes in either the Open Areas or protected areas.

Although listed as a Hawaiian SGCN, the IUCN (2017) provides this assessment of the Tinker's Butterflyfish:

> *The species is common and fairly widespread. Although it is occasionally collected for the aquarium trade, its deep-water habitat likely prevents the harvest of many specimens. Therefore, harvesting does not appear to be a major threat and there are no signs of significant decline. It is listed as Least Concern.*

A total of 5,561 Tinker's Butterflyfish were collected in the WHRFMA from 2000 to 2017 (DAR 2018a), representing 0.09% of the total White List Species collected over the same period. The average number of Tinker's Butterflyfish captured each year since 2000 was 309 individuals, ranging between 166 (2013) and 586 (2015) individuals collected (Table 5-10). Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that between 170 and 590 Tinker's Butterflyfish would be collected annually over the 5-year analysis period.

Although listed as a Hawaiian SGCN, the IUCN (2017) provides this assessment of the Fisher's Angelfish:

> *Listed as Least Concern in view of its wide distribution, large overall population, relatively limited collection for the aquarium fish trade, no substantial habitat loss, and no major threats overall.*

A total of 1,538 Fisher's Angelfish were collected in the WHRFMA from 2002 to 2017 (DAR 2018a)[11], representing 0.03% of the total White List Species collected over the same period. The average number of Fisher's Angelfish captured each year since 2000 was 96 individuals, ranging between 22 (2004) and 288 (2017) individuals collected (Table 5-10). Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that between 20 and 290 Fisher's Angelfish would be collected annually. Fisher's Angelfish have shown a significant increase in population within the Open Areas (Table 5-8), though it should be noted that this species tends to be a deeper water species, and the population estimates for WHAP are considered to be substantial underestimates (DAR 2019a).

Island of Hawai'i population estimates for Psychedelic Wrasse, Tinker's Butterflyfish, and Fisher's Angelfish based on data collected between 2010 and 2016 by the CREP (CREP 2018) are shown in Table 5-10. Based on these estimates, and the minimum and maximum catch for each species over an 18-year period (all within the WHRFMA; fewer than three collectors reported these species in any given year in East Hawai'i, therefore, data were not disclosed[12]), the proportion of the overall population removed by the WHRFMA fishery ranges from less than 1% for Fisher's Angelfish to 3.2% for Tinker's Butterflyfish. In addition, Kane and Tissot (2017) demonstrate that densities of all three species are greater at depths below the 98-foot survey depth of the CREP surveys, suggesting that the actual populations of all three species are higher than those reported by the CREP surveys, and the actual impact of commercial aquarium collection is lower than reported in Table 5-10.

Table 5-10. CREP (2018) estimated populations of Psychedelic Wrasse, Tinker's Butterflyfish, and Fisher's Angelfish for the island of Hawai'i and percentage of populations collected by commercial aquarium fishers in the WHRFMA (DAR 2018a).

Species	Island of Hawai'i Pop[1] (CREP 2018)	30'-60' Open Area Population (2017/2018)[2]	Minimum Collection per Year[3]	Maximum Collection per Year[3]	Minimum % of Hawai'i Population	Maximum % of Hawai'i Population
Psychedelic Wrasse	**36,770**	1,071	97	599	0.26%	1.63%
Tinker's Butterflyfish	**18,475**	N/A	166	586	0.9%	3.17%
Fisher's Angelfish	**666,209**	59,064	22	288	0.003%	0.04%

[1]All species population estimates are likely low due to the depths at which they occur.
[2]Pschedelic Wrasse and Fisher's Angelfish are only occasionally recorded on surveys, so these population estimates are underestimated. Tinker's Butterflyfish generally occurs in deeper habitats not adequately surveyed by transects.
[3]From 2000-2017

Based on deep diver observations, Tinker's Butterflyfish and Psychedelic Wrasse are substantially more common in the long term protected areas (MPAs) (DAR 2019a). Tinker's Butterflyfish is observed more

[11] Data not available for 2000 and 2001.
[12] Some collection data in East Hawai'i were disclosed by the 14 fishers (see Section 5.1), these data and the impacts on the population are provided in Table 5-11.

often in Open Areas when compared to FRAs, while Psychedelic Wrasse observations are equivalent between these two areas (DAR 2019a).

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have ***less than significant direct impacts*** on SGCN species in the WHRFMA.

East Hawai'i

Due to the low number of individual Aquarium Permits and low number of areas fished in East Hawai'i, reliable catch and population numbers are not available for the Psychedelic Wrasse in East Hawai'i. However, no Psychedelic Wrasse have been collected from East Hawai'i in 9 of the 18 years between 2000 and 2017 (DAR 2018a). It is likely that Psychedelic Wrasse are primarily collected as a result of opportunistic collection by fishers while targeting other species. For the 14 fishers who disclosed their catch data (see Section 5.1), collection of Psychedelic Wrasse averaged 2 individuals per year between 2000 and 2017, with a maximum collection of 16 in one year (see Table 5-11), representing 0.04% of the island-wide population. This level of collection is below the lower end of what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).

The same data limitations apply to the Tinker's Butterflyfish in East Hawai'i, though data from two years between 2000 and 2017 were disclosed (DAR 2018a). Collection of Tinker's Butterflyfish for these two years averaged 36 individuals per year collected in East Hawai'i, with a maximum of 38 individuals. Additional data disclosed by the 14 fishers (see Section 5.1) have collection of Tinker's Butterflyfish in East Hawai'i averaging 22 individuals per year, with a maximum collection of 94 individuals, representing approximately 0.5% of the island-wide population estimate (Table 5-11). This level of collection is below the lower end of what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). As noted in other sections, the CREP population estimate for the Tinker's Butterflyfish is likely low, so the actual impact to this species is likely even smaller.

No Fisher's Angelfish have been reported as collected from East Hawai'i during the period 2000-2017.

Under the Pre-Aquarium Collection Ban Alternative, it is anticipated that annual collection of SGCN species over the 5-year analysis period would be similar to the catch from 2000 to 2017.

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on SGCN species in East Hawai'i.

Reef Habitat

Herbivores, which feed on marine algae, and especially coral scraping herbivores such as parrotfish (Scaridae), are widely considered to play a key role in the overall health and subsequent recovery of coral reefs after disturbances such as bleaching. Herbivorous fish constitute roughly 50% of total fish biomass in West Hawai'i (DAR 2019a, Gove et al. 2019). The four largest groups of herbivorous coral reef fishes are the parrotfishes, damselfishes (Pomacentridae), rabbitfishes (Siganidae), and surgeonfishes (Acanthuridae). No parrotfishes or rabbitfishes (none in Hawai'i) are included on the White List, and therefore cannot be collected by commercial aquarium fishers in the WHRFMA. Only one damselfish, the Hawaiian Dascyllus (Section 4.4.1.26), is included on the White List and can be collected. However, Hawaiian Dascyllus are not herbivores and the average number collected per year since 2000 is 1 in East Hawai'i and 119 in the WHRFMA (Table 5-11).

Herbivores collected by the aquarium fishery typically consist of the smaller size classes, either by regulation (e.g., HAR 13-60.4 prohibits the collection of more than 5 Yellow Tang/day larger than 4.5 inches) or by market demand (i.e., minimal market for large adult fish in the aquarium trade). In addition, bag limits are in place for the three White List Species (5 Yellow Tang >4.5" and 5 fish <2"; 5 Kole >4" [AQ fishers only] ; and Achilles Tang [10 fish/day]) that have made up 93.3% of all individuals collected by commercial aquarium fishers in the WHRFMA since 2000 (Section 5.4.1.2). Even with making up the highest proportion of the catch, WHAP data indicate populations of Yellow Tang and Kole continue to increase (Section 5.4.1.2) and based on CREP population estimates the average annual collection of the three species represents less than 4% of the overall island of Hawai'i population of Yellow Tang and Achilles Tang and less than 1% of the overall island of Hawai'i population of Kole (Table 5-11). Additionally, DAR (2019a) reported that herbivore biomass has not changed since 2003 in the open areas or FRAs and has increased by 30.8% in the MPAs. While there has been no significant change in Open Areas or FRAs, there has still been an increasing trend, with a 14.4% increase in herbivore biomass in FRAs and a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (DAR 2019a, Gove et al. 2019). This occurred even with the pressures from commercial aquarium collection, which was occurring during this time. Therefore, it is not anticipated that a significant reduction in herbivores as a result of commercial aquarium collection would occur under the Pre-Aquarium Collection Alternative.

In a study analyzing the effects of aquarium collectors on coral reefs in Kona, Hawai'i, Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting.

The DAR has been conducting related observations since 2003 (DAR 2018c). Monitoring of coral reef benthic cover is conducted approximately every four years at 25 permanent monitoring sites. Monitoring is conducted more frequently if substantial benthic change occurs between regular sampling years (e.g. after a coral bleaching event). The analysis compares the presence or absence of commercial aquarium collecting in West Hawai'i relative to overall coral cover and changes in coral cover. Major results of the study are presented below:

- Coral cover was slightly higher within areas closed to the commercial aquarium fishery compared to Open Areas, but the difference was not statistically significant for any year of monitoring (2003: $p = 0.276$; 2007: $p = 0.275$; 2011: $p = 0.496$; 2014: $p = 0.554$; 2016: $p = 0.673$; 2017: $p = 0.782$). Additionally, there was no apparent trend of declining coral cover in the Open Areas over time.
- From 2003 to 2017, overall mean coral cover declined less within Open Areas compared to areas closed to commercial aquarium collection (Closed areas: -22.5% ± 3.4%; Open Areas: -15.5% ± 2.3%), but this difference in change in coral cover was not significant ($p = 0.093$).
- From 2014 to 2016, West Hawai'i experienced a severe coral bleaching and mortality event, which peaked in the fall of 2015. Over this time-period, overall mean coral cover decline was slightly less

in the areas open to commercial aquarium collection, but again, the difference was not significant (Closed areas: -19.6 % ± 6.0 %; Open Areas: -17.6 % ± 1.3 %; p = 0.605).

- From 2016 to 2017, approximately one year after coral post-bleaching mortality subsided, minimal change in coral cover was documented within areas open to commercial aquarium collection (Open Areas: 0.07 % ± 2.1 %), compared to a slight decline in mean coral cover in areas closed to collection (Closed: -1.94 % ± 2.3 %), and this difference was statistically significant (p = 0.038).

Based on the analysis presented in this section, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on reef habitat or the resilience of corals to respond to widespread bleaching events.

Impact of Collection on White List Species Populations

This Section summarizes the White List Species collection data under the Pre-Aquarium Collection Ban Alternative, as well as population estimates, into tabular format (Table 5-11). The primary purpose of the data analysis in regard to White List Species was to estimate, as accurately as possible, what the current populations of White List Species are, what level of collection was occurring in those populations prior to the 2017 ban on aquarium collection, and the average and maximum proportion of the population collected annually for the period 2000-2017 for each species. The CREP (2018) data compiled by the NOAA are comprehensive in both scope and spatial coverage and provide as accurate a depiction of population numbers as possible for the island of Hawai'i. The DAR (2018a) catch data provide collection numbers to allow for impact analysis. As noted throughout this DEIS, confidentiality regulations (HRS §189-3) and changes in the manner in which data were collected over the years did impact the analysis but was mitigated by the approach used during the analysis (i.e., using aggregate numbers). This method presents the most inclusive evaluation of the impact of the commercial aquarium fish collection on each of the 40 White List Species.

Table 5-11. Summary of CREP (2018) population estimates, disclosed catch data from East and West Hawai'i since 2000 (DAR 2018a), and the impact of average and maximum annual collection by species for the 40 White List Species. n.d. = Not Disclosed (Section 5.1); NA = Insufficient data available

Common Name	Island of Hawai'i Pop. Mean (lower-upper estimate limit) (CREP 2018)	East Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				WHRFMA (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				Island of Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)			
		Average Catch per year	Maximum Catch per Year	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year	Maximum Catch per Year[1]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year[2]	Maximum Catch per Year[2]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.
Achilles Tang[3]	231,377 (113,989-348,765)	703 (337)	1,525 (1,746)	0.30% (0.15%)	0.66% (0.75%)	5,600 (4,058)	5,757 (5,027)	2.42% (1.75%)	2.49% (2.17%)	6,303 (4,395)	7,282 (6,773)	2.72% (1.90%)	3.15% (2.93%)
Bird Wrasse	877,224 (686,135-1,068,313)	n.d. (1)	n.d. (6)	NA (<0.01%)	NA (<0.01%)	345 (146)	624 (224)	0.04% (0.02%)	0.07% (0.03%)	345 (147)	969 (230)	0.04% (0.02%)	0.11% (0.03%)
Black Durgon	1,354,454 (991,054-1,717,854)	n.d. (0)	n.d. (1)	NA (0.00%)	NA (<0.01%)	64 (25)	143 (86)	<0.01% (<0.01%)	0.01% (<0.01%)	64 (25)	207 (87)	<0.01% (<0.01%)	0.02% (0.01%
Black Surgeonfish	549,462 (355,535-743-388)	n.d. (33)	n.d. (181)	NA (0.01%)	NA (0.03%)	3,535 (2,334)	8,598 (4,711)	0.64% (0.42%)	1.56% (0.86%)	3,535 (2,367)	12,133 (4,892)	0.64% (0.43%)	2.21% (0.89%)
Blacklip Butterflyfish	131,260 (53,712-208,807)	n.d. (0)	n.d. (4)	NA (0.00%)	NA (<0.01%)	72 (33)	129 (88)	0.05% (0.03%)	0.10% (0.07%)	72 (33)	201 (92)	0.05% (0.03%)	0.15% (0.07%)
Blackside Hawkfish	246,727 (201,538-291,917)	n.d. (0)	n.d. (1)	NA (0.00%)	NA (<0.01%)	42 (29)	85 (69)	0.02% (0.01%)	0.03% (0.03%)	42 (29)	127 (70)	0.02% (0.01%)	0.05% (0.03%)
Bluestripe Snapper - Taape	7,092,851 (-265,739-14,451,440)	0 (0)	0 (0)	0.00% (0.00%)	0.00% (0.00%)	43 (21)	98 (53)	<0.01% (<0.01%)	<0.01% (<0.01%)	43 (21)	141 (53)	<0.01% (<0.01%)	<0.01% (<0.01%)
Brown Surgeonfish	14,439,543 (12,820,405-16,058,680)	n.d. (0)	n.d. (0)	NA (0.00%)	NA (0.00%)	891 (317)	2,476 (997)	<0.01% (<0.01%)	0.02% (<0.01%)	891 (317)	3,367 (997)	0.01% (<0.01%)	0.02% (0.01%)
Eightline Wrasse	689,221 (535,601-842,842)	n.d. (0)	n.d. (1)	NA (0.00%)	NA (<0.01%)	119 (81)	390 (528)	0.02% (0.01%)	0.06% (0.08%)	119 (81)	509 (529)	0.02% (0.01%)	0.07% (0.08%)
Eyestripe Surgeonfish	578,835 (438,301-719,369)	n.d. (0)	n.d. (0)	NA (0.00%)	NA (0.00%)	403 (11)	1,143 (30)	0.07% (<0.01%)	0.20% (<0.01%)	403 (11)	1,546 (30)	0.07% (<0.01%)	0.27% (0.01%)

Common Name	Island of Hawai'i Pop. Mean (lower-upper estimate limit) (CREP 2018)	East Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				WHRFMA (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				Island of Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)			
		Average Catch per year	Maximum Catch per Year	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year	Maximum Catch per Year[1]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year[2]	Maximum Catch per Year[2]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.
Fisher's Angelfish	666,209 (382,769-949,648)	0 (0)	0 (0)	0.00% (0.00%)	0.00% (0.00%)	96 (66)	288 (267)	0.01% (<0.01%)	0.04% (0.04%)	96 (66)	384 (267)	0.01% (0.01%)	0.06% (0.04%)
Forcepsfish	435,954 (366,537-505,372)	21 (1)	27 (7)	<0.01% (<0.01%)	0.01% (<0.01%)	1,831 (903)	3,152 (1,535)	0.42% (0.21%)	0.72% (0.35%)	1,852 (904)	4,987 (1,542)	0.43% (0.21%)	1.14% (0.35%)
Fourline Wrasse	1,253,164 (798,831-1,707,496)	n.d. (0)	n.d. (1)	NA (0.00%)	NA (<0.01%)	73 (29)	171 (74)	0.01% (<0.01%)	0.01% (0.01%)	73 (29)	244 (75)	0.01% (<0.01%)	0.02% (0.01%)
Fourspot Butterflyfish	797,673 (678,338-917,008)	30 (9)	30 (46)	<0.01% (<0.01%)	<0.01% (<0.01%)	889 (527)	1,630 (896)	0.11% (0.07%)	0.20% (0.11%)	919 (536)	2,524 (942)	0.12% (0.07%)	0.32% (0.12%)
Gilded Triggerfish	129,089 (80,159-178,020)	n.d. (0)	n.d. (3)	NA (0.00%)	NA (<0.01%)	45 (21)	157 (59)	0.03% (0.02%)	0.12% (0.05%)	45 (21)	202 (62)	0.03% (0.02%)	0.16% (0.05%)
Goldrim Tang	97,924 (10,276-185,573)	27 (5)	55 (19)	0.03% (0.01%)	0.06% (0.02%)	554 (329)	1,324 (1,401)	0.57% (0.34%)	1.35% (1.43%)	581 (334)	1,891 (1,420)	0.59% (0.34%)	1.93% (1.45%)
Kole	11,697,561 (9,547,971-13,847,152)	1,047 (88)	3,601 (374)	0.01% (<0.01%)	0.03% (<0.01%)	30,700 (17,985)	42,112 (31,648)	0.26% (0.15%)	0.36% (0.27%)	31,747 (18,073)	73,626 (32,022)	0.27% (0.15%)	0.63% (0.27%)
Hawaiian Dascyllus	225,153 (91,266-359,040)	12 (0)	12 (5)	<0.01% (0.00%)	<0.01% (<0.01%)	119 (77)	231 (169)	0.05% (0.03%)	0.10% (0.08%)	131 (77)	351 (174)	0.06% (0.03%)	0.16% (0.08%)
Hawaiian Whitespotted Toby	685,517 (566,297-804,737)	n.d. (0)	n.d. (0)	NA (0.00%)	NA (0.00%)	257 (135)	896 (552)	0.04% (0.02%)	0.13% (0.08%)	257 (135)	1,153 (552)	0.04% (0.02%)	0.17% (0.08%)
Lei Triggerfish	1,299,027 (1,182,364-1,415,690)	n.d. (0)	n.d. (0)	NA (0.00%)	NA (0.00%)	172 (125)	301 (259)	0.01% (<0.01%)	0.02% (0.02%)	172 (125)	473 (259)	0.01% (0.01%)	0.04% (0.02%)
Longfin Anthias	NA	n.d. (0)	n.d. (2)	NA	NA	102 (53)	102 (147)	NA	NA	102 (53)	204 (149)	NA	NA
Milletseed Butterflyfish	122,588 (69,611-175,565)	n.d. (1)	n.d. (11)	NA (<0.01%)	NA (0.01%)	106 (88)	421 (438)	0.09% (0.07%)	0.34% (0.36%)	106 (89)	527 (449)	0.09% (0.07%)	0.43% (0.37%)
Multiband Butterflyfish	1,788,604 (1,601,944-1,975,264)	n.d. (1)	n.d. (12)	NA (<0.01%)	NA (<0.01%)	1,206 (488)	2,951 (826)	0.07% (0.03%)	0.16% (0.05%)	1,206 (489)	4,157 (838)	0.07% (0.03%)	0.23% (0.05%)

Common Name	Island of Hawai'i Pop. Mean (lower-upper estimate limit) (CREP 2018)	East Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				WHRFMA (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				Island of Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)			
		Average Catch per year	Maximum Catch per Year	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year	Maximum Catch per Year[1]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year[2]	Maximum Catch per Year[2]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.
Orangeband Surgeonfish	1,319,924 (962,298-1,677,550)	16 (4)	16 (17)	<0.01% (<0.01%)	<0.01% (<0.01%)	828 (568)	2,306 (1,636)	0.06% (0.04%)	0.17% (0.12%)	844 (572)	3,136 (1,653)	0.06% (0.04%)	0.24% (0.13%)
Orangespine Unicornfish	897,085 (758,978-1,035,192)	36 (7)	59 (39)	<0.01% (<0.01%)	<0.01% (<0.01%)	5,827 (2,726)	8,813 (7,206)	0.65% (0.30%)	0.98% (0.80%)	5,863 (2,733)	14,654 (7,245)	0.65% (0.30%)	1.63% (0.81%)
Ornate Wrasse	1,630,224 (1,403,166-1,857,282)	15 (5)	15 (24)	<0.01% (<0.01%)	<0.01% (<0.01%)	1,657 (520)	12,445 (1,318)	0.10% (0.03%)	0.76% (0.08%)	1,672 (525)	14,104 (1,342)	0.10% (0.03%)	0.87% (0.08%)
Peacock Grouper - Roi	476,556 (399,275-553,837)	n.d. (0)	n.d. (1)	NA (<0.01%)	NA (<0.01%)	3 (4)	3 (20)	<0.01% (<0.01%)	<0.01% (<0.01%)	3 (4)	6 (21)	<0.01% (<0.01%)	<0.01% (<0.01%)
Pencil Wrasse	169,025 (79,513-258,536)	n.d. (1)	n.d. (4)	NA (<0.01%)	NA (<0.01%)	165 (128)	424 (416)	0.10% (0.08%)	0.25% (0.25%)	165 (129)	589 (420)	0.10% (0.08%)	0.35% (0.25%)
Potter's Angelfish	1,087,709 (826,174-1,349,245)	n.d. (5)	n.d. (19)	NA (<0.01%)	NA (<0.01%)	1,086 (854)	3,370 (3,004)	0.10% (0.08%)	0.31% (0.28%)	1,086 (859)	4,456 (3,023)	0.10% (0.08%)	0.41% (0.28%)
Psychedelic Wrasse	36,770 (10,627-62,913)	n.d. (2)	n.d. (16)	NA (0.01%)	NA (0.04%)	274 (208)	599 (619)	0.75% (0.57%)	1.63% (1.68%)	274 (210)	873 (635)	0.75% (0.57%)	2.37% (1.73%)
Pyramid Butterflyfish	23,217 (559-45,874)	n.d. (1)	n.d. (10)	NA (<0.01%)	NA (<0.04%)	133 (98)	714 (468)	0.57% (0.42%)	3.08% (2.02%)	133 (99)	847 (478)	0.57% (0.43%)	3.65% (2.06%)
Redbarred Hawkfish	231,580 (165,409-297,751)	n.d. (0)	n.d. (1)	NA (0.00%)	NA (<0.01%)	13 (10)	21 (20)	<0.01% (<0.01%)	<0.01% (<0.01%)	13 (10)	34 (21)	<0.01% (<0.01%)	0.01% (0.01%)
Saddle Wrasse	6,396,052 (5,757,305-7,034,799)	9 (0)	9 (0)	<0.01% (0.00%)	<0.01% (0.00%)	602 (304)	982 (585)	<0.01% (<0.01%)	0.02% (<0.01%)	611 (304)	1,585 (585)	<0.01% (<0.01%)	0.02% (0.01%)
Shortnose Wrasse	307,032 (157,058-457,006)	9 (2)	9 (7)	<0.01% (<0.01%)	<0.01% (<0.01%)	228 (175)	582 (558)	0.07% (0.06%)	0.19% (0.18%)	237 (177)	811 (565)	0.08% (0.06%)	0.26% (0.18%)
Spotted Boxfish	94,937 (55,775-134,099)	n.d. (0)	n.d. (2)	NA (0.00%)	NA (<0.01%)	170 (139)	454 (328)	0.18% (0.15%)	0.48% (0.35%)	170 (139)	624 (330)	0.18% (0.15%)	0.66% (0.35%)
Thompson's Surgeonfish	405,776 (205,636-605,916)	n.d. (1)	n.d. (9)	NA (<0.01%)	NA (<0.01%)	182 (130)	947 (931)	0.04% (0.03%)	0.23% (0.23%)	182 (131)	1,129 (940)	0.04% (0.03%)	0.28% (0.23%)

Common Name	Island of Hawai'i Pop. Mean (lower-upper estimate limit) (CREP 2018)	East Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				WHRFMA (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)				Island of Hawai'i (DAR 2018a) (numbers from 14 fishers in parenthesis; DAR 2019b)			
		Average Catch per year	Maximum Catch per Year	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year	Maximum Catch per Year[1]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.	Average Catch per year[2]	Maximum Catch per Year[2]	Average Percent of Hawai'i Pop.	Max Percent of Hawai'i Pop.
Tinker's Butterflyfish	18,475 (1,556-38,505)	36 (22)	38 (94)	0.20% (0.12%)	0.21% (0.51%)	309 (279)	586 (478)	1.67% (1.51%)	3.17% (2.58%)	345 (301)	909 (572)	1.87% (1.63%)	4.92% (3.10%)
Flame Wrasse	NA	n.d. (3)	n.d. (40)	NA	NA	75 (59)	168 (173)	NA	NA	75 (62)	243 (213)	NA	NA
Yellow Tang	8,262,144 (6,849,295-9,674,993)	11,996 (1,580)	33,809 (5,575)	0.15% (0.02%)	0.41% (0.07%)	271,430 (130,569)	386,767 (231,588)	3.29% (1.58%)	4.68% (2.80%)	283,426 (132,149)	668,194 (237,163)	3.43% (1.60%)	8.09% (2.87%)
Yellowtail Coris	391,507 (318,678-464,335)	17 (2)	18 (16)	<0.01% (<0.01%)	<0.01% (<0.01%)	575 (360)	851 (627)	0.15% (0.09%)	0.22% (0.16%)	592 (362)	1,428 (643)	0.15% (0.09%)	0.36% (0.16%)

[1]In some instances, the maximum catch of the 14 fishers requesting permits is greater than the maximum catch previously reported. This is likely due to data that had previously not been disclosed (see Section 5.1).
[2]Based on the sums of the average or maximum from East Hawai'i and the average or maximum from West Hawai'i.
[3]The average and maximum catch for the Achilles Tang in the WHRFMA is limited to 2015-2017 data, after the implementation of the 2014 bag limit, to more accurately reflect future trends.

While research into the reproductive biology and fecundity (i.e., ability to produce offspring) of specific species of reef fish is limited in availability, some generalities can be derived from available research, and most reef species are long-lived and highly productive. For reef fishes in general, the relationship between size and fecundity is well documented, with larger fish producing exponentially more eggs (Thresher 1984, Berkeley et al. 2004). Moreover, evidence from a diverse set of species indicates that older individuals produce larger, faster growing, and more starvation-resistant larvae (Thresher 1984, Bobko and Berkeley 2004). For these reasons, Birkeland and Dayton (2005) recommend protecting larger or older individuals to increase the sustainability of harvested populations.

Yellow Tang is a species which provides a good example of high fecundity, as well as the relationship between size and fecundity. Bushnell et al. (2010) studied Yellow Tang and found large individual variation in batch fecundity, with a range from 44 to >24,000 eggs per female produced on a single sampling date. Smaller females (3.1-4.75-inch standard length [LS]), produced limited numbers of eggs, while larger females (≥4.75-inch LS) were capable of maximal egg production (>20,000 eggs per batch). Bushnell et al. (2010) estimated the annual fecundity of Yellow Tang to average 1,055,628 eggs per female (with a standard error of 120,596 eggs).

In addition to high levels of fecundity, many reef fish are long-lived. Choat and Axe (1996) studied four *Naso* species in the Great Barrier Reef, and found life spans of 35 to 40 years, with rapid growth during the first 3 to 4 years of life. Eble et al. (2009) found that the Hawaiian kala (*Naso unicornis*) is also long-lived, with rapid initial growth. Sampled kala ranged in age from 1 to 58 years with the majority of growth occurring within the first 15% of the life span. These two studies indicate that *Naso* species in general exhibit life-spans in excess of 40 years (Eble et al. 2009). While studying habitat- and sex-specific life history patterns of Yellow Tang, Claisse et al. (2009) found a 41-year old individual. In addition, they found median size and age at the transition between deeper coral-rich and shallow turf dominated habitat use were about 0.75 inch longer and about 2 years older for males than females and coincided with an increase in reproductive output. The sexual difference in size at habitat transition, combined with sexual size dimorphism results in differences in the size distributions of both sexes in the two habitats (Claisse et al. 2009).

Due to the combination of a high fecundity and long life-span, reef fish can likely sustain fairly high levels of continuous harvest. While specific research into sustainable levels of collection has not been conducted for the 40 White List Species, Ochavillo and Hodgson (2006) suggest collection of between 5% and 25% is sustainable for various reef species in the Philippines that are similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish). For 37 of the 40 White List Species, the average annual collection under the Pre-Aquarium Collection Ban Alternative would represents less than 1% of the estimated island-wide population, with the remaining three species averaging less than 5% (Table 5-11).

In addition to the low percentage of the populations which are harvested each year, commercial aquarium fishing has a distinct advantage over other types of fishing because it is targeted to specific species, and within those species, it primarily targets specific size-classes which minimizes the impact to the brood stock. Because commercial aquarium fishers target the smaller individuals in populations, the larger individuals with higher fecundity are left within the population.

Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection under the Pre-Aquarium Collection Ban Alternative would have a ***less than significant direct impact*** on reef fish populations and the reefs in which they occur.

5.4.1.3 WHRFMA-only Programmatic Issuance of Permits Alternative

Under the WHRFMA-only Programmatic Issuance of Permits Alternative, an unlimited number of Aquarium Permits would be issued for the use of fine-mesh nets within the WHRFMA, but fine-mesh nets would not be allowed in East Hawai'i. The impact on biological resources, including reef habitat, within the WHRFMA would be similar to the Pre-Aquarium Collection Ban Alternative. In East Hawai'i, given that the WHRFMA would be open to fishing with the use of fine mesh nets, impacts to biological resources would be anticipated to be similar to the Pre-Aquarium Collection Ban Alternative or even potentially decrease since fishing in the WHRFMA may prove more favorable given the use of fine mesh nets. Therefore, impacts to fish populations are anticipated to be similar to the Pre-Aquarium Collection Ban Alternative for both the WHRFMA and East Hawai'i, with collection impacting less than 3.5% of any single species' population on average.

Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection under the WHRFMA-only Programmatic Issuance of Permits Alternative would have a ***less than significant direct impact*** on reef fish populations and the reefs in which they occur, and ***similar impacts*** when compared to the Pre-Commercial Aquarium Ban Alternative.

5.4.1.4 Achilles Tang Conservation Alternative

Under the Achilles Tang Conservation (Preferred) Alternative, impacts would be the same as those described in Section 5.4.1.2 for the Pre-Aquarium Collection Ban Alternative for all fish, invertebrate species, and reef habitat, with the exception of the Achilles Tang, in both the WHRFMA and East Hawaii.

Based on WHAP data, the DAR has suggested decreasing population trends for the Achilles Tang in the WHRFMA. Commercial aquarium fishers worked with DLNR in 2012 to pass HAR 13-60.4, which beginning in 2014 limited commercial aquarium collection of Achilles Tang to 10 individual fish per day (recreational and non-aquarium commercial harvest is not subject to the bag limit). Under the Achilles Tang Conservation (Preferred) Alternative, the daily bag limit for Achilles Tang in the WHRFMA would be reduced from 10 per day to 5 per day.

Therefore, under this alternative, annual catch of Achilles Tang in the WHRFMA over the 5-year analysis period is estimated to be reduced by 50% from that under the Pre-Aquarium Collection Ban Alternative (5,600; the average amount collected since the 2014 bag limit was imposed) to 2,800, or 1.2% of the island-wide population that would be collected annually over the 5-year analysis period. In East Hawai'i, impacts to the Achilles Tang would be anticipated to be similar to those seen under the No Action Alternative (either remaining similar to historic catch, or potentially increasing slightly due to the bag limit in the WHRFMA), ranging from 0.21% - 0.93% of the island-wide population (Table 5-3), for a total impact of up to 2.13% of the population (WHRFMA and East Hawai'i combined). This level of collection is below the lower end of what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).

Therefore, the Achilles Tang Conservation Alternative would have ***less than significant direct impacts*** on reef fish populations and the reefs in which they occur and would have ***a minor beneficial impact*** for the Achilles Tang when compared to the Pre-Aquarium Collection Ban Alternative.

5.4.1.5 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued to 14 fishers for the use of fine-mesh nets within the WHRFMA. No fine mesh nets would be allowed in East Hawai'i, though collection of aquarium fish would still be permitted using other legal means.

The 14 fishers requesting Aquarium Permits collected up to a maximum of 293,845 fish in the WHRFMA in a single year during the period from 2000-2017 (see Table 5-2). Conservatively assuming collection in the first year of the 5-year analysis period started at this maximum, and then grew at 1.49% per year, a total of 1,513,665 fish would be collected over the 5-year analysis period, or an average of 302,733 per year.

Impacts to individual species in the WHRFMA are shown in Table 5-11, using both the average and maximum number of each of the White List Species collected in the WHRFMA by the 14 fishers annually between 2000 and 2017, and what percent of the CREP population estimates those values represent. The impacts on individual species' populations is less than 2% for all species when looking at average collection rates, and less than 3% when looking at maximum rates.

Additionally, the bag limit for Achilles Tang would be implemented, resulting in similar impacts to that species as seen under the Achilles Tang Alternative, though again, because of the limited number of Aquarium Permits that would be issued, it is anticipated that the impact may be even smaller. Therefore, under this alternative, annual catch of Achilles Tang in the WHRFMA over the 5-year analysis period is estimated to be reduced by 50% from that under the Pre-Aquarium Collection Ban Alternative (4,058; the average amount collected since the 2014 bag limit was imposed, or 5,027, the maximum collected since the bag limit was imposed) to 2,029 to 2,514, or 0.88% to 1.09% of the island-wide population that would be collected annually over the 5-year analysis period. An additional 1,683 to 3,092 Achilles Tang would be estimated to be collected from East Hawai'i (52% of the No Action Alternative, see discussion below, plus 337 to 1,746 from the 14 fishers in East Hawai'i, see Table 5-11). This results in a total of 3,712 to 5,606 Achilles Tang, or 1.60% to 2.42% of the island-wide population. This level of collection is below the lower end of what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).

In East Hawai'i, the impacts would be anticipated to be similar to the No Action Alternative, although lower given that 14 of the fishers would be able to collect aquarium fish in the WHRFMA using fine mesh nets and these fishers are anticipated to decrease their collection in East Hawai'i to levels seen under the Pre-Aquarium Collection Ban Alternative. Based upon data from 2018 (DAR 2019b), the 14 fishers collected approximately 48% of the fish in East Hawai'i. Under the Limited Permit Issuance Alternative, it is thus assumed that the collection in East Hawai'i would decrease 48% from the No Action Alternative collection of 57,503 fish per year, to 29,902 fish, plus an average of 2,159 fish per year from East Hawai'i collection (Pre-Aquarium Collection Ban) by the 14 fishers (see Table 5-2), for a total collection of 32,061 fish per year in East Hawai'i under the Limited Permit Issuance (Preferred) Alternative, or 160,305 fish total over the 5-year analysis period.

Impacts to individual species would be anticipated to follow the Pre-Aquarium Collection Ban Alternative trends for the 14 fishers for the island of Hawai'i (see Table 5-11), plus additional impacts from other fishers in East Hawai'i of 52% of the No Action Alternative. Even when combined with collection from the WHRFMA, the impact to a species' population would be less than 4% (see Section 5.5.1).

Based on the low percentage of the overall populations anticipated to be collected annually by the 14 commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection under the Limited Permit Issuance (Preferred) Alternative would have a ***less than significant*** direct impact on reef fish populations and the reefs in which they occur, and a ***minor beneficial impact*** on reef fish populations compared to the Pre-Commercial Aquarium Collection Ban Alternative.

5.4.2 Indirect Effects

5.4.2.1 No Action Alternative

Under the No Action Alternative issuance of Aquarium Permits would not occur and commercial aquarium fishing would stop in the WHRFMA. In East Hawai'i, aquarium collection using legal gear or methods other than fine-mesh nets would continue. Commercial aquarium fishers may no longer find it feasible to target aquarium fish and may begin to participate in other fisheries, but this is not possible to quantify at this time.

In the WHRFMA, where no fish would be collected, a minor, although unquantifiable, increase in number of White List Species, non-White List Species, and SGCN may occur over the 5-year analysis period, which may provide additional viewing opportunities for tourists, an increase in the prey base, additional individual herbivores to maintain the reef, and increased competition between species for available resources. However, data do not exist that would allow for a thorough analysis of such effects, and many species did not see differences in population trends between areas open and closed to commercial aquarium collection since establishment of the FRAs in 1999 (Table 5-4 and Table 5-8; DAR 2019a).

In East Hawai'i, collection may increase under the No Action Alternative (see Section 5.4.1.1), and without the use of fine mesh nets, the size class of fish collected may increase over that which is caught with fine mesh nets (i.e., the smaller fish would escape the larger mesh), but again this impact cannot be quantified at this time. These larger fish may represent the brood stock. Based on the analysis provided in Section 5.4.1.1, the impact to any population of White List Species of fish would be less than 1% of the island-wide population. Additionally, research conducted on herbivores showed that numbers did not decline in areas open to commercial aquarium collection in the WHRFMA between 2003 and 2017. Since collection rates are generally higher in the WHRFMA, even with the anticipated increase in collection under the No Action Alternative in East Hawai'i, no indirect impacts due to commercial aquarium collection on the biological function of herbivore populations are anticipated.

Therefore, it is anticipated that the No Action Alternative would have a ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur in East Hawaii.

5.4.2.2 Pre-Aquarium Collection Ban Alternative

Under the Pre-Aquarium Collection Ban Alternative issuance of an unlimited number of Aquarium Permits would occur and commercial aquarium fish collection would take place. An estimated 1.7 million individual, primarily juvenile fish would be collected from the WHRFMA and an estimated 91,000 primarily juvenile fish and 67,229 invertebrates would be collected from East Hawai'i. Collection of these primarily juvenile fish and invertebrates would result in a decrease in the number of White List Species, non-White List Species, and SGCN over the 5-year analysis period, which may provide fewer viewing opportunities for tourists, a decrease in the prey base, and reduced competition between species for available resources, Given the low proportion of the island populations of the species that would be removed (Table 5-11, Section 5.4.1.2), and the geographic area over which the collection would occur (i.e., WHRFMA, island of Hawai'i), it is anticipated that indirect impacts on viewing opportunities, prey base, and competition would be minor or nonexistent. This conclusion is supported by the observation that population trends for many species did not differ between areas open and closed to commercial aquarium collection (Table 5-4 and Table 5-8). Additionally, between 2003 and 2017, total fish abundance significantly increased by 34.9% within Open Areas, where commercial aquarium collection was occurring (DAR 2019a, Gove et al. 2019). Total fish biomass also increased by 19.8%, though this change was not statistically significant (DAR 2019a, Gove et al. 2019). Species richness (the number of species observed per survey) remained constant for MPAs, FRAs and Open Areas (DAR 2019a, Gove et al. 2019).

As discussed in Section 5.4.1, herbivore numbers did not decline in the Open Areas between 2003 and 2017, and therefore, no indirect impacts due to commercial aquarium collection under the Pre-Aquarium Collection Ban Alternative on the biological function of herbivore populations are anticipated.

Based on the Tissot and Hallacher (2003) study and the 15 years of coral reef data collected and analyzed by the DAR (2018c), it is not anticipated that any significant indirect impacts to reef habitat would occur under the Pre-Aquarium Collection Ban Alternative. From 2003 to 2017, mean coral cover declined less within Open Areas than within areas closed to commercial aquarium collection (though the difference was not statistically significant; DAR 2019a). The DAR (2019a) concluded that commercial aquarium collecting is not having any measurable negative impact on percent coral cover or change in coral cover over time.

It is anticipated that implementation of the Pre-Aquarium Collection Ban Alternative would have a minor beneficial effect on invasive fish species over the 5-year analysis period. A total of 128 individual Bluestripe Snappers have been caught in the WHRFMA since 2000, based on disclosed data (DAR 2018a). The Peacock Grouper and Blacktail Snapper have not been reported as caught from the WHRFMA over the 18-year assessment period. Of the three invasive fish species, only the Peacock Grouper has been reported as caught (all *n.d.* data) in East Hawai'i.

Based on the analysis in this section, the Pre-Aquarium Collection Ban Alternative would have a ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.2.3 WHRFMA-only Programmatic Issuance of Permits Alternative

Under the WHRFMA-only Programmatic Issuance of Permits Alternative, Aquarium Permits would be issued for the use of fine-mesh nets within the WHRFMA, but fine-mesh nets would not be allowed in East Hawai'i. The indirect effect on biological resources within the WHRFMA would be similar to the Pre-Aquarium Collection Ban Alternative. In East Hawai'i, indirect effects to biological resources would be anticipated to be similar to the No Action Alternative, though with the WHRFMA open to fishing with the use of fine mesh nets, indirect effects of aquarium fish collection in East Hawai'i may return to levels seen under the Pre-Aquarium Collection Ban Alternative or even decrease since fishing in the WHRFMA may prove more favorable given the use of fine mesh nets.

Based on the analysis in this section, the WHRFMA-only Programmatic Issuance of Permits Alternative would have ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.2.4 Achilles Tang Conservation (Preferred) Alternative

Indirect impacts under the Achilles Tang Conservation Alternative would be similar to those of the Pre-Aquarium Collection Ban Alternative. The implementation of the 5 per day bag limit on Achilles Tang may provide a benefit to Achilles Tang populations, potentially leading to minor population growth as well as increased viewing opportunities for tourists, but this cannot be quantified at this time.

Based on the analysis in this section, the Achilles Tang Conservation Alternative would have ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.2.5 Limited Permit Issuance (Preferred) Alternative

Under the Limited Permit Issuance (Preferred) Alternative, Aquarium Permits would be issued to 14 fishers for the use of fine-mesh nets within the WHRFMA. No fine mesh nets would be allowed in East Hawai'i, though collection of aquarium fish would still be permitted using other legal means.

It is anticipated that collection of approximately 1.5 million fish would occur in the WHRFMA, resulting in indirect impacts similar, though smaller in scale, to the Pre-Aquarium Collection Ban Alternative. In East Hawai'i, between 91,000 and 383,489 fish would be collected, and 67,229 invertebrates, resulting in indirect effects between the No Action and Pre-Aquarium Collection Ban alternatives.

Additionally, this alternative would implement a bag limit on Achilles Tang, leading to similar indirect impacts on that species as the Achilles Tang Conservation Alternative, though again, because of the limited number of Aquarium Permits that would be issued, it is anticipated that the indirect effects may be even smaller.

Based on the analysis in this section, the Limited Permit Issuance (Preferred) Alternative would have ***less than significant indirect impact*** on tourists, as well as on collected fish populations and the reefs in which they occur.

5.4.3 Cumulative Impacts

As stated in Section 4.4, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, including a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI). Therefore, the geographic boundary for analysis of cumulative effects is the island of Hawai'i.

5.4.3.1 Recreational Aquarium Fish Collection

As of April 2018, all recreational permits for collection of aquarium species with fine mesh nets were voided, and no collection with fine mesh nets is currently legally allowed, pending environmental review (DAR 2019a). Given the five-year analysis period, it cannot currently be predicted when or if these permits will be reinstated, therefore, the following discussion focuses on the cumulative impacts if the permits were to be reinstated, and pressure remained similar to historic trends.

Recreational aquarium fish collection is governed by state law and regulations. Under HRS 188-31, individuals may use fine mesh nets (< 2-inch mesh) to collect aquatic life for an aquarium. A permit is not required if:

- The net has large mesh (more than two-inch mesh);
- The net has small mesh but is less than three feet in length, height, or width, including the handle; or,
- Using a slurp gun.

A recreational aquarium permit is required if using a small mesh net other than a hand net, or a small mesh hand net larger than the dimensions indicated above. Small mesh throw nets are always prohibited. Regardless of whether a permit is required, regulations that impose bag limits, seasons, and limit the size of fish that can be collected apply to all recreational fish collection. The aquarium permit only exempts a person from the small mesh restriction. The recreational aquarium permit rules apply everywhere in the state, except for West Hawai'i, which has its own rules and permits specific to the WHRFMA (HAR §13-60.4).

Under a recreational aquarium permit, individuals are authorized to collect up to five aquatic animals per day (1,825 per year) (HAR 13-60.4). Since 2000, the number of recreational permits issued for the state (island-specific numbers not available) has averaged 159 annually (DAR 2018a). The DAR collected recreational aquarium fish catch information from 1975 until 1985, after which, data collection was discontinued, and currently no reporting of catch is required for recreational aquarium permit holders. Historic recreational catch data were not digitized or processed into a database, and therefore, are not available for analysis (DAR 2018a).

Because reporting of recreational aquarium catch is not required, the impact of recreational collection on White List Species cannot be quantified. It is likely that not all recreational permit holders collect the maximum allowable number (1,825); however, if each of the average 159 statewide permit holders were to collect 50% of the allowable catch (913), it would result in the collection of 145,088 aquatic animals per year statewide. If it is assumed that only 50% are White List Species, it would result in an estimated 72,544 White List Species collected by recreational aquarium permit holders annually. The same estimation would apply to non-White List Species. These estimates are likely high based on results from Harding (2017), which found that 57% of recreational aquarium permit holders surveyed had not utilized their permit in the previous 12-month period. Of the 43% who had used their permits, their average yearly catch was 45 fish per permit (Harding 2017), which is below the maximum allowable number of 1,825 fish or the 50% used to estimate impacts above.

Because reporting of recreational aquarium catch is not required, the impact of the collection on SGCN cannot be quantified. Nevertheless, it is likely that SGCN are occasionally collected by recreational aquarium permit holders. However, given the low number of SGCN individuals collected by commercial aquarium collectors (average 274 Psychedelic Wrasse/year; average 309 Tinker's Butterflyfish/year; average 96 Fisher's Angelfish/year) it is estimated that recreational collectors are collecting fewer individuals of these species.

Because reporting of interactions (e.g., damage from contact with collection equipment) with corals resulting from recreational aquarium collecting and recreational aquarium catch is not required, the impact of the interaction with reef habitat cannot be quantified. However, studies conducted by Tissot and Hallacher (2003) found that aquarium collecting had no significant impact (beneficial nor detrimental) on reef habitat. In addition, 15 years of coral reef data collected and analyzed by the DAR (2018b) found no significant difference in coral cover in areas open to commercial aquarium fish collection. It is assumed that recreational aquarium collect would likewise not have a significant impact.

Recreational aquarium collection impacts to biological resources cannot be fully quantified. However, data presented by DAR (2014a, 2019a) indicate that some species may be declining in various management areas (e.g., FRA, MPA, Open) due to factors other than commercial aquarium collecting which may include recreational aquarium collection.

5.4.3.2 Non-Aquarium Commercial and Non-Commercial Fishing (Non-Aquarium Fish)

Coral reef species are targeted by non-aquarium commercial fishers using numerous fishing gears including nets, traps, hook and line, spear, hand, and other methods. Commercial fish industry landings in Hawai‘i have increased annually since 2006 and the NOAA reported total landings in 2013 were valued near $108 million dollars (DLNR 2015). Akule (coastal pelagic scads) dominate nearshore commercial landings and are typically collected using surround or fence nets, gillnets or hook and line (Western Pacific Regional Fishery Management Council-WPRFMC 2017). Other top species by weight and value include soldierfishes, parrotfish, surgeonfishes and goatfishes, which may be targeted because they may bring a high price in some seasons (WPRFMC 2017).

Non-commercial fishing includes subsistence/consumptive, recreational, and cultural fishing and gathering activities that occur in ocean and coastal zones. The State of Hawai’i has the most developed recreational fishing infrastructure in the U.S. Pacific and is a substantial economic contributor to the State. The State of Hawai'i does not track non-commercial fish collection. However, creel surveys suggest that the total inshore non-commercial catch from reef areas could be as high as the reported commercial catch (WPRFMC 2017).

The most recent DAR summary report available on the West Hawai'i aquarium fishery (DAR 2019a) analyzed data collected since 2003 by the Hawai'i Marine Recreational Marine Fishing Survey (HMRFS) and subsequently since 2007 by NOAA's Marine Recreational Information Program (MRIP) to gain perspective on the generalized impact on reef fishes by aquarium collecting versus other types of reef fishing activities.

Statewide, looking at the period from 2008-2011, the number of reef fishes caught by the recreational and commercial sectors was found to be comparable, averaging 1,511,025 per year for recreational fishers and 1,554,010 per year for commercial (i.e., non-aquarium) fishers.

McCoy et al. (2018) found that 12.8% of households on Hawai'i participate in recreational (non-aquarium) fishing. Most of this fishing is conducted using lines from shore (65.6%), which catches an estimated 0.33 pounds of reef fish per hour fished (McCoy et al. 2018). The results of this study found that on Hawai'i, non-commercial annual catch was approximately 10.5 times commercial catch when comparing the average pounds per year between 2004 and 2013 (McCoy et al. 2018).

In West Hawai'i (i.e., the WHRFMA), on average the commercial aquarium fishery annually takes 1.8 times (343,729/year) the number of reef fishes taken annually by recreational and other commercial fishers combined (194,674/year) (DAR 2019a). However, if Yellow Tang, which is primarily collected at small sizes and generally not targeted by other fishers, is excluded, on average the recreational and commercial fisheries combine to take 3 times the number of reef fishes (194,674/year) caught annually by aquarium collectors (64,815/year) (DAR 2019). In terms of reef fish biomass caught by the different fisheries in West Hawai'i (i.e., the WHRFMA), DAR (2019a) concluded that more biomass is taken by the combined recreational and commercial fisheries regardless of including Yellow Tang (2.8 times) or excluding Yellow Tang (8.6 times). In addition, unlike the aquarium fishery which targets mostly immature fish, the commercial and recreational fisheries selectively target the larger breeding portion of the population which has profound implications for the sustainable usage of the resource (DAR 2019a). Therefore, on the island of Hawai'i, commercial aquarium fish collection constitutes 25% of the total catch and 11% of the biomass (when excluding Yellow Tang, whose population has been increasing even with commercial aquarium collection).

The non-aquarium commercial fish industry targets some coral reef species; however, commercial non-aquarium fishers do not directly target most White List Species. Data for non-aquarium commercial fishing is lacking due to the DAR confidentiality regulations (HRS §189-3). Because most non-aquarium commercial fishers do not target aquarium species, there are usually less than three fishers reporting. Therefore, the data presented in Table 5-12 are underestimated.

Table 5-12. Available data on White List Species collected by commercial non-aquarium fishers in the State and on the island of Hawai'i from 2000-2017 (DAR 2018a). n.d. = Not Disclosed (see Section 5.1).

White List Species	WHRFMA Catch		East Hawai'i Catch		Island of Hawai'i Catch		State Catch Total	
	Total	Annual Average	Total	Annual Average	Total	Annual Average	Total	Annual Average
Achilles Tang	1,552	87	2,435	136	3,987	222	10,641	592
Yellow Tang	n.d.		n.d.		n.d.		n.d.	
Kole (=Goldring Surgeonfish, Yelloweye, Goldring)	4,773	266	28,496	1,584	33,269	1,849	103,391	5,744
Peacock Grouper (=Roi, Bluespot Peacock Grouper)	212	12	73	4	285	16	17,892	994
Eyestripe Surgeonfish (=Palani)	4,891	272	2,412	134	7,303	406	202,286	11,239
Orangeband (=Shoulder) Surgeonfish	396	22	604	34	1,000	56	95,380	5,299
Saddle Wrasse	4	1	62	4	66	4	1,150	64
Brown Surgeonfish (=Lavender, Forktail Tang)	n.d.		58	4	58	4	58	4
Bluestripe Snapper (=Taape)	15,499	861	64,660	3,593	80,159	4,454	715,913	39,773
Total Collected	**27,327**		**98,800**		**126,127**		**1,146,711**	

It is expected that the average number of White List individuals collected annually by non-aquarium commercial fishers would continue at these rates (at a minimum) over the 5-year analysis period.

Because reporting of non-aquarium recreational, cultural and subsistence/consumptive catch is not required, the impact of recreational, cultural and subsistence/consumptive collection on White List Species, non-White List Species, and SGCN cannot be quantified. However, nearshore recreational and subsistence catch is likely at similar catch levels as that of non-aquarium commercial fishing (Friedlander 2017).

The impacts of non-aquarium commercial and non-commercial fishing on biological resources cannot be fully quantified. However, as discussed above data presented by DAR (2019a) indicate that some species are declining in various management areas (e.g., FRA, MPA, Open) due to factors other than commercial aquarium collecting, which include non-aquarium commercial and non-commercial fishing. However, there is no way to fully quantify the cumulative effects of past and ongoing non-aquarium commercial and non-commercial fishing on biological resources. Given the assumed past and present impacts of non-aquarium commercial and non-commercial fishing on biological resources, foreseeable future actions would likely result in some impacts to biological resources.

5.4.3.3 Commercial Aquarium Collection

As noted in Section 1.0, the commercial aquarium collection fishery has existed in Hawai'i since the late 1940s. Commercial aquarium collection pursuant to permits issued by DLNR was only recently halted after the Supreme Court of Hawai'i's determination that DLNR's issuance of the permits required compliance with HEPA. Cumulatively, since 1976, a total of 8.6 million White List Species individuals have been collected by commercial aquarium fishers in the WHRFMA area (DAR 2018a). Over 69% of that catch has occurred since 2000 and was included in the analysis of this DEIS. Regardless, this collection has already occurred, and is reflected in the current population estimates used to evaluate impacts on species (see Section 5.4.1.2).

Given the long history of commercial aquarium collection in Hawai'i, it is reasonably foreseeable that commercial aquarium collection will continue. Based on available data regarding species abundance and yearly commercial aquarium catch over the past 18 years, it is expected that in the reasonably foreseeable future, commercial aquarium collection will proceed generally at the same rate and have the same level of impact as in the past 18 years. To the extent new data regarding the impacts of commercial aquarium collection on biological resources becomes available in the future, DLNR may consider those data and, to the extent necessary, supplement this impacts analysis.

As noted in Section 5.4.1.2:

- Reef fish have high fecundity and are long lived, and as such produce a large number of young each year over many years;
- Commercial aquarium collection targets juvenile fish leaving behind the adult broodstock; and,
- A low percentage of the overall population of each of the targeted species would be collected annually by commercial aquarium fishers, and this collection would be spread throughout the year and across multiple areas.

As such, Section 5.4.1.2 concludes that commercial aquarium collection would not have a significant impact on island of Hawai'i reef fish populations. Thus, it is not anticipated that losses would accumulate over time due to the low percentage collected each year and the high fecundity of reef fishes.

5.4.3.4 Tourism

Hawai'i is a major tourist destination and the tourism industry contributes the most to the state's economy. Over time this industry has grown and reshaped the native landscapes and sensitive ecosystems through major coastal development, increased energy consumption, and tourism based recreational activities.

Major coastal development for tourism (i.e., hotels, resorts, restaurants, recreational outfitters) and associated point source pollution (e.g., petroleum hydrocarbons, pharmaceuticals, heavy metals, and sediment from agriculture and development) threaten the quality of coral reef ecosystems (State of Hawai'i 2010). When coral reefs are damaged, it could potentially expose reef dependent organisms and leave them vulnerable to other threats such as disease, predation, and climate change (State of Hawai'i 2010), including the reef fishes and other aquatic animals targeted by both commercial and recreational aquarium fishers.

Human interaction with native flora and fauna is also a growing concern. Damage to sensitive ecosystems (i.e., coral reefs, tide pools, shorelines) through tourism-based recreation overuse (e.g., SCUBA diving, snorkeling, etc.) has been attributed to killing many aquatic organisms that in turn may affect many more species that rely on such organisms as a food source. Damage to coral reef habitat in association with tourism (through coastal development, point source pollution, and recreational activities) threatens most White List Species that are dependent on reefs for habitat and foraging in the foreseeable future (State of Hawai'i 2010).

5.4.3.5 Climate Change

Warming of the planet and rising average temperatures may produce variations in precipitation and temperature patterns, sea levels, and storm severity. This process is commonly referred to as "climate change." Changes in sea surface temperatures have been documented, with temperatures warmer than normal in recent years (increase of 0.22 °F per decade), and even reaching record levels of thermal stress in September 2015 (Casey 2001; Gove et al. 2016). Warmer water temperatures can result in coral bleaching. When water is too warm, corals will expel the algae living in their tissues causing the coral to turn completely white. When coral bleaches, it is not dead; corals can survive a bleaching event, but they are under more stress and are subject to mortality. In 1998, global coral bleaching and die-off was unprecedented in geographic extent, depth, and severity. Researchers predict that coral bleaching events would occur when the average sea temperatures are 33.8 °F or more above average (DLNR 2015). In the fall of 2015, leeward reefs of Hawai'i Island suffered catastrophic coral mortality due to widespread and severe coral bleaching. Survey results indicated that overall coral bleaching prevalence averaged 53.3% and resulted in an average coral cover loss of 49.7%. Regional differences in bleaching prevalence and subsequent coral mortality were not detected. High post-bleaching mortality was detected for the coral species, *Pocillopora meandrina, Porites evermanni*, and *Porites lobata* (Kramer et al., 2016). Acidification can also damage corals and marine life that depend on minerals for shell/skeletal development. The acidity of the Pacific Ocean has increased by about 25% over the last 300 years and is predicted to increase 40-50% by 2100 (EPA 2016).

Based on studies in the Great Barrier Reef, fishing pressure had minimal effect on bleaching (Hughes et al. 2017). On the island of Hawai'i, the total cover of hard coral decreased between 2003 and 2017 in MPAs, FRAs and in Open Areas, with the smallest decline seen in Open Areas, though all areas saw significant declines ranging from 48.7% in Open Areas to 57.8% in FRAs (DAR 2019a, Gove et al. 2019). Given that Open Areas did not see a more severe decline than areas closed to commercial aquarium collection, it is not anticipated that commercial aquarium collection has a less than significant impact on coral declines.

Currently, it is projected that with warming of approximately 5ºF per decade, coral reefs will experience annual bleaching beginning by about 2040 in the Hawaiian Islands, though this may be delayed by approximately 11 years if the warming reductions in the 2015 Paris Agreement are met (U.S. Global Change Research Program [USGCRP] 2018). Bleaching and acidification will result in a loss of reef structure and lead to declines in fishery yields and loss of habitat (USGCRP 2018). Bleaching events in Hawai'i are tracked by NOAA, the DLNR, DAR, and other partners (found online at www.hawaiicoral.org). Changes in climate currently impact the physical resources of Hawai'i. Warming sea temperatures and acidification could result in damage, disease outbreaks, and ultimately death of coral reefs. The weakening or loss of coral reef ecosystems may threaten entire marine ecosystems in the region as many organisms, including numerous fish species, are not only dependent on these ecosystems for suitable habitat, but due to the isolation of the islands in the central pacific, are unable to move to new environments that provide suitable conditions for survival (EPA 2016).

Several White List and non-White List Species are endemic to the Hawaiian Archipelago (including Johnston Atoll) and therefore may be impacted when faced with changes in climate over time (e.g., warming temperatures, habitat loss due coral bleaching, etc.). The extent and severity of impacts to White List Species from climate change have been ongoing for decades and are expected to increase in the foreseeable future. If environmental fluctuations resulting from climate change (e.g., tropical storms, coral bleaching episodes, acidification, etc.), or other natural or human factors, change habitat conditions, fishing mortality may present a higher risk to some White List and non-White List Species and SGCN.

5.4.3.6 Cumulative Impact Conclusion

The DAR (2019a) has noted significantly declining populations in one or more of the management areas for 12 of the White List Species, and cumulatively, all of the factors discussed above likely contribute to the declines. Therefore, cumulative impacts to these 12 White List Species would occur under any of the five alternatives under consideration and would be **significant** (including the No Action Alternative). Minor cumulative impacts to the remaining 28 White List Species are anticipated, given that populations have remained stable or increased for 24 of those species, and population trend data is not available for the other four species[13].

However, as noted in Section 5.4.3, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019a). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. In addition, for the 12 species that have shown a significant decline

[13] Species not adequately surveyed by WHAP include Tinker's Butterflyfish, Longfin Anthias, Flame Wrasse, and Eyestripe Surgeonfish. Tinker's Butterflyfish have a CREP (2018) population estimate of 18,475, and collection under any of the alternatives would be less than 5% of the island-wide population (though it should be noted that the vast majority of the population occurs well below the 98-foot depth surveyed by the CREP and thus the population estimate is likely low). Eyestripe Surgeonfish has a CREP (2018) population estimate of 578,835, and collection under any of the alternatives would be less than 0.3% of the island-wide population. Flame Wrasse do not have a CREP population estimate, but collection has been less than 175 individuals per year for the island of Hawai'i between 2000 and 2017. Longfin Anthias also do not have a CREP population estimate, but collection has been less than 150 individuals per year for the island of Hawai'i.

in population size in one or more management area since establishment of the WHRFMA in 1999, commercial aquarium collection under any of the five alternatives would collect less than 1% of the island-wide population estimates for 10 of the species (Table 5-14). For the remaining two species, Achilles Tang and the Pyramid Butterflyfish, commercial aquarium collection would collect less than 4% of the island-wide population (Table 5-14). Based on this, while commercial aquarium collection does contribute to the cumulative impact, it is a **less than significant** factor in the observed declines.

Additionally, measures included in the Preferred Alternative (e.g., limited permit issuance, reduced Achilles Tang bag limit) may mitigate potential impacts by limiting the number of Aquarium Permits issued as well as the number of Achilles Tang that can be collected by commercial aquarium collectors each day. As described above, commercial aquarium collection is not the only stressor on this species, and therefore, it is anticipated that additional conservation measures designed to address the other stressors (e.g., commercial and recreational fisheries) will need to be implemented in order to sustain the population. The DAR (2019a) supports this conclusion, stating that conservative bag limits, as proposed in the Preferred Alternative for commercial aquarium collection, should be considered for other fisheries as well. There are currently no bag limits for Achilles Tang applied to any other fishery.

5.4.4 Mitigation

No significant adverse direct or indirect biological resource impacts are anticipated under any of the five alternatives under consideration. Significant cumulative impacts are anticipated; however, commercial aquarium collection is a less than significant factor in the cumulative impact. Therefore, no mitigation is required or proposed.

Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of Aquarium Permits that would be issued, limiting collection using fine mesh nets to the WHRFMA, and reducing the bag limit for the Achilles Tang, all of which would minimize impacts to biological resources.

5.5 SUMMARY OF IMPACTS

Table 5-13 summarizes the environmental consequences by alternative during the 5-year analysis period.

Table 5-13. Summary of direct and indirect impacts by alternative over the 5-year analysis period.

Alternative	Socioeconomics			Cultural Resources	Biological Resources	
	Direct	Indirect	Tourism	Direct and Indirect	Collection of Fish	Coral Reefs and Herbivores
No Action	$2 million added to the economy (based on fishing in East Hawai'i), unknown number of jobs (<57)	$6.3 million added to the economy, unknown number of indirect jobs (less than other alternatives)	No interactions between collectors and tourists in the WHRFMA, potential increase in East Hawai'i	No impact on culturally significant fish populations	No collection in WHRFMA Collection of 287,516 fish in East Hawai'i	No impact on coral. No impact on herbivore numbers.

Alternative	Socioeconomics			Cultural Resources	Biological Resources	
	Direct	Indirect	Tourism	Direct and Indirect	Collection of Fish	Coral Reefs and Herbivores
Pre-Aquarium Collection Ban	$8.2 million added to the economy and 57 jobs	$41 million added to the economy, unknown number of indirect jobs	No known quantifiable impact on the tourism industry		Collection of 1.7 million White List Species fish from the WHRFMA Collection of 91,000 fish from East Hawai'i	
WHRFMA-only Programmatic Issuance of Permits	$7.9 to $8.2 million added to the economy and 57 jobs.	$39.5 to $41 million added to the economy, unknown number of indirect jobs	No known quantifiable impact on the tourism industry		Collection of 1.7 million White List Species fish from the WHRFMA Collection of less than 91,000 fish from East Hawai'i	
Achilles Tang Conservation	$7.9 million added to the economy and 57 jobs	$39.5 million added to the economy, unknown number of indirect jobs	No known quantifiable impact on the tourism industry, may increase viewing potential for Achilles Tang		Collection of 1.7 million White List Species fish from the WHRFMA, collection of Achilles reduced by 50% Collection of 91,000 fish from East Hawai'i	
Limited Permit Issuance (Preferred)	$4.4 to $6.5 million added to the economy and 14 jobs	$22 to $32.5 million added to the economy, unknown number of indirect jobs	No known impact on the tourism industry, may increase viewing potential for Achilles Tang		Collection of 1.5 million White List Species fish from the WHRFMA, collection of Achilles Tang reduced by >50%, Collection of between 160,305 fish from East Hawai'i	

5.5.1 Summary of Impacts on White List Species Populations

Table 5-14 below summarizes the population impacts (based on the percent of the population collected) of the five alternatives on each of the 40 White List Species. The No Action Alternative looks at the 15 White List Species with historic collection data from East Hawai'i; the Pre-Aquarium Collection Ban Alternative and the WHRFMA-only Programmatic Issuance of Permits Alternative are based on average and maximum collection for the entire island of Hawai'i (see Table 5-11); the Achilles Tang Conservation Alternative is also based on the average and maximum collection for the island of Hawai'i, but with a decreased Achilles Tang collection in the WHRFMA; and, the Limited Permit Issuance Alternative is based on the average and maximum collection of the 14 fishers in the WHRFMA, with a decrease in the Achilles Tang collection, added to the impacts from East Hawai'i under this alternative (based on the No Action).

Table 5-14. Summary of the annual impact (percent collected by commercial aquarium collectors) on populations of the White List Species based on CREP (2018) population estimates and the projected annual collection under each alternative (see Table 5-1 and 5-11 for additional details). NA indicates the species does not have a population estimate.

Species	No Action Alternative	Pre-Aquarium Collection Ban Alternative	WHRFMA-Only	Achilles Tang Conservation	Limited Permit Issuance
Achilles Tang	1.11%	2.72% to 3.15%		1.41% to 2.13%	1.60% to 2.42%
Bird Wrasse	n.d.	0.04% to 0.11%			0.02% to 0.03%

Species	No Action Alternative	Pre-Aquarium Collection Ban Alternative	WHRFMA-Only	Achilles Tang Conservation	Limited Permit Issuance
Black Durgon	n.d.	<0.01% to 0.02%			<0.01%-0.01%
Black Surgeonfish	0.03%	0.64% to 2.21%			0.45% to 0.91%
Blacklip Butterflyfish	n.d.	0.05% to 0.15%			0.03% to 0.07%
Blackside Hawkfish	n.d.	0.02% to 0.05%			0.01% to 0.03%
Bluestripe Snapper - Taape	n.d.	<0.01%			<0.01%
Brown Surgeonfish	n.d.	0.01% to 0.02%			<0.01%-0.01%
Eightline Wrasse	n.d.	0.02% to 0.07%			0.01% to 0.08%
Eyestripe Surgeonfish	n.d.	0.07% to 0.27%			<0.01%-0.01%
Fisher's Angelfish	n.d.	0.01% to 0.06%			0.01% to 0.04%
Forcepsfish	n.d.	0.43% to 1.14%			0.21% to 0.35%
Fourline Wrasse	n.d.	0.01% to 0.02%			<0.01% to 0.01%
Fourspot Butterflyfish	n.d.	0.12% to 0.32%			0.07% to 0.12%
Gilded Triggerfish	n.d.	0.03% to 0.16%			0.02% to 0.05%
Goldrim Tang	0.06%	0.59% to 1.93%			0.37% to 1.48%
Kole	<0.01%	0.27% to 0.63%			0.15% to 0.27%
Hawaiian Dascyllus	n.d.	0.06% to 0.16%			0.03% to 0.08%
Hawaiian Whitespotted Toby	n.d.	0.04% to 0.17%			0.02% to 0.08%
Lei Triggerfish	n.d.	0.01% to 0.04%			0.01% to 0.02%
Longfin Anthias	n.d.	NA			NA
Milletseed Butterflyfish	n.d.	0.09% to 0.43%			0.07% to 0.37%
Multiband Butterflyfish	n.d.	0.07% to 0.23%			0.03% to 0.05%
Orangeband Surgeonfish	n.d.	0.06% to 0.24%			0.04% to 0.13%
Orangespine Unicornfish	0.01%	0.65% to 1.63%			0.31% to 0.82%
Ornate Wrasse	n.d.	0.10% to 0.87%			0.03% to 0.08%
Peacock Grouper - Roi	n.d.	<0.01%			<0.01%
Pencil Wrasse	n.d.	0.10% to 0.35%			0.08% to 0.25%
Potter's Angelfish	n.d.	0.10% to 0.41%			0.08% to 0.28%
Psychedelic Wrasse	n.d.	0.75% to 2.37%			0.57% to 1.73%
Pyramid Butterflyfish	n.d.	0.57% to 3.65%			0.43% to 2.06%
Redbarred Hawkfish	n.d.	<0.01%			<0.01%-0.01%
Saddle Wrasse	n.d.	<0.01% to 0.02%			<0.01%-0.01%
Shortnose Wrasse	n.d.	0.08% to 0.26%			0.06% to 0.18%
Spotted Boxfish	n.d.	0.18% to 0.66%			0.15% to 0.35%
Thompson's Surgeonfish	n.d.	0.04% to 0.28%			0.03% to 0.23%
Tinker's Butterflyfish	0.94%	1.87% to 4.92%			2.12% to 3.36%
Flame Wrasse	n.d.	NA			NA

Species	No Action Alternative	Pre-Aquarium Collection Ban Alternative	WHRFMA-Only	Achilles Tang Conservation	Limited Permit Issuance
Yellow Tang	0.60%	3.43% to 8.09%			1.91% to 3.18%
Yellowtail Coris	n.d.	0.15% to 0.36%			0.09% to 0.16%

5.6 EVALUATION OF HEPA SIGNIFICANCE CRITERIA

Below is a summary of the evaluation of the significance criteria described in Title II, Chapter 200, Hawai'i Administrative Rules, with the five criteria where the DLNR requested further analysis shown in bold.

- **Significance Criteria #1:** The Preferred Alternative (i.e., Limited Permit Issuance Alternative) does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource.

  Fish Populations: Collection of the 40 White List Species represents less than 3% of each population when looking at average collection rates, and less than 4% when looking at maximum collection rates. Ochavillo and Hodgson (2006) suggest collection of between 5%-25% is sustainable for various reef species similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, triggerfish). Under the Limited Permit Issuance Alternative, only six species have a maximum collection rate above 1% of the estimated island of Hawai'i population estimates (Table 5-14). Collection of these species would need to increase by 1.6 to 2.9 times the maximum levels seen between 2000 and 2017 to reach 5% of the estimated populations, and two of these species (Yellow Tang and Achilles Tang) currently have bag limits, with a reduced bag limit for the Achilles Tang proposed under the Preferred Alternative. Based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas, as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection likely has minimal impacts on populations in general. The DAR (2019a) has noted that 24 of the 40 White List Species have remained stable or significantly increased between 1999 and 2017, when commercial aquarium collection was at a higher rate than what would occur under the Preferred Alternative, therefore, no impacts to these species are anticipated. For the 12 White List Species which had significant declines, as noted in Section 5.4.3, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019a). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. The pressures from commercial aquarium collection under the Preferred Alternative are anticipated to be lower than rates seen prior to the October 2017 ban on commercial aquarium collection; therefore, it is not anticipated that a significant impact on fish populations as a result of the Preferred Alternative would occur.

  Reef Habitat: Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. Additionally, the DAR (2019a) reported that herbivore biomass has not changed since 2003 in the open areas or FRAs and has increased by 30.8% in the MPAs. While there has been no significant change in Open Areas or FRAs, there has still been an increasing trend, with a 14.4% increase in herbivore biomass in FRAs and a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (DAR 2019a, Gove et al. 2019). This occurred even with the pressures from commercial aquarium collection, which was occurring during this time. The pressures from commercial aquarium collection under the Preferred Alternative are anticipated to be lower than rates seen prior to the October 2017 ban on commercial aquarium collection; therefore, it is not anticipated that a significant impact on reef habitat as a result of the Preferred Alternative would occur.

<u>Cultural Resources</u>: As concluded in the CIA, cultural impacts would occur if issuance of Aquarium Permits under an alternative would cause a significant decline in the population of a White List Species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. Table 4-3 lists the 40 White List Species, and Section 4.4 includes a brief summary of known cultural significance by species. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the 33 species on the White List identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted. As detailed in Section 5.4, populations of the White List Species are not anticipated to significantly decline under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on cultural resources would occur as a result of the Preferred Alternative.

<u>Other Resources</u>: Aside from reducing the number of Aquarium Permits issued and reducing the daily bag limit for Achilles Tang, the Preferred Alternative does not include any activities different from, or in addition to, those that have occurred in the past. There would be no construction of permanent or semi-permanent infrastructure, no discharges into coastal, surface or ground waters, and no dredging, and no significant use of hazardous materials that could be released into the environment. The Preferred Alternative would not result in significant beneficial or adverse impacts to water and air quality, geology and soil resources, aesthetics, noise, vegetation, terrestrial wildlife, and avian species, threatened and endangered species, land use, public health and safety, communications, transportation, utilities, or population and demographics from the current baseline condition.

- **<u>Significance Criteria #2</u>**: The Preferred Alternative does not curtail the range of beneficial uses of the environment. Act 306 has created a platform on which the public can learn about and participate in the management of the fishery. Since the Act's implementation, the DAR has created FRAs and conducts annual monitoring and research on the fish and coral, ensuring that the full range of beneficial uses of the environment remain now and into the future. The loss of the aquarium fishery may mean the loss of funds to support monitoring and research that benefits reef ecosystems.

Aquatic Invasive Algae Control: Tissot and Hallacher (2003) found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. Additionally, the DAR (2019a) reported that herbivore biomass has not changed since 2003 in the open areas or FRAs and has increased by 30.8% in the MPAs. While there has been no significant change in Open Areas or FRAs, there has still been an increasing trend, with a 14.4% increase in herbivore biomass in FRAs and a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (DAR 2019a, Gove et al. 2019). This occurred even with the pressures from commercial aquarium collection, which was occurring during this time. The pressures from commercial aquarium collection under the Preferred Alternative are anticipated to be lower than rates seen prior to the October 2017 ban on commercial aquarium collection; therefore, it is not anticipated that a significant impact on aquatic invasive algae control as a result of the Preferred Alternative would occur.

Tourism: Available data do not suggest that the commercial aquarium collection has impacted the tourism industry in Hawai'i. The Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. Total spending by visitors to the Hawaiian Islands increased 5.6% to a new high of $16.81 billion (HTA 2018). When adjusted for inflation, total visitor spending was up 3.5% from 2016. A total of 9,404,346 visitors came by air or by cruise ship to the state, up 5.3% from the previous record of 8,934,277 visitors in 2016. Total visitor days rose 4.8% compared to 2016. The average spending per day by these visitors ($198 per person) was also higher than 2016 ($197 per person; HTA 2018). Additionally, as described in Section 5.4, populations of the White List Species are not anticipated to significantly decline, therefore not significantly impacting viewing opportunities. Consequently, continued commercial aquarium collection under the Preferred Alternative, which would limit the number of Aquarium Permits and decrease collection, is not anticipated to significantly impact tourism.

Integrity of Diverse Aquatic Ecosystems: As described in Section 5.4, populations of the White List Species are not anticipated to significantly decline. Additionally, Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. Tissot and Hallacher (2003) further found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. Additionally, the DAR (2019a) reported that herbivore biomass has not changed since 2003 in the open areas or FRAs and has increased by 30.8% in the MPAs. While there has been no significant change in Open Areas or FRAs, there has still been an increasing trend, with a 14.4% increase in herbivore biomass in FRAs and a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (DAR 2019a, Gove et al. 2019). This occurred even with the pressures from commercial aquarium collection, which was occurring during this time. The pressures from commercial aquarium collection under the Preferred Alternative are anticipated to be lower than rates seen prior to the October 2017 ban on commercial aquarium collection; therefore, it is not anticipated that a significant impact on the integrity of diverse aquatic ecosystems as a result of the Preferred Alternative would occur.

- **<u>Significance Criteria #3</u>**: The Preferred Alternative does not conflict with the State's long-term environmental policies, goals, or guidelines as expressed in chapter 344 HRS. As described in Section 5.4, populations of the White List Species are not anticipated to significantly decline under the Preferred Alternative and impacts to coral reefs or herbivores are not anticipated, therefore the Preferred Alternative is not in conflict with the conservation of natural resources or the flora and fauna. There would be a minor, beneficial impact to the economy under the Preferred Alternative. There would be no impact on human population, threatened and endangered species, parks, recreation, and open spaces, transportation, energy use, community life and housing, or education and culture. As described in Section 1.2.3.1, multiple opportunities have been provided throughout the history of the commercial aquarium fishery for citizen participation, including public comment periods during the DEA and FEA (see Section 1.1.2), and as part of this DEIS.

- **<u>Significance Criteria #4:</u>** The Preferred Alternative does not substantially affect the economic welfare, social welfare, and cultural practices of the community or State, but plays an important role as a nearshore fishery in the State. According to DAR (2019a), the marine aquarium fishery is the most economically valuable commercial inshore fishery in the State of Hawai'i, with 68% of the value coming from the Island of Hawai'i, mainly West Hawai'i. Under the Preferred Alternative, it is anticipated that $4.4 to $6.5 million would be added to the state's economy over the 5-year analysis period (average of $883,081 to $1,294,497 per year), and a minimum of 14 jobs would be created. Loss of the fishery would result in the loss of income, tax revenue, and jobs.

    <u>Cultural Practices</u>: As concluded in the CIA, cultural impacts would occur if issuance of Aquarium Permits under an alternative would cause a significant decline in the population of a White List Species considered to be a cultural resource, either directly through the collection of fish or indirectly through habitat impacts. Table 4-3 lists the 40 White List Species, and Section 4.4 includes a brief summary of known cultural significance by species. While not all species have a known Hawaiian cultural significance, for this analysis, it was assumed that the 33 species on the White List identified as having a cultural use for food, medicinal, religious or ceremonial purposes could have a cultural impact if populations of those species were impacted. As detailed in Section 5.4, populations of the White List Species are not anticipated to significantly decline under the Preferred Alternative. Therefore, it is not anticipated that a significant impact on cultural practices would occur as a result of the Preferred Alternative.

- <u>Significance Criteria #5</u>: The Preferred Alternative would not affect public health.

- Significance Criteria #6: The Preferred Alternative does not involve substantial secondary impacts, such as population changes or effects on public facilities. There is no expectation that populations or the public would be negatively impacted by continuing the fishery.

- Significance Criteria #7: The Preferred Alternative does not involve a substantial degradation of environmental quality. Two studies have concluded that the fishery has no significant impact on coral or the reef ecosystem (Tissot and Hallacher 2003; DAR 2019a).

- **Significance Criteria #8:** The Preferred Alternative does not involve a commitment for larger actions. When the full range of impacts to White List Species are considered (e.g., recreational aquarium collection, non-aquarium commercial fishing, recreational fishing, tourism, climate change), there is a significant cumulative impact to some White List Species. However, the Preferred Alternative is not a significant contributor to the cumulative effect upon the environment. The DAR (2019a) has noted significantly declining populations in one or more of the management areas for 12 of the White List Species, and cumulatively, all of the factors discussed in Section 5.4.3 (including recreational aquarium fish collection, non-aquarium commercial and non-commercial fishing, tourism, and climate change) likely contribute to the declines. However, as noted in Section 5.4.3, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019a). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. In addition, for the 12 species that have shown a significant decline in population size in one or more management area since establishment of the WHRFMA in 1999, commercial aquarium collection under the Preferred Alternative would collect less than 1% of the island-wide population estimates for 10 of the species. For the remaining two species, Achilles Tang and the Pyramid Butterflyfish, commercial aquarium collection would collect less than 1.1% of the Achilles Tang population and less than 2.1% of the Pyramid Butterflyfish. Impacts to Kole, which are also commonly collected for consumption, would be less than 0.3% of the island-wide population. Additionally, this species has shown significant increases in population since establishment of the WHRFMA (DAR 2019a), despite cumulative pressures from both commercial aquarium collection and other fisheries. Based on this, while commercial aquarium collection does contribute to the cumulative impact, it is a less than significant factor in the observed declines. Minor cumulative impacts to the remaining 28 White List Species are anticipated, given that populations have remained stable or increased for 24 of those species, and population trend data is not available for the other four species[14].

[14] Species not adequately surveyed by WHAP include Tinker's Butterflyfish, Longfin Anthias, Flame Wrasse, and Eyestripe Surgeonfish. Tinker's Butterflyfish have a CREP (2018) population estimate of 18,475, and collection under any of the alternatives would be less than 5% of the island-wide population (though it should be noted that the vast majority of the population occurs well below the 98-foot depth surveyed by the CREP and thus the population estimate is likely low). Eyestripe Surgeonfish has a CREP (2018) population estimate of 578,835, and collection under any of the alternatives would be less than 0.3% of the island-wide population. Flame Wrasse do not have a CREP population estimate, but collection has been less than 175 individuals per year for the island of Hawai'i between 2000 and 2017. Longfin Anthias also do not have a CREP population estimate, but collection has been less than 150 individuals per year for the island of Hawai'i.

- Significance Criteria #9: The Preferred Alternative does not affect threatened or endangered species or their habitats nor does it have a significant impact on rare species.
- Significance Criteria #10: The Preferred Alternative does not detrimentally affect air or water quality or ambient noise levels. At most, 14 boats would be involved in the island of Hawai'i aquarium fishery under the Preferred Alternative as compared to the thousands of other boats on the waters of Hawai'i.
- Significance Criteria #11: The Preferred Alternative would not significantly affect or suffer damage by being located in environmentally sensitive areas, geologically hazardous land, estuaries, freshwater, or coastal water. As noted earlier, the fishery has been active since the late 1940s. Regulations have been implemented restricting the fishery from sensitive areas.
- Significance Criteria #12: The Preferred Alternative does not substantially affect scenic vistas and view planes identified in county or state plans or studies.
- Significance Criteria #13: The Preferred Alternative does not require substantial energy consumption.

No significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of Aquarium Permits that would be issued, limiting collection using fine mesh nets to the WHRFMA, and reducing the bag limit for the Achilles Tang, all of which would minimize impacts to biological resources.

Under HRS 188-31, the DLNR may issue a commercial Aquarium Permit to a qualified party for a period of one year in duration, subject to renewal. Therefore, this DEIS analyzes the direct, indirect, and cumulative impacts of issuance of 14 Aquarium Permits on affected resources for a period of five years. Less than significant or slightly beneficial impacts are expected under the Preferred Alternative.

6.0 AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

See the FEA[15] for a list of agencies, organizations, and individuals consulted during development of the FEA, which was used as the basis for development of this DEIS.

6.1 CONSULTED PARTIES

The following individuals requested to be a Consulted Party during development of the DEIS:

- Keith Dane, Hawai'i Policy Advisor, The Humane Society of the United States

[15] http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf

- Rene Umberger, Executive Director, For the Fishes
- Laura Friend, Litigation Fellow, The Humane Society of the United States
- Miyoko Sakashita, Oceans Director, Center for Biological Diversity
- Mike Nakachi, President, Moana Ohana
- Teresa E. Kaneakua, ʻAho Hui Kiaʻi Kānāwai Lead Compliance Specialist, Office of Hawaiian Affairs
- Inga Gibson, Policy Director, Pono Advocacy, LLC
- Kealoha Pisciotta, Mauna Kea Anaina Hou and Kai Palaoa

Each of these individuals was contacted on August 2, 2019 via email and/or mail, seeking advice and input for DEIS development. The Applicant requested any information or advice concerning the fishery and other potentially impacted environmental, cultural, or other resources. Consulted Parties were asked to respond within 30 days. Comments received and responses to those comments are provided in Appendix B. The consultation process for cultural resources is described in depth in Section 4 of Appendix A.

6.2 FEDERAL AGENCIES

The following federal agencies were consulted during the development of this DEIS:

- National Marine Fisheries Service
- Coral Reef Ecosystem Program

6.3 STATE AGENCIES

The following state agencies were consulted during the development of this DEIS

- Hawai'i Department of Land and Natural Resources, Division of Aquatic Resources
- Hawai'i State Department of Health, Office of Environmental Quality Control

7.0 DISTRIBUTION OF THE DEIS

The distribution list for the DEIS is included in Appendix C.

8.0 LIST OF PREPARERS

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9.0 LITERATURE CITED

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APPENDIX A—CULTURAL IMPACT ASSESSMENT

A Cultural Impact Assessment for the Proposed Issuance of Fourteen Commercial Aquarium Permits within the West Hawai‘i Regional Fishery Management Area

Including the Near Shore Waters from ‘Upolu Point to Ka Lae,
Kohala, Kona, and Ka‘ū Districts, Island of Hawai‘i
(except those areas already designated for no collection)

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A Cultural Impact Assessment for the Proposed Issuance of Fourteen Commercial Aquarium Permits within the West Hawai‘i Regional Fishery Management Area

‘Upolu Point to Ka Lae,
Kohala, Kona, and Ka‘ū Districts,
Island of Hawai‘i

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1. INTRODUCTION

At the request of the Pet Industry Joint Advisory Council (PIJAC), ASM Affiliates (ASM) has prepared a Cultural Impact Assessment (CIA) for the proposed issuance of fourteen commercial aquarium permits within the West Hawai‘i Regional Fishery Management Area (WHRFMA). The WHRFMA(the study area), established in 1998 by ACT 306 of the State Legislature of Hawai‘i, includes the nearshore waters of the Kohala, Kona, and Ka‘ū Districts on the west side of Hawai‘i Island, extending from ‘Upolu Point to Ka Lae, and from the upper reaches of the wash of the waves onshore, seaward to the limit of the State’s police power and management authority (Figure 1). This CIA is intended to inform an HRS Chapter 343 Environmental Impact Statement (EIS) being prepared on behalf of PIJAC (the applicant) that will allow for the issuance of fourteen annual commercial aquarium permits for the collection of forty fish species (referred to as ‘white list’ species) from within the WHRFMA, excluding those areas already designated for no collection. The no collection areas include all previously established Marine Life Conservation Districts (MLCDs), Fish Replenishment Areas (FRAs), Netting Restricted Areas (NRAs), and Fisheries Management Areas (FMAs) located within the WHRFMA (see Figure 1). Per the draft EIS for this project, the proposed action is as follows:

> Under the Limited Permit Issuance Alternative, the DLNR would begin issuing new Aquarium Permits to 14 aquarium fishers in the WHRFMA, thereby allowing these 14 individuals to resume commercial aquarium fish collection in the WHRFMA. No additional permits would be issued. Permittees would abide by all rules and regulations set forth in HRS 189-2,3 (Commercial Marine Permit), HRS-188-31 (Section 1.2.1), governing Commercial Aquarium Permit use, and would obtain a West Hawai′i Aquarium Permit as required under HAR 13-60.4 (Section 1.2.3.2). These rules and regulations include restrictions on equipment, restrictions on access to various areas, bag limits on various collected fish species, collection in the WHRFMA restricted to 40 White List species only, and reporting requirements. In addition, daily bag limit for commercial aquarium collection of Achilles Tang within the WHRFMA would be reduced from 10 per day to 5 per day.

The following report, which has been prepared in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impacts*, adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997 (Office of Environmental Quality Control (OEQC) 1997), assesses the potential cultural impacts of aquarium collection by the proposed fourteen permit holders.

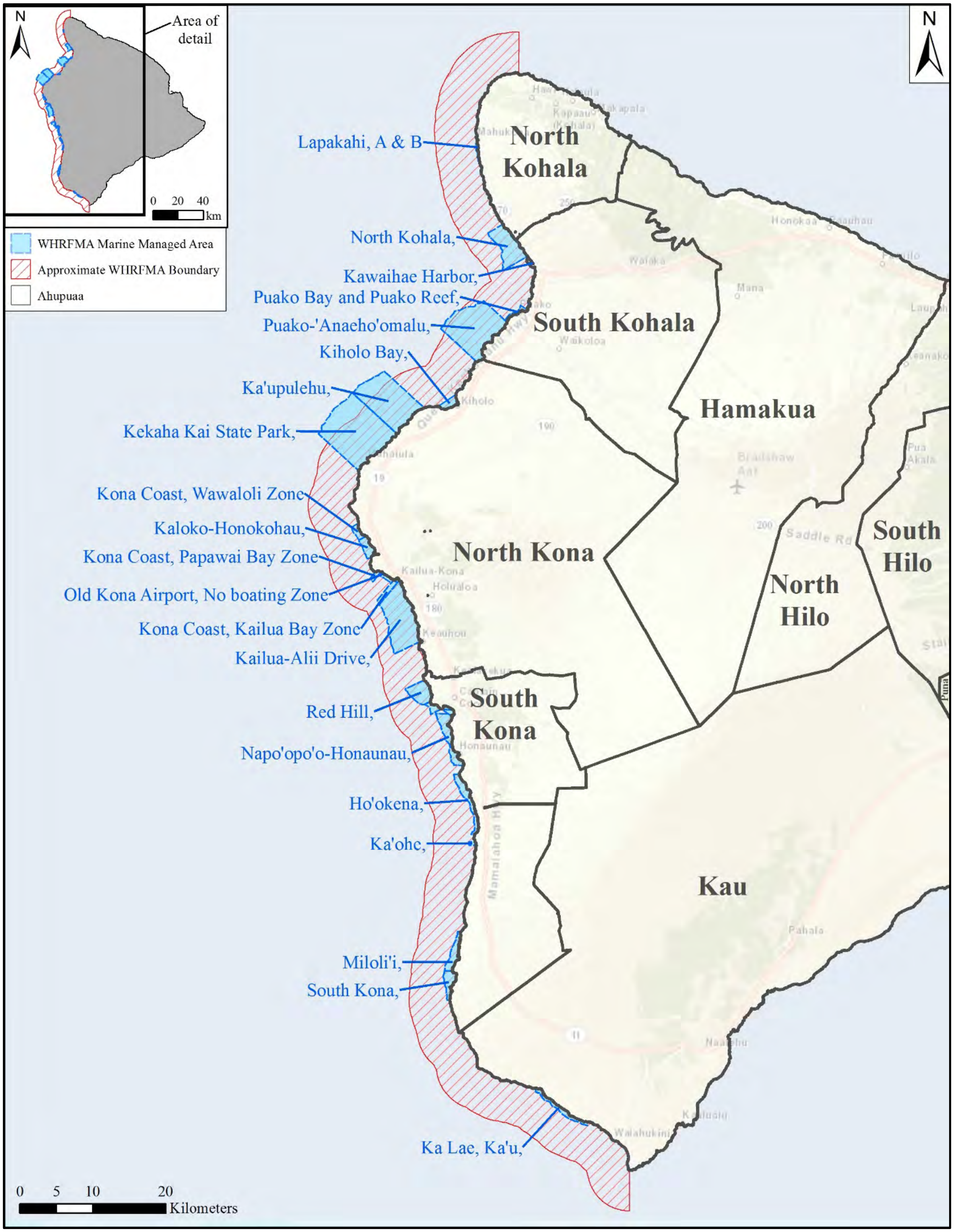

Figure 1. Map showing the extent of the West Hawaiʻi Regional Fishery Management Area, extending from the Kohala to the Kaʻū Districts of Hawaiʻi Island, with the no collection areas indicated.

REGULATORY BACKGROUND OF THE PROPOSED ACTION

The objective of the action proposed in the EIS is to create a program under the Department of Land and Natural Resources (DLNR) (the approving agency) that will help to facilitate a permitting process for the issuance of commercial aquarium permits within the WHRFMA (pursuant to Aquarium Fishing Permits issued under Hawai'i Revised Statute §188-31) so that fourteen commercial aquarium fishers' on the Island of Hawaiʻi can continue to operate their businesses in compliance with all applicable State of Hawaiʻi laws, rules, and regulations pertaining to the industry. Hawai'i Revised Statute (HRS) §188-31 (2013; Title 12 – Conservation and Resources; 188 – Fishing Rights and Regulations; 188-31 – Permits to take aquatic life for aquarium purposes) states that:

1. Except as prohibited by law, the department, upon receipt of a written application, may issue an aquarium fish permit, not longer than one year in duration, to use fine meshed traps, or fine meshed nets other than throw nets, for the taking of marine or freshwater nongame fish and other aquatic life for aquarium purposes.
2. Except as prohibited by law, the permits shall be issued only to persons who can satisfy the department that they possess facilities to and can maintain fish and other aquatic life alive and in reasonable health.
3. It shall be illegal to sell or offer for sale any fish and other aquatic life taken under an aquarium fish permit unless those fish and other aquatic life are sold alive for aquarium purposes. The department may adopt rules pursuant to HRS chapter 91 for the purpose of this section.

Additionally, aquarium permits issued for commercial aquarium collection within the WHRFMA are subject to the terms and conditions set forth in Hawaiʻi Administrative Rule (HAR) 13-60.4, which includes provisions for restrictions on equipment and access to various areas within the fishery, collection restrictions (40 White List species only), bag limits on certain fish species, and catch reporting requirements.

From 2000 to 2017, the DLNR issued between 24 and 60 commercial aquarium permits annually within the WHRFMA (Pet Industry Joint Advisory Council 2018). However, no commercial aquarium fishing permits have been issued or renewed by the DLNR under HRS §188-31—and no aquarium collection has occurred within the WHRFMA—since September of 2017, when the Supreme Court of Hawaiʻi ruled that the issuance of such permits (for aquarium collection using fine meshed traps or nets) constitutes a discretionary State action and is thus subject to the Hawaiʻi Environmental Policy Act (HEPA). HEPA requires that State agencies consider the impact of governmental actions on the environment by preparing an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) to document the potential impacts of the State action.

Accordingly, a Final Environmental Assessment (FEA) for the issuance of commercial aquarium permits for the entire Island of Hawaiʻi (Pet Industry Joint Advisory Council 2018) was prepared (by the current applicant) and submitted to the DLNR for review on June 7, 2018. The FEA, proposed a "finding of no significant impacts" (FONSI) for the action, but the DLNR disagreed with that finding and determined, based on the significance criteria outlined in Title 11, Chapter 200, Hawaiʻi Administrative Rules, that the project could have a significant impact on the environment, and therefore required the preparation of an Environmental Impact Statement (EIS).

As stated in Act 50, proposed and passed as Hawaiʻi State House of Representatives Bill No. 2895, and signed into law by the Governor on April 26, 2000, "environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights," as:

> . . . native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the "aloha spirit" in Hawaiʻi. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.
>
> Moreover, the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture.

It is the need to identify and address the effects of the proposed action (issuing fourteen commercial aquarium fishing permits within the WHRMA) on Hawaii's culture, and traditional and customary rights, that has necessitated the preparation of this CIA.

ASSESSING THE POTENTIAL CULTURAL IMPACTS OF THE PROPOSED ACTION

In a letter reviewing the FEA for the issuance of commercial aquarium permits for the Island of Hawaiʻi (dated July 26, 2018), Suzanne Case, Chair of the DLNR, specifically requested that further analysis occur in the EIS on several significance criteria under HAR § 11-200-12, including the take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources, and the impact of the take of aquarium fish on cultural practices in the state. More specifically, with regards to assessing the cultural impacts, Case writes that:

> Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modern technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.

While the action proposed in the current EIS differs somewhat from the action previously proposed in the FEA—limiting the geographic extent for the issuance of permits to the WHRFMA (rather than the entire Island of Hawaiʻi) and capping the total number of annual commercial aquarium permits issued at 14—the additional analysis requested above by the DLNR has been used to guide the scope of work presented in this CIA, which was prepared following the OEQC *Guidelines for Assessing Cultural Impacts* (adopted by the Environmental Council, State of Hawaiʻi, November 19, 1997). According to those guidelines:

> In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. (State of Hawai'i, Office of Environmental Quality Control 2012:11)

For this reason, for assessing the potential cultural impacts of the issuance of fourteen commercial aquarium permits within the WHRFMA, the entire fishery management area along the western coast of Hawaiʻi Island is considered, not just those areas within which commercial aquarium fishing will be permitted. To Hawaiʻi's host culture, the ocean is viewed as an integrated whole, flowing unrestrained by politically imposed boundaries. While the proposed collection of fish to supply the aquarium industry will not be conducted in all existing marine managed areas, this study, in alignment with the OEQC guidelines seeks to understand the cultural beliefs, practices, and resources, even within those communities situated in or adjacent to previously established marine managed areas. This study therefore, utilizes a *moku* (district) level analysis and at times draws upon cultural-historical background for specific *ahupuaʻa*.

The following CIA report is divided into five main sections, which includes: 1) and introduction of the proposed action; 2) a description of the general geographic context of the study area, which includes a discussion on the formalization of the WHRFMA and the establishment of the marine managed areas; 3) a culture-historical background for the nearshore waters of West Hawaiʻi Island that includes a discussion of the traditional Hawaiian cultural significance of each type of aquarium fish taken; 4) a summary of the methods and results of consultation with traditional cultural practitioners and other knowledgeable informants regarding cultural resources and cultural practices of the study area, and the proposed action's potential impacts; and 5) an analysis of potential cultural impacts that may result from the proposed action. At the conclusion of the CIA recommendations are offered regarding appropriate mitigation strategies that may be employed by the applicant and DLNR to help minimize the potential for cultural impacts that could result from the issuance of fourteen commercial aquarium permits within the WHRFMA.

2. STUDY AREA DESCRIPTION

The study area for the CIA consists of the entire West Hawaiʻi Regional Fishery Management Area (WHRFMA), which extends for 147 miles along the west coast of Hawaiʻi Island from its northernmost extent at ʻUpolu Point in the Kohala District to its southern most extent at Ka Lae in the Kaʻū District (see Figure 1). The DLNR describes the geographical jurisdiction of the WHRFMA as extending from "the upper reaches of the wash of the waves on shore, seaward to the limit of the State's police power and management authority" (DLNR 1999:3). The specific boundaries of the WHRFMA are described as follows in Hawaiʻi Administrative Rules §13-60.4-2:

> …The four points shall be identified as the landward northern point, the landward southern point, the seaward northern point, and the seaward southern point. The landward boundary for each of these areas shall be an imaginary line drawn along the highest wash of the waves between the landward northern point and the landward southern point. Should there be a stream or river flowing into the ocean, the landward boundary shall be an imaginary straight line drawn between the shoreline on either side of the stream or river, as if the stream or river was not there. Imaginary straight lines drawn through the landward and seaward northern points, and through the landward and seaward southern points, shall constitute the northern and southern boundary lines of each area. The seaward boundary of each area shall be determined by an imaginary line drawn along the one hundred fathom (six hundred feet) depth contour, between the intersection of the one hundred fathom depth contour and the northern and southern boundary lines. Seaward GPS reference points are for guidelines and the one hundred fathom depth contour otherwise controls the seaward boundary. Any area designated in this chapter shall include the submerged lands and overlying waters within these four boundaries. (DLNR 1999:5)

The WHRFMA spans the coastline of three traditional *moku* (districts) on the west side of Hawai‘i Island—Kohala (North and South), Kona (North and South), and Ka‘ū—and includes more than 170 distinct *ahupua‘a* (Soehren 2004, 2005a, 2005b), whose boundaries encompass the shoreline resources and, in many cases, extend out into the nearshore waters of the fishery. Geologically, the jagged coastline is formed by four of the island's five volcanoes (Kohala, Mauna Kea, Hualālai, and Mauna Loa; Figure 2), and the underwater terrain typically follows the sloping profile of those volcanoes to the bottom of the Pacific Ocean (Sherrod et al. 2007). West Hawai‘i Island also has the longest continuous coral reef in the main Hawaiian Islands, and is home to a highly productive and diverse marine ecosystem that supports an abundance of tropical corals, reef fishes, sea turtles, cetaceans, and manta rays. Boating access to the WHRFMA is limited to four small boat harbors (SBH) located at Kawaihae, Honokōhau, Kailua-Kona, and Keauhou, an anchorage at Mahukona, and launch ramps at Puakō, Honaunau, Kauhako (the beach at Ho‘okena), Miloli‘i, and Kaulana that are operated by the DLNR, Division of Boating and Ocean Recreation (DOBOR) and the County of Hawai‘i (Figure 3).

The Kohala District (North and South) encompasses the northernmost region of the study area (Figure 4). Beginning at the northern tip of the Island at ‘Upolu Point in the *ahupua‘a* of Kahei, this district extends south to the *ahupua‘a* of Waikoloa and the *‘ili kūpono* of ‘Anaeho‘omalu—traditionally a politically independent land division within the Waikoloa Ahupua‘a. Within the Kohala District are seven marine managed areas: Lapakahi MLCD-Subzones A and B; North Kohala FRA; Kawaihae Harbor FMA; Wailea Bay MLCD; Puakō Bay and Puakō Reef FMA; and the Puakō-‘Anaeho‘omalu FRA and NRA (see Figure 4 and Figure 5). The Kohala portion of the study area (Figure 6) is comprised of short expanses of reefs, sheltered bays, rocky shoreline that are interspersed with low lying cliffs, with a few white sand beaches near the Kawaihae area. Most of the North Kohala shoreline (from Kāhei-Hualua Ahupua‘a at the north to Waikā Ahupua‘a at the south) has remained undeveloped with the exception of a few homes situated *makai* (seaward) of the ‘Akoni Pule Highway and the Kawaihae-Mahukona Road. This modern settlement pattern stands in contrast to the South Kohala shoreline (from Kawaihae 1 Ahupua‘a at the north to Waikoloa Ahupua‘a and ‘Anaeho‘omalu at the south) portion of the study area, which contains several large resort developments along the coast. Geologically speaking, this northernmost section of the study area is situated along the coast of Kohala Volcano, and contains the oldest lava substrates (see Figure 2).

Similar to North Kohala, the South Kohala coast (Figure 7) is comprised of low rocky shorelines interspersed with both large and small stretches of fine white sand beaches. The reef system in this portion of the study area is far more developed and in some places extends for some distance into the sea. It is at these white sand beaches fronting the well-developed reef areas that residential and large scale commercial developments specifically resorts and condominiums) are concentrated. A distinguishing characteristic of this region are the many shallow bays, some of which were traditionally walled (both natural and artificial) and converted into *loko i‘a* (fishponds), and the many naturally occurring *loko wai* (freshwater ponds). Both of these features were traditionally utilized for aquaculture and were strictly managed. Currently, within South Kohala, DOBOR maintains the Kawaihae small boat harbor and the Puakō launch ramp (see Figure 3). This section of the study area includes the coastal portions of three of the island's volcanoes, Kohala, Mauna Kea, Mauna Loa (see Figure 2).

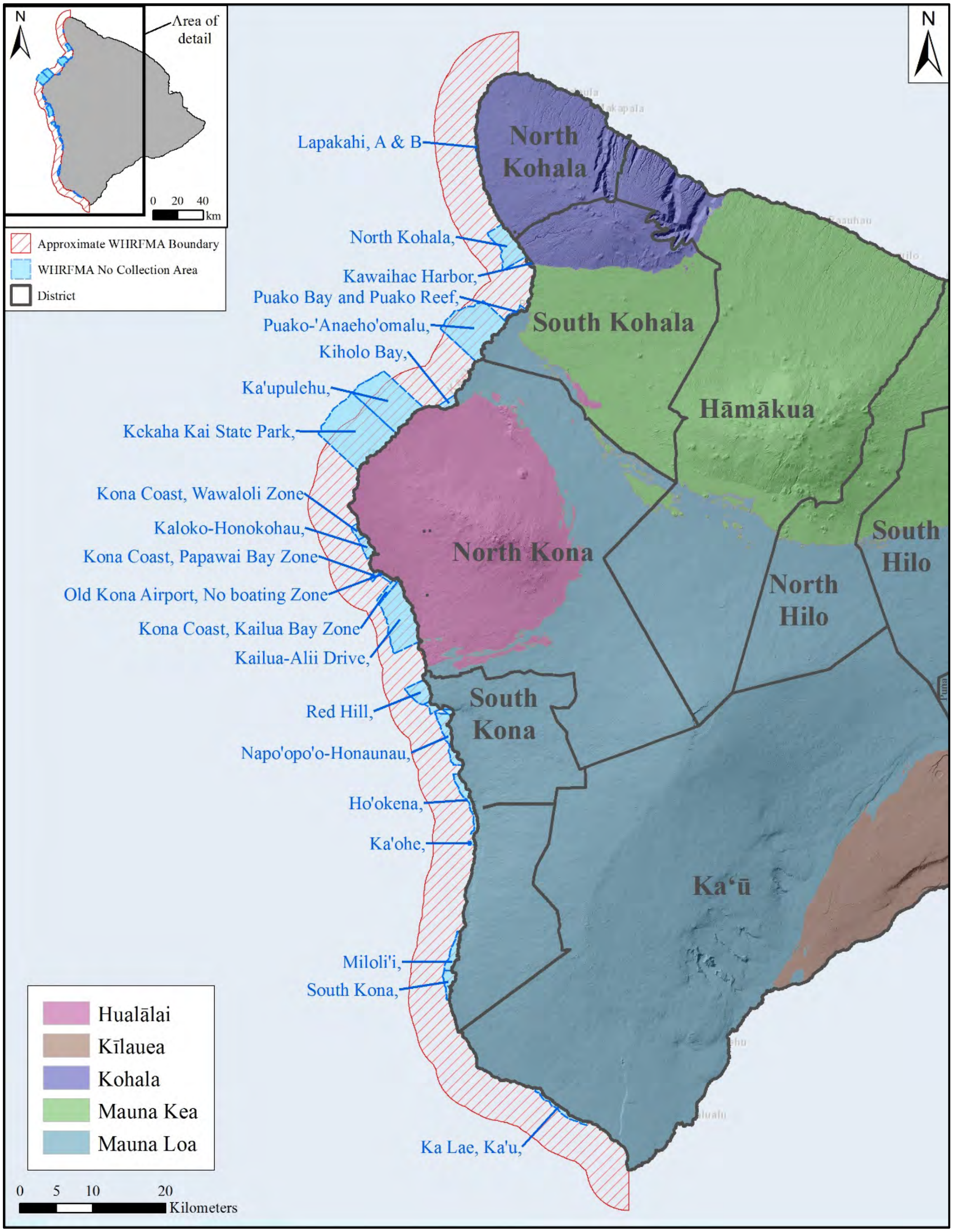

Figure 2. Geological map of the West Hawai‘i Regional Fishery Management Area.

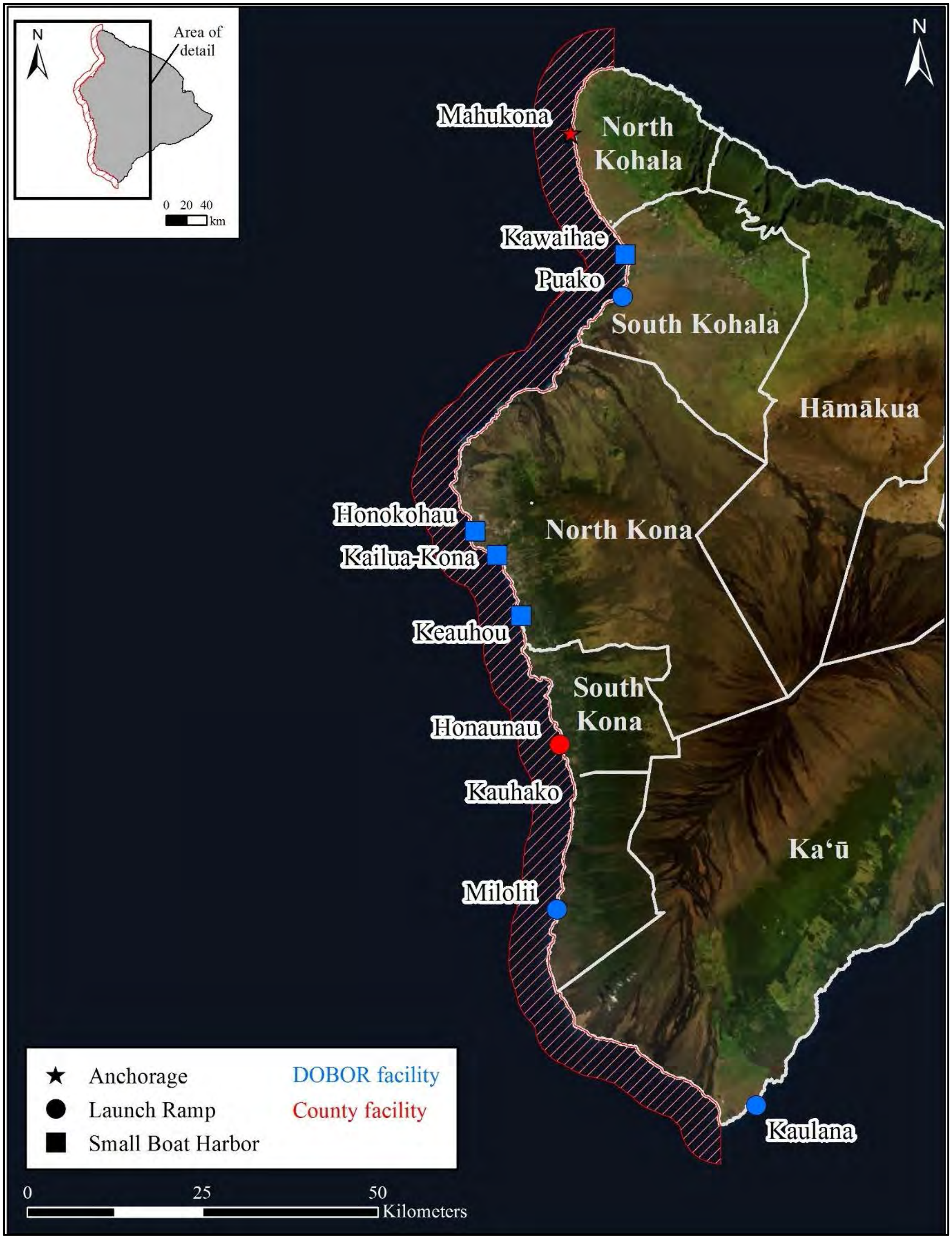

Figure 3. Map showing the location of harbors and launch ramps within (and nearby) the WHRFMA.

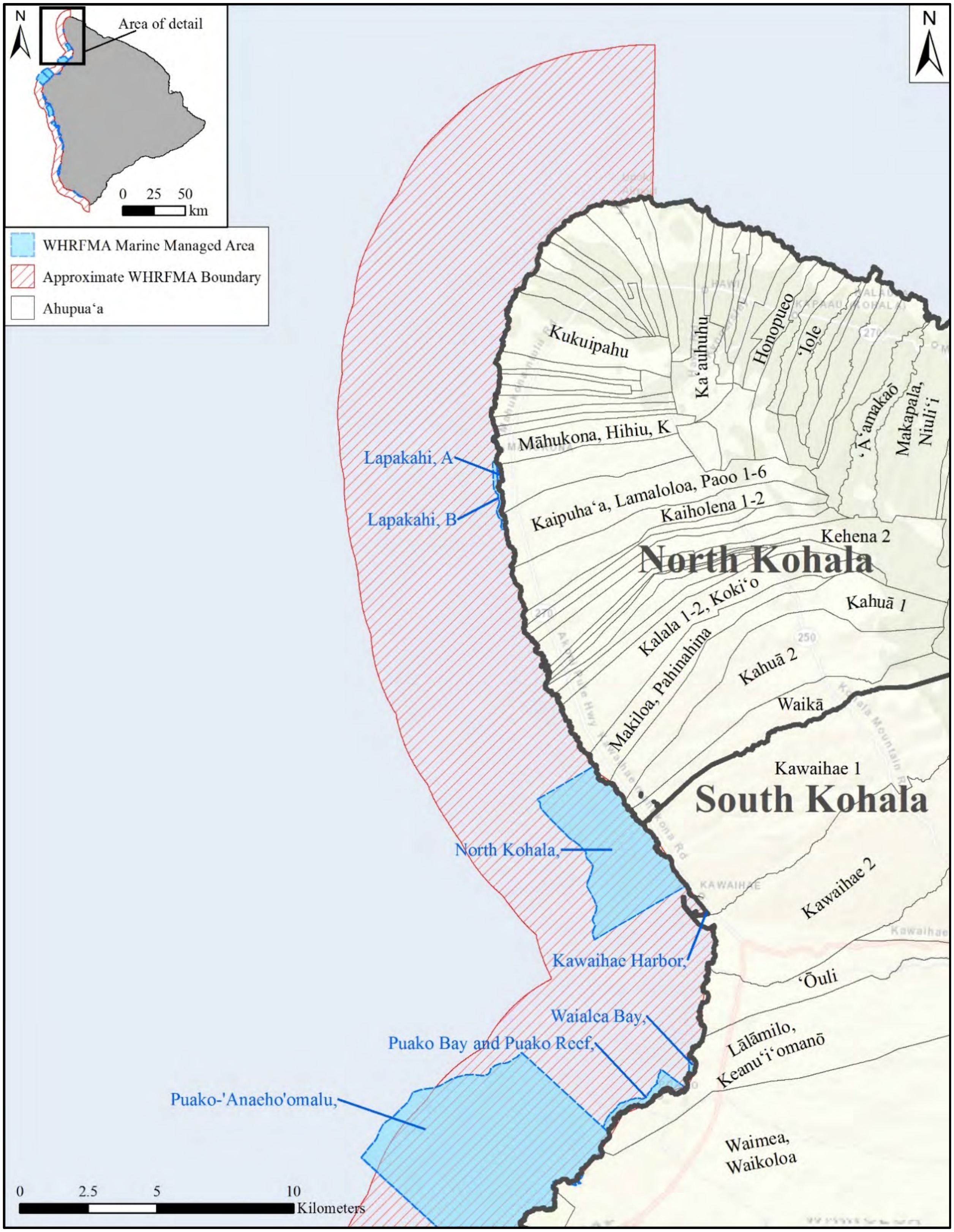

Figure 4. Detail of the North and South Kohala portion of the West Hawaiʻi Regional Fishery Management Area.

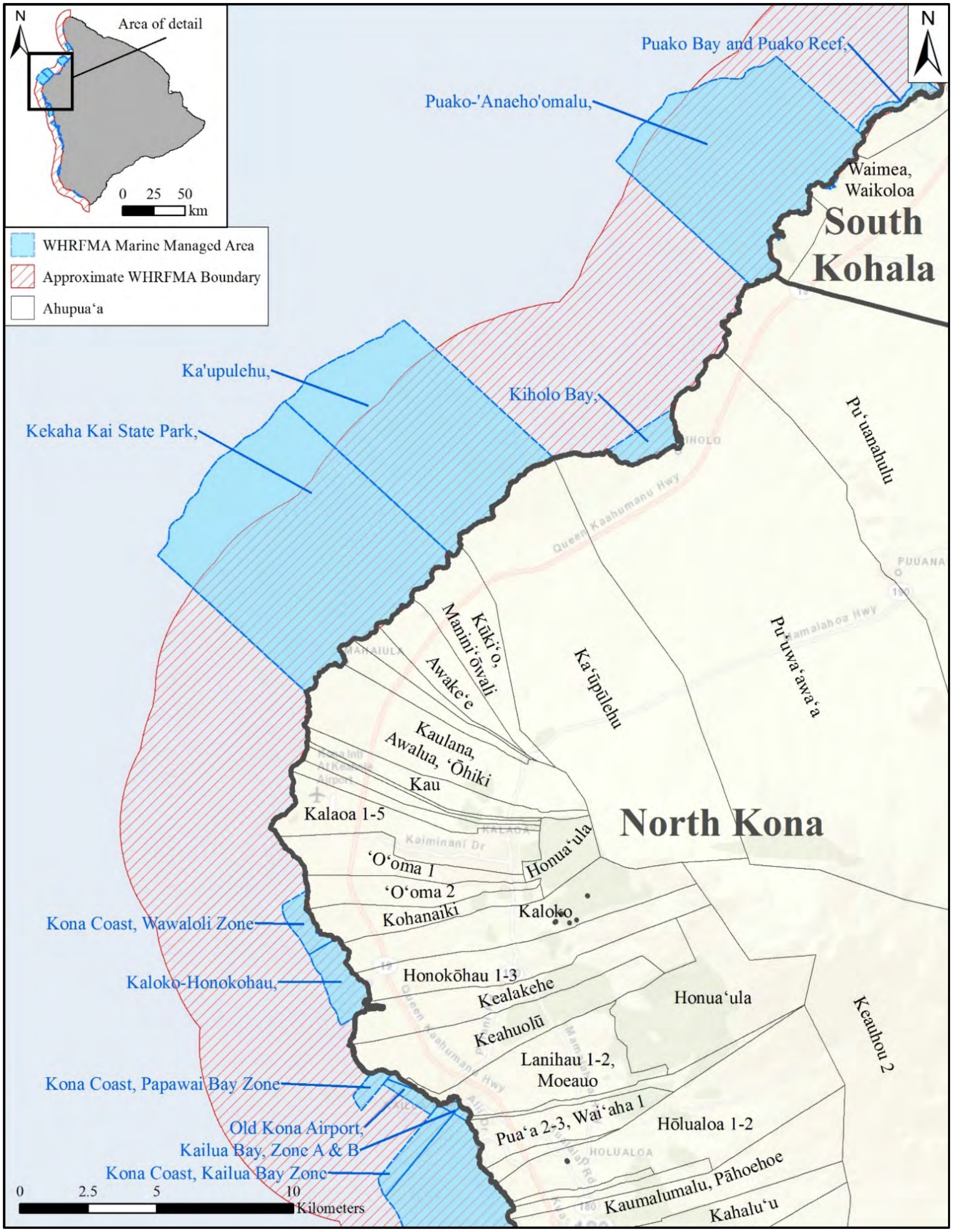

Figure 5. Detail of the North Kona portion of the West Hawai‘i Regional Fishery Management Area.

Figure 6. North Kohala coastline fronting Kaiholena Ahupua‘a, view to the south.

Figure 7. South Kohala coastline fronting Puakō in Lālāmilo Ahupua‘a, view to the north with Kohala Volcano visible in the background.

The Kona District, which makes up the greatest portion of the WHRFMA (see Figure 5 and Figure 8), commences at its northernmost *ahupua‘a* of Pu‘u Anahulu at the boundary of the South Kohala District, and extends south to Kaulanamauna Ahupua‘a at the boundary of the Ka‘ū District. The Kona portion of the WHRFMA includes at least ninety-eight *ahupua‘a* (Soehren 2004). Within the North Kona District (from Pu‘uanahulu Ahupua‘a at the north to Honalo-Mā‘ihi 1 & 2 Ahupua‘a at the south) are eleven marine managed areas: Kīholo Bay FMA; Ka‘ūpūlehu Marine Reserve; Kikaua Point-Mākole‘ā NRA (labeled in Figure 5 as the "Kekaha Kai State Park"); the Kona Coast FMAs, which includes the Wāwāloli, Papawai Bay, and Kailua Bay; Kaloko-Honokōhau FRA; Old Kona Airport MLCD and no boating zone; Kailua Bay Zones A & B FMA, Kailua-Keauhou Bay FRA (labeled in Figure 8 as the "Kailua-Alii Drive" and "Keauhou Bay").

The coastline of the North Kona region is characterized by its rocky shoreline, low lying cliffs, many sheltered bays, speckled with both white and black sand beaches, as well as pebbled beaches (Figures 9 and 10). The latter two beach types were created as a result of more recent volcanic activity originating from the slopes of Hualālai Volcano, upon which most of this district is situated, although the northernmost section of this district includes coastal Mauna Loa flows as well (see Figure 2). The reefs in this area are well developed, and in some areas extend upwards of 0.5 miles into the ocean. Also, present within this region are *loko wai* and *loko i‘a*. Similar to South Kohala, modern settlement in North Kona (inclusive of residential and large scale commercial development) is centered primarily around the sandy beaches and *loko wai*, although it does extend into the more desolate lava fields adjacent to those areas as well. Population density along the Kona coast increases significantly in the region extending south from the Kona Airport at Keāhole Point (the western tip of Hawai‘i Island) to Keauhou Bay, within the town of Kailua-Kona. The area *makai* Ali‘i Drive along the coast within Kailua-Kona is extensively developed and heavily populated. Within North Kona, DOBOR maintains the Honokōhau, Kailua-Kona, and Keauhou small boat harbors (see Figure 3).

The South Kona District (from Ke‘eke‘e-Kanakau Ahupua‘a at its northern extent to Kaulanamauna Ahupua‘a at its southern extent) includes eight marine managed areas (see Figure 8 and Figure 11): Red Hill FMA; Kealakekua Bay MLCD Zones A & B; Nāpo‘opo‘o-Hōnaunau FRA; Ho‘okena FRA; Ka‘ohe FRA; Miloli‘i FRA, and the Hanamalo Point-Kanewa‘a Point NRA (labeled as South Kona in Figure 11). The coastline in this area is predominately rocky, comprised of both high and low-lying cliffs interspersed with an occasional black sand beach. Many sheltered bays are also present along the South Kona coast. The reefs in this area are well developed, especially in the larger sheltered bays. Modern coastal development, now comprised of residential lots has, for the most part, followed traditional coastal settlement patterns which are concentrated in the vicinity of Kealakekua Bay, Kahauloa, Ke‘ei, Hōnaunau, Keālia, Kauhakō, Ho‘okena, Ka‘ohe, Pāpā, and Miloli‘i (Figure 12). DOBOR currently maintains the Miloli‘i launch ramp, while the County of Hawai‘i maintains the Hōnaunau launch ramp (see Figure 3). Although no longer considered an active boat ramp, historically, Ho‘okena beach (Kauhakō) also served as a major landing point. Geologically this section of the study area is situated entirely along the coast of Mauna Loa, as is the adjacent section of the study area within the Ka‘ū District (see Figure 2).

The southernmost portion of the WHRFMA, within the Ka‘ū District, extends from Manukā Ahupua‘a at its northern end to Ka Lae (the southernmost point of Hawai‘i Island) and the *ahupua‘a* of Pu‘u‘eo, at its southern end (see Figure 11). The only marine managed area in this portion of the WHRFMA is the Kanonohe-Kalipoa netting restricted area, which is labeled "Ka Lae, Ka‘u" in Figure 11. This portion of Ka‘ū is characterized by its rocky coastline with both high and low-lying cliffs and the occasional white or black sand beach occurring within some of the many sheltered bays (Figure 13). The reefs in this area are mostly short, but highly developed. DOBOR currently maintains one (Kaulana launch ramp) of the two launch ramps in the Ka‘ū District. The Kaulana launch ramp is, however, located to the east beyond the WHRFMA boundaries (see Figure 3).

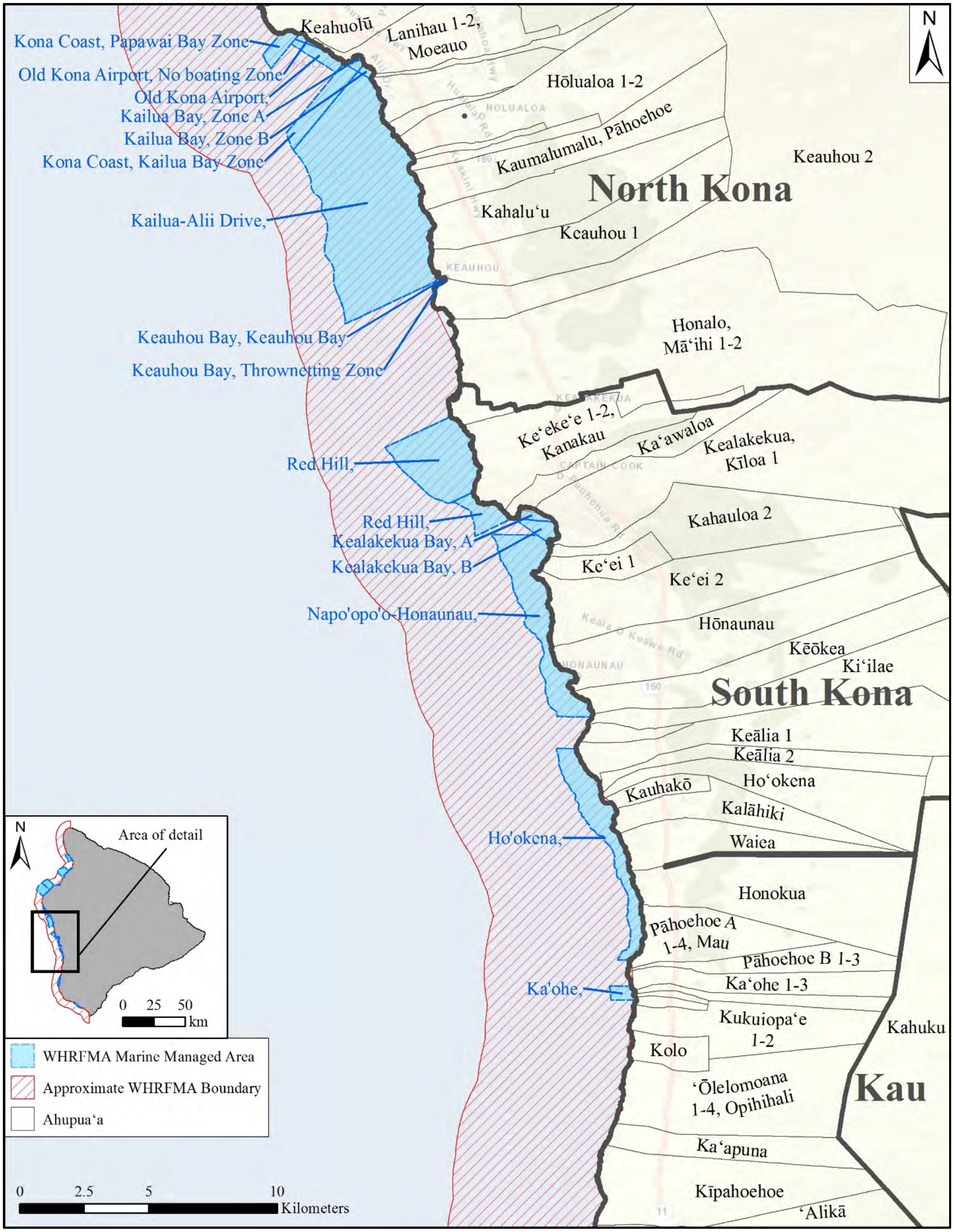

Figure 8. Detail of the South Kona portion of the West Hawai'i Regional Fishery Management Area.

Figure 9. Low, rocky coastline of North Kona fronting Keahuolū Ahupuaʻa, view to the north.

Figure 10. Laʻaloa Beach Park along the North Kona coastline, view to the north.

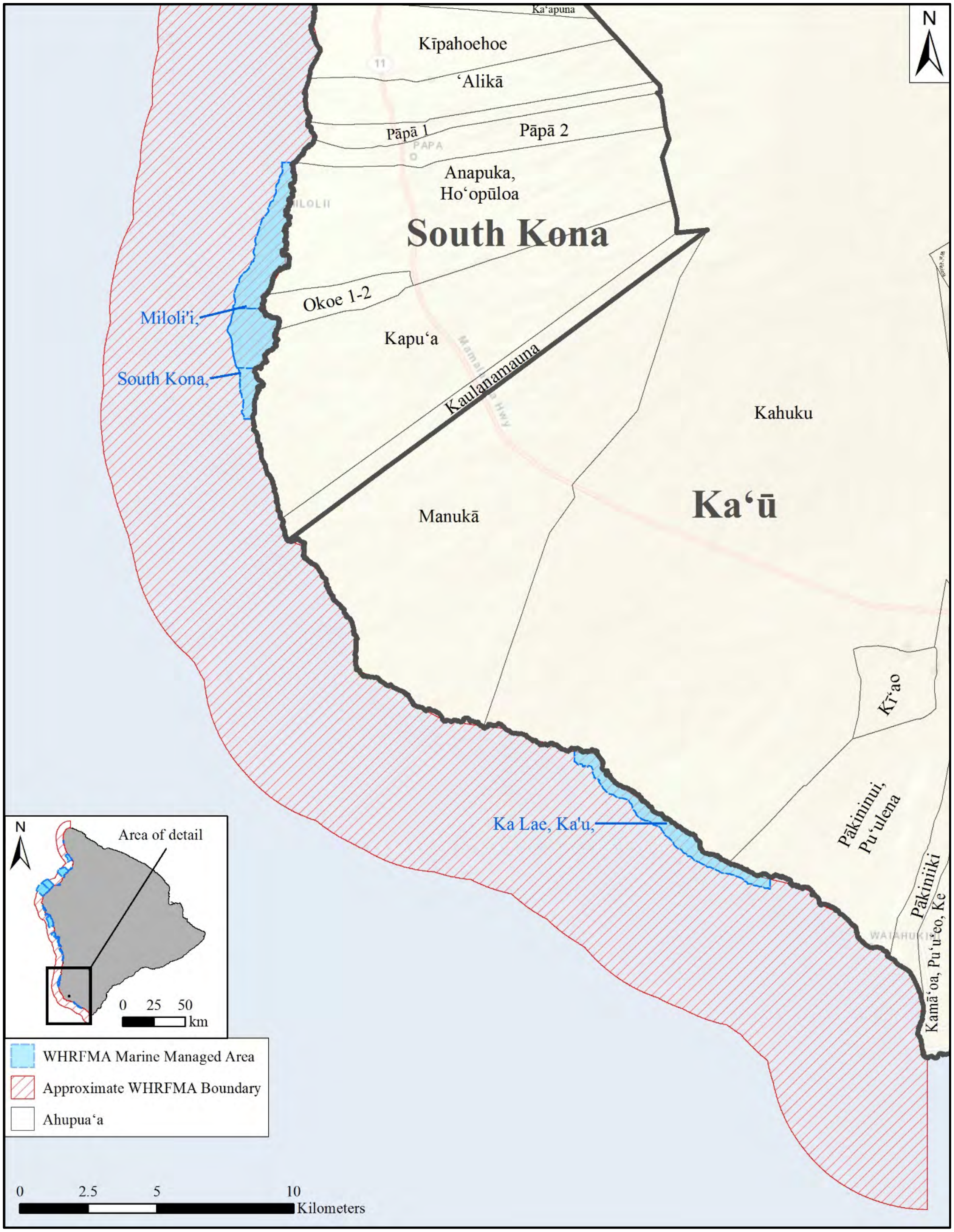

Figure 11. Detail of the Ka'ū portion of the West Hawai'i Regional Fishery Management Area.

Figure 12. South Kona coastline, view to the south across Pāpā Bay towards Miloli‘i.

Figure 13. Ka‘ū coastline, view to the northwest from Ka Lae.

AQUARIUM FISHING AND THE ESTABLISHMENT OF THE WHRFMA

The collection of aquarium fish in West Hawaiʻi has a long and contentious history (Walsh 2000). While Division of Fish and Game received legislative authority to regulate the industry and issue Aquarium Fishing Permits as early as the 1950s, and division suspended those permits for a time in 1973 over public concern about aquarium collection, aquarium collection activities remained largely unregulated in West Hawaiʻi until roughly twenty years ago, when the WHRFMA was established. The concept of the WHRFMA was introduced to the Hawaiʻi legislature by Democratic Representative David Tarnas in 1997 as House Bill (HB) 3457. This bill was introduced following decades of conflict between various user groups within West Hawaiʻi fishery (Walsh 2000). The discussions to improve marine management efforts within West Hawaiʻi came primarily through the West Hawaiʻi Reef Fish Working Group (WHRFWG), a group that formed in May of 1996 following the passage of House Concurrent Resolution (HCR) 184, which requested that the DLNR convene a task force to assist in developing a comprehensive management plan to regulate the take of aquarium fish within the area. In describing the purpose of HB 3457, Walsh writes:

> This bill established a West Hawaii Regional Fishery Management Area along the entire West Hawaii coast (Upolu Pt. to Ka Lae) to provide for effective management of marine resources. Along several provisions of this bill was a requirement to set aside 50% of the FMA as Fish Replenishment Areas (FRAs) where aquarium collecting was prohibited….During committee hearings of HB3457, the 50% provision for FRAs was reduced to "a minimum of 30%". (Walsh 2000:3)

With the support of aquarium collectors and other user groups, HB 3457 was approved by the Hawaiʻi State Legislature on July 13, 1998, where it became Act 306 and subsequently codified as HRS 188F (Walsh 2014). This Act established the WHRFMA to: "(1) Effectively manage fishery activities to ensure sustainability; (2) Enhance nearshore resources; and (3) Minimize conflicts of use in this coastal area" (ibid.:3). With the passage of the act, the DLNR, Division of Aquatic Resources (DAR) was tasked with meeting four additional management goals for the fishery: "(1) Designate a minimum of 30% of coastal waters as Fish Replenishment Areas (FRAs) where aquarium collecting is prohibited. (2) Establish a day-use mooring buoy system and designate some high-use areas where no anchoring is allowed. (3) Establish a portion of the FRAs as fish reserved where no fishing of reef-dwelling fish is allowed. (4) Designate areas where the use of gill nets is prohibited" (ibid.:9).

Community Consultation and the Creation of the Fish Replenishment Areas within the WHRFMA

Additionally, Act 306 also mandated that the DLNR/DAR conduct close and substantial consultation with community members and resource users during the FRA designation process. To aid with the execution of Act 306, in 1998, Pete Hendricks of DAR, along with Sara Peck of the West Hawaii Sea Grant and Dr. William J. Walsh began to assemble a council that would have broad geographic representation and representation from various stakeholders, communities, and user groups in West Hawaiʻi. On June 16, 1998, this council, originally dubbed the West Hawaiʻi Fisheries Management Council (WHRFMC) convened with twenty-four voting members and representation from various state agencies, user groups, and community members. The council's name was later changed to the West Hawaiʻi Fisheries Council (WHFC). As the FRA designation process unfolded, the participating aquarium collectors, after seeing that the FRA site selection process included more than 30% of the WHRFMA, began to openly oppose the designation process. Despite the challenges faced by the council in maintaining attendance and reaching critical management decisions, nine separate areas (including previously protected areas) comprising a total of 35.2% of the WHRFMA were selected (Walsh 2000).

One of the major complications that arose during the selection process concerned the fishing communities in both Miloliʻi and Hoʻokena, who had worked previously with Dr. Kimberly Lowe of DAR in creating FMA proposal for their respective areas. According to Walsh (2000:5), the FMA proposals "specified a ban on aquarium collecting in a 33-mile zone in the vicinity of these communities" and that "of and by itself this zone exceeded 30% of the coastline." Despite this prior plan, all parties including those representing these communities were able to reach a compromise, "which ultimately reduced these no collecting areas to slightly more than a third of what the communities had expected" (ibid.:5)." In order to enhance enforceability and stabilize the West Hawaiʻi fishery, the council added several provisions to the draft FRA rule (Hawaiʻi Revised Statutes (HAR) §13-60.3), which included:

> Two boundary changes, establishment of seaward boundaries at 600 ft., inclusion of GPS boundary coordinates, prohibition of aquarium collecting gear or collected animals within FRAs, and aquarium vessel registration/identification system, and a control date for possible future use in a limited entry program. (Walsh 2000:5)

The proposed FRA rules were subsequently presented to the public on April 28, 1999 at a well-attended public hearing, where they received overwhelming support (93.5% of the 876) from a wide range of the community members present (Walsh 2014). The FRA rules were later voted on by the Board of Land and Natural Resources (BLNR), who unanimously approved them and their provisions, with the exception of the prohibition on aquarium collecting gear within the FRAs, which was ultimately omitted from the final rules package without explanation. After review by the Attorney General's office, on December 17, 1999 the proposed rules were sent back to the BLNR for re-approval, and HAR §13-60.3 was signed by Governor Ben Cayetano on December 31, 1999 (Walsh 2000:1). The latter four management goals described above, which prohibit the collecting of aquarium fish anywhere within the FRA boundaries, were subsequently adopted as HAR §13-60.4 (following the repeal of HAR §13-60.3), and signed into law by Governor Neil Abercrombie on December 26, 2013 (Walsh 2014). The on shore boundaries of the FRAs created by Act 306—whose seaward boundaries extend to a depth of 100 fathoms—are marked with distinct yellow signs that indicate that the taking of aquarium fish is prohibited (Figure 14). There a currently ten established FRAs located within the WHRFMA, along with various other Marine Life Conservation Districts (MLCDs), Netting Restricted Areas (NRAs), and Fisheries Management Areas (FMAs) where aquarium fishing is not permitted (see Figure 1).

Figure 14. Example of a yellow FRA sign (located at Makahiki Point, Pāpā Bay, South Kona) indicating that aquarium collection is prohibited, view to the north.

Creation of the "White-List" Species

The rules adopted in 2013 (HAR §13-60.4) also called for the establishment of a list of fish species (a "white-list") that could be taken by aquarium collectors within the WHRFMA (Walsh 2013). After an analysis of relative catch report data, population data, and habitat maps provided by DAR and NOAA, the DLNR established a list of forty distinct fish species (henceforth referred to as the "white-list") that could be taken, while the capture of all other fish (not on the list) was prohibited. Subsection b of HAR §13-60.4-7 states that, "In addition to other regulations deemed necessary for the management of the West Hawai‘i regional fishery management area, an aquarium permit holder may only take or possess specimens of the following species of fish for aquarium purposes while within the West Hawai‘i regional fishery management area…" (DLNR 1999:15–16). Table 1, presented below, lists all forty fish white-list species sorted by scientific name and the common name as it appears in subsection b of HAR §13-60.4-7 (ibid).

Table 1. "White-List" Species

Scientific Name	*Common Name*	*Scientific Name*	*Common Name*
Acanthurus achilles	Achilles tang	*Ctenochaetus strigosus*	goldring surgeonfish
Acanthurus dussumieri	eyestripe surgeonfish	*Dascyllus albisella*	Hawaiian Dascyllus
Acanthurus nigricans	goldrim surgeonfish	*Forcipiger flavissimus*	forcepsfish
Acanthurus nigrofuscus	brown surgeonfish	*Gomphosus varius*	bird wrasse
Acanthurus olivaceus	orangeband surgeonfish	*Halichoeres ornatissimus*	ornate wrasse
Acanthurus thompsoni	Thompson's surgeonfish	*Hemitaurichthys polylepis*	pyramid butterflyfish
Anampses chrysocephalus	psychedelic wrasse	*Lutjanus kasmira*	bluestripe snapper, taape
Canthigaster jactator	whitespotted Toby	*Macropharyngodon geoffroy*	shortnose wrasse
Centropyge fisheri	Fisher's angelfish	*Melichthys niger*	black Durgon
Centropyge potteri	Potter's angelfish	*Naso lituratus*	orangespine unicornfish
Cephalopholis argus	peacock grouper, roi	*Ostracion meleagris*	spotted boxfish
Chaetodon kleinii	blacklip butterflyfish	*Paracirrhites forsteri*	blackside hawkfish
Chaetodon miliaris	milletseed butterflyfish	*Pseudanthias hawaiiensis*	Hawaiian longfin Anthias
Chaetodon multicinctus	multiband butterflyfish	*Pseudocheilinus octotaenia*	eightline wrasse
Chaetodon quadrimaculatus	fourspot butterflyfish	*Pseudocheilinus tetrataenia*	fourlined wrasse
Chaetodon tinkeri	Tinker's butterflyfish	*Pseudojuloides cerasinus*	smalltail wrasse
Cirrhilabrus jordani	flame wrasse	*Sufflamen bursa*	lei triggerfish
Cirrhitops fasciatus	redbarred hawkfish	*Thalassoma duperrey*	saddle wrasse
Coris gaimard	yellowtail coris	*Xanthichthys auromarginatus*	gilded triggerfish
Ctenochaetus hawaiiensis	chevron tang	*Zebrasoma flavescens*	yellow tang

3. CULTURE-HISTORICAL CONTEXT

To understand the vast landscape of the study area and the inherent cultural mores and traditions that developed as a direct result of interacting with this very landscape, it is imperative that the culture-historical research be conducted within the epistemological framework of the host culture. This is achieved by presenting indigenous narratives wherever possible. As such, this chapter presents a discussion of the culture-historical background for the study area. The information presented below is meant to provide a comprehensive understanding of the cultural significance of the area and the "white-list" species, and to establish an analytical basis for the assessment of any potential cultural impacts that the proposed issuance of fourteen commercial aquarium permits within the WHRFMA might have.

The chronological summary presented below begins with the settlement of the Hawaiian Islands followed by a discussion on the development of the *ahupua'a* system and its marine components. This is followed by a presentation of legendary accounts that focuses on the oceanic origins and cosmogony of the Hawaiian people, or Kānaka Maoli (lit. the true people), and a discussion on traditional marine resource management strategies and fishing practices, as well as traditional nearshore fishing techniques. To develop an understanding of the customary uses of the "white-list" species, a discussion on Hawaiian fish nomenclature is provided, which is followed by a detailed presentation on the cultural uses of all species listed on the "white-list." This is followed by a summary of hallmark historic events specific to West Hawai'i, which include the arrival of westerners in 1779 and the first company of missionaries in 1820, and the subsequent transformation of traditional marine resource management practices. A discussion of the 1848 *Māhele 'Āina* and its effects on traditional marine resource procurement are then presented which is followed by a presentation on the boundary commission testimonies for the respective districts. The culture-historical background section concludes with a summary of the events during the second half of the 19th century, with emphasis on the gradual transformation of commercial fishing in Hawai'i.

SETTLEMENT OF THE HAWAIIAN ISLANDS

While the question of the timing of the first settlement of Hawai'i by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, and radiometric). However, none of these theories is today universally accepted. What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations they went through on their way to establish a uniquely Hawaiian culture. More recently, with advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have convincingly argued that Polynesians arrived in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter (c.f., Kirch 2011). The initial migration to Hawai‘i is believed to have occurred from Kahiki (the ancestral homelands of Hawaiian gods and people) with long distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawai‘i's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy and Handy 1991). This was a period of great exploitation and environmental modification when early Hawaiian fishers and farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and belief: the major gods Kāne, Kū, Lono, and Kanaloa; the *kapu* system of law and order; the *pu‘uhonua* (places of refuge), their *‘aumakua* (family or personal gods), and the concept of *mana* (supernatural or divine power).

For generations following initial settlement, communities were clustered along the watered, *ko‘olau* (windward) shores of the Hawaiian Islands. Along the *ko‘olau* shores, streams flowed and rainfall was abundant, and agricultural production became established. The *ko‘olau* region also offered sheltered bays from which deep-sea fisheries could be easily accessed, and nearshore fisheries, enriched by nutrients carried in the freshwater, could be maintained in fishponds and coastal waters. It was around these bays that clusters of houses where families lived could be found (McEldowney 1979). In these early times, Hawai‘i's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy and Handy 1972).

Following the initial settlement period, areas with the richest natural resources became populated and perhaps crowded, and by about A.D. 1200, the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000). Along the *kona* coast of Hawai‘i Island, communities were initially established near sheltered bays with access to fresh water, where an abundance of marine resources were readily available. As indicated by the archaeological record, historic documentation, and legendary accounts, this shoreline zone was used primarily for habitation and related activities, such as recreation, ceremonial practices, canoe storage, fishing and associated rituals, and burial (Johnson and Wolforth 2006). Smaller temporary habitations associated with fishing activities were also common along the shore (Cordy 1995).

By the early 17th century, the Hawaiian royalty built chiefly centers within the shoreline zone of central Kona with royal compounds located at Kailua in the vicinity of Kamakahonu and Kaiakeakua, Kahalu‘u-Keauhou, Ka‘awaloa-Kealakekua, and Hōnaunau. Such royal centers included dwellings for chiefs, their court, and local *maka‘āinana* (common people) in addition to public structures, such as *heiau,* sporting grounds and places of refuge (Cordy 1995). As the population continued to expand so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. During this expansion period, additional migrations to Hawai‘i occurred from Tahiti in the Society Islands (Kamakau 1976).

Rosendahl (1972) has proposed that settlement along the leeward coast of Hawai‘i Island at this time was seasonal and recurrent, and that coastal sites were primarily occupied during the drier summer to exploit marine resources, while the upland sites were primarily occupied during the wetter winter months to focus on agriculture. An increasing reliance on agricultural products may have eventually caused a shift in social networks, as Hommon (1976) argues kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua‘a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to the permanent dispersed occupation of both coastal and upland areas.

DEVELOPMENT OF THE *AHUPUA‘A* SYSTEM

For Hawai‘i Island, the formalization of the *ahupua‘a* land management system is attributed to ‘Umi a Līloa, a renowned *ali‘i* of the Pili line who rose to power during the early 16th century (Cordy 1994). ‘Umi a Līloa was also known for separating the various classes of chiefs, priests, and laborers (Beamer 2014; Cordy 2000; Kamakau 1992). An *ahupua‘a* is a traditional land division that typically incorporated all of the eco-zones from the mountains to the sea, and for several hundred yards beyond the shore, assuring a diverse subsistence resource base for its residents, and a source of taxation (tribute) for the chiefs (Hommon 1986). Although the *ahupua‘a* land division typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974; Kamakau 1976). *Ahupuaʻa* boundaries were generally defined by the natural topography (i.e. hills, ridgelines, gulches, craters, etc.) as well as the natural resources that occurred within a given area (Lyons 1875). In summarizing the types of ecozones that could be found in a given *ahupuaʻa*, Hawaiian scholar and historian, Samuel Kamakau writes:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*ʻano*). The part directly in back and in front of the summit proper is called the *kuamauna* , mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao ʻeiwa*, and makai of that the *wao maʻukele*. Makai of the *wao maʻukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the *ʻamaʻu*, fern belt, and makai of the *ʻamaʻu* the *ʻapaʻa*, grasslands.
>
> A solitary group of trees is a *moku laʻau* (a "stand" of trees) or an *ulu laʻau*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa waʻa*) grow is a *wao koa* and mauka of there is a *wao laʻau*, timber land. These are dry forest growths from the *ʻapaʻa* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao maʻukele*, the wet forest.
>
> Makai of the *ʻapaʻa* are the *paheʻe* [*pili* grass] and *ʻilima* growths and makai of them the *kula*, open country, and the *ʻapoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *ʻae kai*, the water's edge.
>
> That is the way *ka poʻe kahiko* [the ancient people] named the land from mountain peak to sea. (Kamakau 1976:8–9)

The *ahupuaʻa* were also divided into smaller individual parcels of land (such as the *ʻili, kōʻele, māla*, and *kīhāpai*, etc.), generally oriented in a *mauka-makai* direction, and often marked by stone alignments (*kuaiwi*). In these smaller land parcels the native tenants tended fields and cultivated crops necessary to sustain their families, and the chiefly communities with which they were associated. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people, who lived in a given *ahupuaʻa* had access to most of the resources from mountain slopes to the ocean. These access rights were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility for stewardship of the natural environment, and supplying the needs of the *aliʻi* (see Kamakau 1961:372-377 and Malo 1951:63-67).

Entire *ahupuaʻa*, or portions of the land were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *aliʻi-ʻai-ahupuaʻa* (chief who controlled the *ahupuaʻa* resources). The *aliʻi-ʻai-ahupuaʻa* in turn answered to an *aliʻi ʻai moku* (chief who claimed the abundance of the entire district). Thus, *ahupuaʻa* resources supported not only the *makaʻāinana* and *ʻohana* who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resources management planning. In this system, the land provided fruits and vegetables and some meat in the diet, and the ocean provided a wealth of protein resources. Also, in communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in procurement of marine resources) came to be strictly adhered to. It is in this cultural setting that we find the present study area.

Nā Papakū O Ka Moana: Marine Extension of the *Ahupuaʻa*

The *ahupuaʻa* land management system and its traditional resource zones also served as a terrestrial extension of Hawaiʻi's oceanic ecosystem. Kānaka Maoli organized the *kai* into distinct ecological zones along both horizontal and vertical planes known as *nā papakū o ka moana* (marine zones). Each named zone was unique based on location, depth, color, geographical character, and procurable coastal and pelagic resources, as well as *wiliau* (ocean currents). These zones extended from where the waves gently dissolve over the sand to the distant *kahikimoe* (horizon). In his book *Hawaiian Antiquities*, Hawaiian scholar David Malo (1951:48–49) enumerated some of these *papakū o ka moana* as follows:

1. The ancients applied the name *kai* to the ocean and all its parts. That strip of the beach over which the waves ran after they had broken was called *ae-kai*.
2. A little further out where the waves break was called *poina-kai*. The name *pue-one* was likewise applied to this place. But the same expressions were not used of places where

shoal water extended to a great distance, and which were called *kai-kohola* (such as largely prevail for instance at Waikiki).

3. Outside of the *poina-kai* lay a belt called the *kai-hele-ku*, or *kai-papau*, that is, water in which one could stand, shoal water; another name given it was *kai-ohua*.
4. Beyond this lies a belt called *kua-au* where the shoal water ended; and outside of the *kua-au* was a belt called *kai-au*, *ho-au*, *kai-o-kilo-hee*, that is, swimming deep or sea for spearing squid, or *kai-hee-nalu*, that is, a surf swimming region. Another name still for this belt was *kai-kohola*.
5. Outside of this was a belt called *kai-uli*, blue sea, squid-fishing sea *kai-lu-hee*, or sea-of-the-flying-fish, *kai malolo*, or sea-of-the-*opelu*, *kai-opelu*.
6. Beyond this lies a belt called *kai-hi-aku*, sea for trolling the *aku*, and outside of this lay a belt called *kai-kohola*, where swim the whales, monsters of the sea; beyond this lay the deep ocean, *moana*, which was variously termed *waho-lilo* (far out to sea), or *lepo* (underground), or *lewa* (floating), or *lipo* (blue-black), which reach Kahiki-moe, the utmost bound of the ocean.
7. When the sea is tossed into billows they are termed *ale*. The breakers which roll in are termed *nalu*. The currents that move through the ocean are called *au* or *wili-au*.
8. Portions of the sea that enter into recesses of the land are *kai-hee-nalu*, that is a surf-swimming region. Another name still *kai-o-kilo-hee*, that is swimming deep, or sea for spearing squid, or called *kai-kuono*; that belt of shoal where the breakers curl is called *pu-ao*; another name for it is *ko-aka*.
9. A blow-hole where the ocean spouts up through a hole in the rocks is called a *puhi* (to blow). A place where the ocean is sucked with force down through a cavity in the rocks is called a *mimili*, whirlpool; it is also called *mimiki* or an *aaka*.
10. The rising of the ocean tide is called by such names as *kai-pii* (rising sea), *kai-nui* (big-sea), *kai-piha* (full sea), and *kai-apo* (surrounding sea).
11. When the tide remains stationary, neither rising nor falling, it is called *kai-ku*, standing sea; when it ebbs it is called *kai-moku* (the parted sea), or *kai-emi* (ebbing sea), or *kai-hoi* (retiring sea), or *kai-make* (defeated sea).
12. A violent, raging surf is called *kai-koo*. When the surf beats violently against a sharp point of land, that is a cape (*lae*), it is termed *kai-ma-ka-ka-lae*.
13. A calm in the ocean is termed a *lai* or a *malino* or a *pa-e-a-e-a* or a *pohu*.

As coastline geography is variable along the western shore of Hawai‘i Island, ranging from nearly vertical sea cliffs to fine-sanded bays, not all oceanic zones exist in all locales. According to Kamakau (1979), there were names for sea ponds that were nearly entirely surrounded by land—*kai hāloko* or *kai puhi lala*; for bays—*kai kū‘ono*; for lagoons—*loko kai*; for areas of the sea that were nearly landlocked—*hāloko kai*; and for places where seawater surged into a pond—*kai hī*. There were also specific names to indicate areas where waves multiplied—*kai ko‘o*, and subsequently diverged from each other—*kai kulana.* Kamakau (1979) also mentions that in more rugged environments, such as at Ka Lae in Ka‘ū, places where waves crashed against points of land were known as *kai maka lae*, and places where waves crashed into the bases of cliffsides were termed *kai kuehu*. Terms were also given to rocky places on the shoreline where waves broke within a crevice—*kai puhi*; where the sea ebbed up and down inside a crevice—*mimilo*, *mimiki*, or *‘a‘aka*; and for blowholes, which were known simply as *puhi* (ibid.). In locales such as Ka‘ū and the southern part of South Kona, the rocky shoreline limited resource areas where reef-bound marine life dwelled, including “squid, mullet, goatfish, parrotfish and the like” (Handy and Pukui 1998:223).

Kānaka Maoli also distinguished the various moods and surface characteristics of the ocean by name. For instance, calm and peaceful seas were *kai malina*, *kai pohu*, or *kai paeaea*; and areas where the sea was glassy and appeared to puddle on the surface were *kai kāhekaheka*, *kai ki‘o*, or *kai hāpuna* (Kamakau 1979). The famed proverbial sayings, “Ke kai malino o Kona” and “Kona, kai malino a Ehu” refers to the calm seas of the Kona District with the latter saying associating the calm seas with Kona’s ruling chief ‘Ehu (Pukui 1983:186,199). The calm sea of Kona, which produced “innumerable streaks of color” is described in the saying, “Kona i ke kai mā‘oki‘oki” which has been translated by Pukui (1983:199) to mean “Kona the sea that is cut up.”

There were also designations for contrasting parts of the *kai* based upon its color. Areas of the *kai* that were white were generally referred to as *kai kea*, with foamy, white seas being distinguished as *kai keʻokeʻo*. Kānaka Maoli further distinguished striated, variegated seas for which the Kona District was famed, as *kai māʻokiʻoki*, and sections that were richly red like *ʻalaea* (ocherous earth) as *kai ʻulaʻula* (red sea) and golden yellow like *ʻōlena* (turmeric) as *kai lenalena* (yellow sea). The ancient people also identified parts of the *kai* which were designated for certain activities. For instance, shallow parts of the sea where one could wade out into the shoal were known as the *kai hele kū*, and places where one could submerge and bathe were referred to as *kai ʻau kohana*. There were also places designated for diving—*kai luʻu,* as well as surfing—*kai heʻe nalu* or *kuaʻau* (Kamakau 1979).

Access to nearshore and offshore fisheries constituted an important component of the *ahupuaʻa* system. In detailing the nature of traditional fishers, Lyons writes:

> While the smaller ahupuaas had to content themselves with the immediate shore fishery extending out not further than a man could touch bottom with his toes, the larger ones swept around outside of these, taking to themselves the main fisheries much in the same way as that in which the forests were appropriated. (Lyons 1875:111)

In describing the intimate connection between the *ʻohana* the *ahupuaʻa* system, Handy and Pukui (1998:18) relate, "the *ʻOhana* as a functioning social mechanism operates within the *milieu* of the sea, shore, coastal and inland slopes and uplands, subject to weather, sun and moon." Regarding marine resource management, Kānaka Maoli carefully regulated resource extraction within the different designated marine zones (discussed above) to ensure the preservation of the physical, biological, and ecological integrity of the *kai*, as well as the perpetuation of the ancient *ʻohana* (family) based socio-economic system (Jokiel et al. 2011). As related by Handy and Pukui:

> . . . The fisherman needing *poi* or *ʻawa* would take fish, squid or lobster upland to a household known to have taro, and would return with his *kalo* (taro) or *paʻiʻai* (hard poi, the steamed and pounded taro corm). A woman from seaward, wanting some medicinal plant, or sugar cane perhaps, growing on the land of a relative living inland would take with her a basket of shellfish or some edible seaweed and return with her stalks of sugar cane or her medicinal plants. In other words, it was the *ʻohana* that constituted the community within which the economic life moved. (Handy and Pukui 1998:6)

***Kuleana*: The Establishment of Native Access to Natural Resources**

The *hoaʻāina* (native tenants) and *ʻohana* (families) who lived on the land had rights to the gather forest and marine resources for subsistence and for tribute (Jokiel et al. 2011; MacKenzie 1991). As part of these rights, the *ahupuaʻa* residents were also required to supply resources and labor that supported the royal community of regional and/or island kingdoms as well as provide offerings to appease their multitude of *akua* (Malo 1951). These services were a *kuleana* (privilege and responsibility) that came with the tenancy within a given *ahupuaʻa*. The *ahupuaʻa* thus became the equivalent of a local community, with its own social, economic, and political significance, and it also served as a taxable base for the *aliʻi* during the *Makahiki* (festival beginning about the middle of October and lasting about four months, with sports and religious festivities and taboo on war) (Kelly 1956). During the annual *Makahiki* procession, the highest chief of the land sent select members of his retinue to collect *hoʻokupu* (tribute and offerings) in the form of goods from each *ahupuaʻa*. The *hoaʻāina* (native tenants) who resided in the *ahupuaʻa* brought their share of *hoʻokupu* to an *ahu* (altar) that was symbolically marked with the image of a *puaʻa* (pig). Kamakau describes some of the reasons for the annual *Makahiki* and notes the observance of *kapu* that restricted the consumption of certain vegetables and meats including fish:

> The Makahiki festival was a time to rest, and a time to make great feasts of commemoration (*ʻahaʻaina hoʻomanaʻo*) for life and health of the body, and for the help received from the gods. All manual labor was prohibited and there were several days of resting and feasting. Chiefs and people made manu joyful Makahiki feasts at the end of each year. The custom (*malama*) of feasting came from very ancient times; and from the time that chiefs became rulers of the kingdoms…
>
> They made kapu the last three months of the year. The Makahiki began (*e kauwelu ai*) in the month of Hilina, and at this time pork, coconut, and fish were placed under kapu; the eating of flesh foods (*iʻo*) was kapu during these months. (Kamakau 1964:19)

Ahupuaʻa were ruled by *aliʻi ʻai ahupuaʻa* or chiefs who controlled the *ahupuaʻa* resources; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land (Malo 1951). *Ahupuaʻa* residents were not bound to the land, nor were they the property of the *aliʻi*. If the living conditions under a particular *ahupuaʻa* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable living conditions

(Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief lose the support and loyalty of his, or her, principal supporters. *Ahupuaʻa* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord, who oversaw and coordinated stewardship of an area's natural resources (ibid.). In some places, the *poʻo lawaiʻa* (head fisherman) held the same responsibilities as the *konohiki* (Jokiel et al. 2011). Under this system, the *konohiki* had the right "to regulate the taking of fish and other marine life from the reefs and fishing grounds abutting the *ahupuaʻa*" (MacKenzie 1991:173). *Hoaʻāina* also had a right to gather fish, which was, however, "subject to the right of the *konohiki* to manage and conserve the fisheries" (ibid.).When necessary, the *konohiki* took the liberty of implementing *kapu* (restrictions and prohibitions) to protect the *mana* of the area's resources from physical and spiritual depletion.

Many *ahupuaʻa* were further divided into smaller land units termed *ʻili* and *ʻili kūpono* (often shortened to *ʻili kū*) and cultivated patches known as *kōʻele*, *māla*, and *kīhāpai* (Beamer 2014; Lyons 1875). *ʻIli* were created for the convenience of the *ahupuaʻa* chief, and they served as the basic land unit in which the *hoaʻāina* made a living; these land units were often retained by specific *ʻohana* for long periods of time (Jokiel et al. 2011; MacKenzie 2015). As the *ʻili* themselves were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with them. The right to use and cultivate *ʻili* was maintained within the *ʻohana*, regardless of any change in title of the *ahupuaʻa* chief (Handy and Handy 1991). Malo (1951), recorded several types of *ʻili*, including the *ʻili paʻa,* a single intact parcel, and the *ʻili lele*, a discontinuous parcel dispersed across an area. Whether dispersed or wholly intact, the *ʻili* land division required a cross section of the available resources, and for the *hoaʻāina*, this generally included access to agriculturally fertile lands, and the coastal fisheries. While much of these same resource principles applied to another type of *ʻili*, the *ʻili kūpono*, these land units were politically independent of the *ahupuaʻa* chief. This *ʻili kūpono* designation was often applied to specific areas containing resources that were highly valued by the ruling chiefs, such as fishponds (Handy and Handy 1991).

The *aliʻi* who presided over the *ahupuaʻa* (*aliʻi-ʻai-ahupuaʻa*), in turn, answered to an *aliʻi ʻai moku* (chief who claimed the abundance of the entire *moku or* district) (Malo 1951). Although *moku* (districts) were comprised of multiple *ahupuaʻa*, they were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). This form of district subdividing was integral to Hawaiian life and was strictly adhered to. Collectively, the *aliʻi* regardless of their rank, held a vested responsibility, and were obligated to ensure, "the beneficial use of the land for all of the people" (MacKenzie 1991:173). It is vital to note that this complex and highly established system evolved well-before the Western concept (and practice) of private property and codified laws was introduced to the Hawaiian Islands. As knowledge of place developed over the centuries and was passed down intergenerationally through example, direct teaching, and experience, detailed information of an area's natural cycles and resources became ingrained and well-understood. Decisions pertaining to the use and management of natural resources were based on generations worth of highly informed knowledge, and were sustainably adapted to meet the needs of a growing population.

This highly-complex land management system set the foundation for traditional customary rights of the Kānaka Maoli, all while mirroring the Hawaiian thought process, and the unique culture that coevolved with these islands. Their relationship to the land and sea was fortified by their spiritual beliefs and origin stories that tied them to the greater cosmos. As evidenced in the subsequent section, the ancient Kānaka Maoli did not agree on a single creation story. Their pluralistic outlook on their origins reveal their profound connection to the ocean. The ocean was a living deity who they called Kanaloa. The ocean was the pathway of the gods and people who traveled by way of the *waʻa* (canoe) and the very element that connected them to their ancestral homeland, Kahiki. The ocean was the seat of life from which the islands were fished, and pulled up from its depth. The ocean and its creatures shared a kinship connection to the chiefs and the people, and were incorporated in an ancient genealogical chant known as the *Kumulipo*. As ancient as some of these stories may be, they remain an integral component for understanding the deep reverence and connection Kānaka Maoli have to the their land and sea.

OCEANIC ORIGINS

The Kānaka Maoli were anchored through their ingrained philosophy of life to the *ʻāina* (land), *wai* (water), *lewa* (heavens), and the *kai* (ocean). These life-giving aspects of their natural environment were the foundation upon which they constructed their physical and spiritual world. Every natural element found within the Hawaiian world, whether on the land, in the sea, or in the heavens, was believed to be the physical embodiment of the *akua* (deities). The natural wonders of the universe were the source of life for the Kānaka Maoli, and were thus acknowledged, named, and deeply revered. Traditional legendary accounts describing the origins of the *Kanaka* (humans) are plentiful, and a review of these accounts reveals that the ancient people of these islands did not agree on a single creation story (Fornander 1916–1917). While Western scientists emphasize the geological formation of the Hawaiian Islands, traditional accounts feature the ocean as the origin of the islands. The ocean is also described as the pathway of the gods, carrying them from their ancestral homeland of Kahiki to the shores of Hawaiʻi. As the current study area includes the nearshore waters of West Hawaiʻi, the most relevant of these accounts are summarized below.

The Great Fishermen, Kapūheʻeuanui

One such account concerns the genealogy of a Tahitian priest,ʻŌpuʻukahonua (lit. the budding earth), who established the "royal parents or ancestors of these islands," as there were, "ninety-five generations from him to Kamehameha the Great" (Fornander 1916–1917:20). According to this genealogical account (as told by Fornander 1916–1917:20), the islands "were found or obtained by the fishing of Kapuheeuanui," a great fisherman (*ka lawaiʻa nui*), who fished them up one-by-one:

> When Kapuheeuanui let down his fishing line into the sea from Kapaahu [Kohala] his line caught something that he thought was a fish and drew the line onto the canoe when, behold, it was a piece of coral. The priest Laulialamakua came along as Kapuheeuanui was disentangling his line from the coral and preparing to throw it away. Then the priest spoke to him, "Eh! Don't throw away that piece of coral, for that is a chief, a foreteller of events. Go thou and look for a pig and appease the god, and after prayer call its name Hawaiiloa, then throw it back into the sea, and it will grow up into an island." (ibid.)

Kapūheʻeuanui obeyed the commands of the priest and the next day, he went back out and again fished up another piece of coral. The priest Laulialamakua intervened and declared that this piece of coral be called Mauiloa. On the third day of fishing, Kapuheʻeuanui caught another piece of coral and showed it to the priest who named it Oʻahunuialaʻa. Day after day, Kapuheʻeuanui continued to fish up coral fragments all of which were named by the priest "until all the islands now comprising the group were successfully raised as corals." Fornander also narrates a chant describing the fishing up of the islands by the great fisherman Kapūheʻeuanui:

E Lono, e Lono-e! E Lonokaeho!	O Lono, O Lono, listen, O Lonokaeho!
Lonokulani alii o Kauluonana.	Lonokulani, chief of Kauluonana,
Eia na waaa kau mai,	Here are the canoes, get on board,
E hoi e noho ia Hawaiikuauli,	Come along and dwell in Hawaii-with-the-green-back,
He aina loaa i ka moana,	A land that was found in the ocean,
I hoea mai loko o ka ale;	That was thrown up from the sea,
I ka halehale poi pu a Kanaloa;	From the very depths of Kanaloa,
He koakea i halelo i ka wai,	The white coral in the watery caves
I lou i ka makau a ka lawaia,	That was caught on the hook of the fisherman;
A ka lawaia nui o Kapaahu	The great fisherman of Kapaahu,
A ka lawaia nui o Kapuheeuanui	The great fisherman Kapuheeuanui.
A pae na waa, kau mai,	The canoes touch the shore, come on board,
E holo ai i Hawaii, he moku;	Sail to Hawaii, an island,
He moku Hawaii,	An island is Hawaii;
He moku Hawaii na Lonokaeho.	An island is Hawaii for Lonokaeho to dwell on.
(Fornander 1916–1917:22-23)	

Fornander reported that this chant was recited by the Tahitian chief Makuakaumana when he and the 12th century priest Paʻao went back to Tahiti in search of a new chief for Hawaiʻi Island. When Makuakaumana and his company had reached the shores of Moaʻulanuiʻākea in Tahiti, Makuakaumana called out to Lonokaeho to sail to Hawaiʻikuauli, (a poetic name given to Hawaiʻi Island describing its verdant countryside) to become its principle chief. Lonokaeho declined the offer and instead arranged for the chief Pili to sail to Hawaiʻi to become its chief. This chant also tells of the islands being fished up from the depth of the ocean, from the realm of the great oceanic deity, Kanaloa, who is mentioned in the chant excerpted above. Kanaloa is also the subject of many legends discussed below.

Kanaloa, Deity of the Ocean

Kanaloa is one of the four male gods that were worshipped by both *makaʻāinana* (lit. people that attend the land) and *aliʻi* (chiefs) in Hawaiʻi and throughout Polynesia (Beckwith 1970; Malo 1951). The three other male gods—Kāne, Kū, and Lono, along with four female gods: Laʻilaʻi, Haumea, Hina, and Pelehonuamea, make up the pantheon of Hawaiian gods (Kanakaʻole Kanahele et al. 2009). In the islands of the South Pacific, Kanaloa is known by other names (Taaroa in Tahiti; Tangaloa in Samoa; Tanaoa in Marquesas; Tangaro in Aotearoa) and in some places he is considered the creator, and the god of the ocean (ibid.). In Hawaiʻi, his domain extended over the ocean and many native Hawaiians today maintain the understanding that the ocean itself is Kanaloa. Kanaloa (the ocean) was considered the roadway for the navigator and served as the connection between the various islands across the vast Pacific Ocean; navigators and paddlers, who traveled at the mercy of the Kanaloa often invoked prayers to him for favorable weather and ocean conditions (ibid.).

Kanaloa is embodied in several ocean species including the elusive and polychromatic *heʻe* (octopus) and *mūheʻe* (squid) (Handy and Handy 1991). The *heʻe* form of Kanaloa was also applied to the area of healing and was used by a *kahuna lapaʻau* (healing practitioner) to perform a healing ceremony called *heʻe mahola* (Malo 1951). Malo (ibid.:109) expounds upon this ceremony writing, "[t]he *hee mahola* ceremony was through to be the thing to disperse (*hehee*) disease and bring healing to the body." Other important body forms of Kanaloa included the *koholā* (whale), specifically the *palaoa* (sperm whale), from which the *lei niho palaoa* (ivory tooth pendant) was carved and worn exclusively by Hawaiian *aliʻi*. Although whales are typically considered deep sea creatures, recent studies have shown that whales contribute to important nutrient cycling for reef fish (Smith et al. 2013). Kanaloa is also embodied in other large marine mammals including the *naiʻa* (dolphin), *niuhi* (tiger shark), *pololia* (jellyfish), and the *hāhālua* (manta ray) (Kanakaʻole Kanahele et al. 2009; Liliuokalani 1978).

Kānenuiʻākea: The Creator of Heaven and Earth and the Arrival of Kāne, Kanaloa, and Haumea in Keʻei, South Kona

A portion of the current study area, Keʻei in South Kona is mentioned in a legendary account recorded by Kamakau (1968) that details the initial arrival of Kāne, Kanaloa, and Haumea to the Hawaiian Islands, where they were first glimpsed by two fishermen near Keʻei. The arrival of these gods is described in both textual and chant form, with the latter comparing their arrival to swimming fish moving on the currents from Kahiki, their ancestral homeland. Kamakau (ibid.) also relates that Kānenuiʻākea was considered the creator of the "heavens and earth." In describing the arrival of Kāne, Kanaloa, and their *kaikuahine* (sister) Haumea, Kamakau writes:

> …it is said, Kane, Kanaloa, and Haumea came from Kahiki and from the firmament (*mai ka lewa mai*). They were first seen by a couple of fishermen outside of Keʻei, in South Kona. Kuheleimoana and Kuheleipo were the two fishermen who first saw these spirits (*poʻe akua*) coming over the surface of the sea. When the two men saw these wonderful beings they knelt in profound respect, and they gave them white fish and pointed out the *ʻawa* plants mauka of ʻAlanapo in Keʻei. Those of us who study and understand clearly the prophetic chants (*mele wanana*) know that the name of Haumea was given to the woman who came with Kane and his companion because she was a woman of mysterious and recurrent births (*no ka mea o Haumea ka wahine hanau kupanaha a hanau wawa*). Here is a *mele* of the *poʻe kahiko* that makes this clear:

Holo mai Kane mai Kahiki,	Here comes Kane from Kahiki,
Holo a iʻa iloko o ke kai,	Coming like a fish in the sea,
Ke kekele ʻau i ka moana;	Gliding through the currents of the ocean;
O Haumea ke kaikuahine	Haumea the sister
O Kanaloa ia me Kane	And Kanaloa are with Kane.
E kiʻi e ka iʻa kea i kai,	We get the white fish from the sea,
Laʻa i kuʻemake o Kane,	That is sacred to the eyebrows of Kane,
Laʻahia i ke kanawai,	Consecrated to him by his edict,
He mau lawaiʻa i ka moana,	We two fishermen on the ocean,
O Kuheleimoana O Kuheleipo,	Kuheleimoana and Kuheleipo,
E kaka ana i ka malie,	Who are deep-sea fishing in the calm,
I ka laʻi ku pohu malino,	In the windless calm,
I na kai malino a ʻEhu.	In the calm seas of ʻEhu.
Hukia i ka ʻupena luelue.	The bag net is drawn up.
E hoʻi kakou i ka uka,	We return to shore,
E ʻalana i ka pu ʻawa hiwa;	And offer the choice ʻawa;
Haʻawi i ke kaikuahine.	It is given to the sister.
Elua ʻolua ko Haumea i ke keiki.	There are two of you, and Haumea conceives a child.
I hanau i kana hiapo,	She gives birth to her first-born,
O Kaʻulawena Konohiki Wananakalana.	Kaʻulawena Konohiki Wananakalana.

According to Kamakau, the child Ka‘ulawena Konohiki Wananakalana (also known as Mapunaia‘a‘ala) was fathered by one of the Ke‘ei fishermen, Kuheleipo. In the Hawaiian cosmogonic chant, *Kumulipo* (discussed in further detail below), Mapunaia‘a‘ala was an ancestor of Māui, another noted demi-god who is celebrated in traditional lore for fishing the islands up from the depths of the sea (Beckwith 1951).

Māui Uses Manaiakalani to Fish the Hawaiian Islands Out of the Sea

Another account describing the oceanic origins of the Hawaiian Islands features the Pan-Pacific *kupua* or demi-god known as Māui, who among many other monumental life feats is said to have fished the Hawaiian Islands out of the depths of the sea using his supernatural fishhook called Manaiakalani, which was later cast up into the heavens. Westervelt writes:

> Maui went out from his home at Kauiki, fishing with his brothers. After they had caught some fine fish the brothers desired to return, but Maui persuaded them to go our farther. Then when they became tired and determined to go back, he made the seas stretch out and the shores recede until they could see no land. Then drawing the magic hook, he baited it with the Alae or sacred mud hen belonging to his Mother Hina…
>
> Down in the deep sea sank the hook with its struggling bait, until it was seized by “the land under the water.”
>
> But Hina the mother saw the struggle of her sacred bird and hastened to the rescue. She caught a wing of the bird, but could not pull the Alae from the sacred hook. The wing was torn off. Then the fish gathered around the bait and tore it to pieces. If the bait could have been kept entire, then the land would have come up in a continent rather than as an island. Then the Hawaiian group would have been unbroken. But the bait broke—and the islands came up as fragments from the under world. (Westervelt 1910:26–28)

The *Kumulipo*

While the above accounts attribute the origin of the Hawaiian Islands to various *akua* (deities) and great fishermen who raised coral and islands from the depths of the ocean, the following account is a *mele ko‘i honua*, or cosmogonic chant, known as the *Kumulipo,* which explains the origins of the Hawaiian universe in a different manner. This account describes the birth of various aquatic and terrestrial organisms found in the Hawaiian Islands. Containing over 2,000 lines, this chant was uttered by the high priest Puou in Kealakekua, Kona upon the birth of the 18th-century high chief Ka‘ī‘īmamao, as a way to recognize and fortify the depth of his royal family’s divine origin (Liliuokalani 1978). Various scholars and Hawaiian royalty including Queen Lili‘uokalani and her brother King David Kalākaua have attempted to translate this epic chant, with each translator offering their own interpretation. The *Kumulipo* anchors the Hawaiian world and its people to the ocean by way of the primal substance known to the Hawaiian people as *walewale* (slime). According to the *Kumulipo*, all animate and inanimate objects were *hānau* (born), including the *‘uku ko‘ako‘a* (coral polyp), which was recorded as the very first organism born in the ocean. The small and simple *‘uku ko‘ako‘a* is of vital importance to life, as it is the basic building block for all life in the sea. It is from the *‘uku ko‘ako‘a* that the *‘āko‘ako‘a* (coral head) was born, thus forming the broader foundation for all other marine organisms that inhabit the nearshore reefs, where benthic species and other fish live, including the white list species that are the subject of the current study.

This lengthy chant is broken up into sixteen *wā* (eras). The recurring theme of duality appears in the first four *wā* in which each aquatic life form is paired with a terrestrial counterpart. The first *wā* describes a time of eternal darkness (*pō*) that passes progressively, through the union of male and female energies, ultimately giving birth to light (*ao*). It is in this first *wā* that organisms of the benthic zone are born. The second *wā* of the *Kumulipo* describes the birth of the fishes and their forest counterparts; the third *wā* describes the emergence of the winged creatures of both land and sea., and the fourth *wā* describes the birth of the amphibious creatures (Beckwith 1951). In her explanation of the pairs of aquatic and terrestrial counterparts, Martha Beckwith writes:

> The names are not invented for mere rhyme value…The punning of names have in some cases a practical magical function. For example, in plant medicine the first food to be taken after dosing with a special medicinal herb is the sea-growing thing whose name matches with it…Such is the nature of the language that these lists may be extended indefinitely. (Beckwith 1951:50–51)

It is not until the eight *wā* of the Kumulipo that the Kanaka Maoli, or the people of the Hawaiian Islands, are born. This birth order informs us of the Hawaiian thought process, which suggests that Kanaka Maoli derive from the same source as all other living creatures, and are therefore an integral part of the vastly complicated and fragile system of life. The idea that Kanaka Maoli were born so long after the ocean helps provide context for understanding the reverence that they hold for the *kai* and all of its life forms. The *Kumulipo* also serves as a reminder that the well-being of Kanaka Maoli is dependent upon maintaining the delicate balance between all life forms, and that a symbiotic relationship exists between the land and the ocean. Although this accounts is set in Hawaiʻi's distant past, the messages and nuanced meanings remain deeply embedded in the spirits and minds of Native Hawaiians today.

For the purposes of the current study, in an effort to provide a more complete understanding of the cosmogony of marine life in the Hawaiian Islands, the entirety of the second *wā* of the *Kumulipo* is provided in the original Hawaiian with an English translation next to it. The Hawaiian version of this chant comes from a text written by King David Kalākaua that was published by Beckwith (1951:190–194). The English translation is derived from a version of the *Kumulipo* published by King Kalākaua's sister, Queen Liliʻuokalani (Liliuokalani 1978:6–11). Both the Hawaiian and English versions have been transcribed and are presented below in their entirety. All fish names are presented in bold print for emphasis; while the white-list species have been underlined for ease of identification:

123. *Hanau kama a ka Powehiwehi*	The first child born of Powehiwehi (dusky night)
124. *Hoʻoleilei ka lana a ka Pouliuli*	Tossed up land for Pouliuli (darkest night),
125. *O Mahiuma, o Maʻapuia*	For Mahiuma or Maapuia,
126. *O noho i ka ʻaina o Pohomiluamea*	And lived in the land of Pohomiluamea (shoughy hill of Mea);
127. *Kukala mai ka Haipu-aalamea*	Suppressed the noise of the growth of unripe fruit,
128. *O naha wilu ke au o Uliuli*	For fear Uliuli would cause it burst, and the stench
129. *O hoʻohewahewa a kumalamala*	To disagree and turn sour,
130. *O pohouli a pohoʻeleʻele*	For pits of darkness and pits of night.
131. *O na wai ehiku e lana wale*	Then the seven waters became calm.
132. *Hanau kama a* ***hilu****, a holo*	Then was born a child (kama), 'twas a **Hilu** and swam.
133. *O ka* ***hilu*** *ia pewa lala kau*	The **Hilu** is a fish with standing fins,
134. *O kau[l]ana a Pouliuli*	On which Pouliuli sat.
135. *O kuemiemi a Powehiwehi*	So undecided seemed Powehiwehi,
136. *O pouliuli ke kane*	For Pouliuli was husband
137. *O Powehiwehi ka wahine*	And Powehiwehi his wife.
138. *Hanau ka iʻa, hanau ka* ***Naiʻa*** *i ke kai la holo*	And fish was born, the **Naia** (porpoise) was born in the sea and swam.
139. *Hanau ka* ***Mano****, hanau ka* ***Moana*** *i ke kai la holo*	The **Mano** (shark) was born, the **Moana** was born in the sea and swam.
140. *Hanau ka* ***Mau****, hanau ka* ***Maumau*** *i ke kai la holo*	The **Mau** was born, the **Maumau** was born in the sea and swam.
141. *Hanau ka* ***Nana****, hanau ka* ***Mana*** *i ke kai la holo*	The **Nana** was born, the **Mana** was born in the sea and swam.
142. *Hanau ka* ***Nake****, hanau ka* ***Make*** *i ke kai la holo*	The **Nake** was born, the **Make** was born in the sea and swam.
143. *Hanau ka* ***Napa****, hanau ka* ***Nala*** *i ke kai la holo*	The **Napa** was born, the **Nala** was born in the sea and swam.
144. *Hanau ka* ***Pala****, hanau ke* ***Kala*** *i ke kai la holo*	The **Pala** was born, the **Kala** was born in the sea and swam.
145. *Hanau ka* ***Paka****, hanau ka* ***Papa*** *i ke kai la holo*	The **Paka** (an eel) was born, the **Papa** (crab) was born in the sea and swam.
146. *Hanau ke* ***Kalakala****, hanau ka* ***Huluhulu*** *i ke kai la holo*	The **Kalahala** was born, the **Huluhulu** was born in the sea and swam.
147. *Hanau ka* ***Halahala****, hanau ka* ***Palapala*** *i ke kai la holo*	The **Halahala** was born, the **Palapala** was born in the sea and swam.
148. *Hanau ka* ***Peʻa****, hanau ka* ***Lupe*** *i ke kai la holo*	The **Pea** (starfish) was born, the **Lupe** was born in the sea and swam.
149. *Hanau ke* ***Ao****, hanau ke* ***Awa*** *i ke kai la holo*	The **Ao** was born, the **Awa** was born in the sea and swam.
150. *Hanau ke* ***Aku****, hanau ke* ***ʻAhi*** *i ke kai la holo*	The **Aku** (bonito) was born, the **Ahi** (same kind) was born in the sea and swam.
151. *Hanau ka* ***Opelu****, hanau ke* ***Akule*** *i ke kai la holo*	The **Opelu** (same as above) was born, the **Akule** was born in the sea and swam.
152. *Hanau ka* ***ʻAmaʻama****, hanau ka* ***ʻAnae*** *i ke kai la holo*	The **Amaama** (mullet) was born, the **Anae** (large kind) was born in the sea and swam.
153. *Hanau ka* ***Ehu****, hanau ka* ***Nehu*** *i ke kai la holo*	The **Ehu** was born, the **Nehu** was born in the sea and swam.
154. *Hanau ka* ***ʻIao****, hanau ka* ***ʻAoʻao*** *i ke kai la holo*	The **Iao** (used for bait) was born, the **Aoao** was born in the sea and swam.
155. *Hanau ka* ***ʻOno****, hanau ke* ***Omo*** *i ke kai la holo*	The **Ono** (large fish) was born, the **Omo** was born in the sea and swam.
156. *Hanau ka* ***Pahau****, hanau ka* ***Lauhau*** *i ke kai la holo*	The **Pahau** (striped flatfish) was born, the **Lauhau** was born in the sea and swam.
157. *Hanau ka* ***Moi****, hanau ka* ***Loʻiloʻi*** *i ke kai la holo*	The **Moi** was born, the **Loiloi** was born in the sea and swam.
158. *Hanau ka* ***Mao****, hanau ka* ***Maomao*** *i ke kai la holo*	The **Mao** was born, the **Maomao** was born in the sea and swam.
159. *Hanau ke* ***Kaku****, hanau ke* ***Aʻuaʻu*** *i ke kai la holo*	The **Kaku** was born, the **Aʻuaʻu** was born in the sea and swam.
160. *Hanau ke* ***Kupou*** *hanau ke* ***Kupoupou*** *i ke kai la holo*	The **Kupou** was born, the **Kupoupou** was born in the sea and swam.
161. *Hanau ka* ***Weke****, hanau ka* ***Lele*** *i ke kai la holo*	The **Weke** was born, the **Lele** was born in the sea and swam.
162. *Hanau ka* ***Palani****, hanau ka* ***Nukumomi*** *i ke kai la holo*	The **Palani** was born, the **Nuku Moni** was born in the sea and swam.
163. *Hanau ka* ***Ulua****, hanau ka* ***Hahalua*** *i ke kai la holo*	The **Ulua** was born, the **Hahalua** was born in the sea and swam.
164. *Hanau ka* ***ʻAoʻaonui****, hanau ka* ***Pakuʻikuʻi*** *i ke kai la holo*	The **Aoaonui** was born, the **Pakuikui** was born in the sea and swam.
165. *Hanau ka* ***Maʻiʻiʻi****, hanau ka* ***Alaʻihi*** *i ke kai la holo*	The **Maiii** was born, the **Alaihi** was born in the sea and swam.
166. *Hanau ka* ***ʻOʻo****, hanau ka* ***ʻAkilolo*** *i ke kai la holo*	The **Oo** was born, the **Akilolo** was born in the sea and swam.
167. *Hanau ka* ***Nenue****, noho i kai*	The **Nenue** was born and lived in the sea;

168. *Kiaʻi ia e ka Lauhue noho i uka*	Guarded by the Lauhue that grew in the forest.
169. *He po uheʻe i ka wawa*	A night of flight by noises
170. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
171. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
172. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
173. *Hanau ka* ***Pahaha*** *no i kai*	The **Haha** was born and lived in the sea;
174. *Kiaʻi ia e ka Puhala noho i uka*	Guarded by the Puhala that grew in the forest.
175. *He po uheʻe i ka wawa*	A night of flight by noises
176. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
177. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
178. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
179. *Hanau ka* ***Pahau*** *noho i kai*	The **Pahau** was born in the sea;
180. *Kiaʻi ia e ka Lauhau noho i uka*	Guarded by the Lauhau that grew in the forest.
181. *He po uheʻe i ka wawa*	A night of flight by noises
182. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
183. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
184. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
185. *Hanau ka* ***Heʻe*** *noho i kai*	The **Hee** was born and lived in the sea;
186. *Kiaʻi ia e ka Walaheʻe noho i uka*	Guarded by the Walahee that grew in the forest.
187. *He po uheʻe i ka wawa*	A night of flight by noises
188. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
189. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
190. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
191. *Hanau ka* ***ʻOʻopukai*** *noho i kai*	The **Oopukai** was born and lived in the sea;
192. *Kiaʻi ia e ka ʻOʻopuwai noho i uka*	Guarded by the Oopuwai that lived in the forest.
193. *He po uheʻe i ka wawa*	A night of flight by noises
194. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
195. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
196. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
197. *Hanau ka* ***puhi Kauwila*** *noho i kai*	The **Puhi kauwila** was born and lived in the sea;
198. *Kiaʻi ia e ka Uwila noho i uka*	Guarded by the Uwila that lived in the forest.
199. *He po uheʻe i ka wawa*	A night of flight by noises
200. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
201. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
202. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
203. *Hanau ka* ***Umaumalei*** *noho i kai*	The **Umaumalei** was born and lived in the sea;
204. *Kiaʻi ia e ka ʻUlei noho i uka*	Guarded by the Ulei that grew in the forest.
205. *He po uheʻe i ka wawa*	A night of flight by noises
206. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
207. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
208. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
209. *Hanau ka* ***Pakuʻikuʻi*** *noho i kai*	The **Pakuikui** was born and lived in the sea;
210. *Kiaʻi ia e ka laʻau Kukui noho i uka*	Guarded by the Laukukui that grew in the forest.
211. *He po uheʻe i ka wawa*	A night of flight by noises
212. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
213. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
214. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
215. *Hanau ka* ***Laumilo*** *noho i kai*	The **Laumilo** was born and lived in the sea;
216. *Kiaʻi ia e ka [laʻau] Milo noho i uka*	Guarded by the Milo that grew in the forest.
217. *He po uheʻe i ka wawa*	A night of flight by noises
218. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
219. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
220. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
221. *Hanau ke* ***Kupoupou*** *noho i kai*	The **Kapoou** was born and lived in the sea;
222. *Kiaʻi ia e ka Kou noho i uka*	Guarded by the Kou that grew in the forest.
223. *He po uheʻe i ka wawa*	A night of flight by noises
224. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
225. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
226. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
227. *Hanau ka* ***Hauliuli*** *noho i kai*	The **Hauliuli** was born and lived in the sea;
228. *Kiaʻi ia e ka Uhi noho i uka*	Guarded by the Uhi that grew in the forest.
229. *He po uheʻe i ka wawa*	A night of flight by noises
230. *He nuku, he kai ka ʻai a ka iʻa*	Through a channel; salt water is life to fish;
231. *O ke Akua ke momo, ʻaʻoe komo kanaka*	So the gods may enter, but not man.
232. *O kane ia Waiʻololi, o ka wahine ia Waiʻolola*	Man by Waiololi, woman by Waiolola,
233. *Hanau ka* ***Weke*** *noho i kai*	The **Weke** was born and lived in the sea;

234. *Kia'i ia e ka Wauke noho i uka*	Guarded by the Wauke that grew in the forest.
235. *He po uhe'e i ka wawa*	A night of flight by noises
236. *He nuku, he kai ka 'ai a ka i'a*	Through a channel; salt water is life to fish;
237. *O ke Akua ke momo, 'a'oe komo kanaka*	So the gods may enter, but not man.
238. *O kane ia Wai'ololi, o ka wahine ia Wai'olola*	Man by Waiololi, woman by Waiolola,
239. *Hanau ka* **'A'awa** *noho i kai*	The **Aawa** was born and lived in the sea;
240. *Kia'i ia e ka 'Awa noho i uka*	Guarded by the Awa that grew in the forest.
241. *He po uhe'e i ka wawa*	A night of flight by noises
242. *He nuku, he kai ka 'ai a ka i'a*	Through a channel; salt water is life to fish;
243. *O ke Akua ke momo, 'a'oe komo kanaka*	So the gods may enter, but not man.
244. *O kane ia Wai'ololi, o ka wahine ia Wai'olola*	Man by Waiololi, woman by Waiolola,
245. *Hanau ka* ***Ulae*** *noho i kai*	The **Ulae** was born and lived in the sea;
246. *Kia'i ia e ka Mokae noho i uka*	Guarded by the Mokae that grew in the forest.
247. *He po uhe'e i ka wawa*	A night of flight by noises
248. *He nuku, he kai ka 'ai a ka i'a*	Through a channel; salt water is life to fish;
249. *O ke Akua ke momo, 'a'oe komo kanaka*	So the gods may enter, but not man.
250. *O kane ia Wai'ololi, o ka wahine ia Wai'olola*	Man by Waiololi, woman by Waiolola,
251. *Hanau ka* ***Palaoa*** *noho i kai*	The **Palaoa** (sea-elephant) was born and lived in the sea;
252. *Kia'i ia e ka Aoa noho i uka*	Guarded by the Aoa that grew in the forest.
253. *He po uhe'e i ka wawa*	A night of flight by noises
254. *He nuku, he kai ka 'ai a ka i'a*	Through a channel; salt water is life to fish;
255. *O ke Akua ke momo, 'a'oe komo kanaka*	So the gods may enter, but not man.
256. *O ke ka'ina a* ***palaoa*** *e ka'i nei*	The train of the **Palaoa** (walrus) that swim by,
257. *E kuwili o ha'aha'a i ka moana*	Embracing only the deep blue waters,
258. *O ka* ***opule*** *ka'i loloa*	Also the **Opule** that move in schools,
259. *Manoa wale ke kai ia lakou*	The deep is as nothing to them.
260. *O* ***kumimi****, o ka lohelohe a pa'a*	And the **Kumimi** (a crab) and Lohelohe (a locust) cling together
261. *O ka'a monimoni i ke ala*	To the rolling motion of their cradle
262. *O ke ala o Kolomio o miomio i hele ai*	On their path so narrow, so slim, to move,
263. *Loa'a Pimoe i ke polikua*	Till Pimoe (a mermaid) is found in the depth of her cave,
264. *O Hikawainui, o Hikawaina*	With Hikawainui, and Hikawaine
265. *O pulehulehu hako'ako'a*	Amongst piles of heated coral
266. *Ka mene 'a'ahu wa'awa'a*	That were thrown in piles unevenly,
267. *O holi ka poki'i i ke au ia uliuli*	So thin and scraggy in the blue tide.
268. *Po'ele wale ka moana powehiwehi*	Surely it must be dismal, that unknown deep;
269. *He kai ko'ako'a no ka uli o Paliuli*	'Tis a sea of coral from the depth of Paliuli,
270. *O he'e wale ka 'aina ia lakou*	And when the land recedes from them
271. *O kaha uliuli wale i ka po—la*	The east is still in darkness of night,
272. *Po—no*	'Tis night

As reflected in the origin stories previously described, the Kānaka Maoli ordered all living things in the world. The ocean and its creatures were living resources of divine origin capable to living and reproducing without the aid of man. Their dependency on thriving but finite resources of the Hawaiian Islands and the adjacent oceanscape, coupled with an ever growing population, required that the Kānaka Maoli, form the beginning, develop systems, practices, and cosmology that would maintain the ecological and spiritual integrity of the islands' finite resources. Over time, what developed was sophisticated and highly integrated set of stewardship practices that were codified in the socio-political system, and interwoven with their spiritual beliefs.

TRADITIONAL RESOURCE MANAGEMENT PRACTICES

The ancient and ingrained philosophy of life of the Native Hawaiian people, or Kānaka Maoli, was reinforced through cultural norms, beliefs, values, and practices that tied them to their environment in a very intimate and profound way. Evident in traditional resource stewardship practices are several underlying components: having a personal and reciprocal relationship with the resources; the belief that all things are interconnected; exercising self-control; having the staunch support of a socio-political system that valued the management and beneficial use of natural resources; and uncodified laws that imposed serious consequences for violators. This lifestyle helped maintain natural, spiritual, and social orders that were actualized as place-based cultural practices. In describing the intimate relationship that exists between the Hawaiian people and the *'āina* (land) and the *kai* (ocean), Hawaiian historian and cultural specialist, Kepā Maly writes:

> In the Hawaiian context, these values—the "sense of place"—have developed over hundreds of generations of evolving "cultural attachment" to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawai'i, one must understand that Hawaiian

culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture ends and nature begins.

> In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The *ʻāina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (Maly 2001:1)

The *ʻōlelo noʻeau* (proverbial saying) "*Hānau ka ʻāina, hānau ke aliʻi, hānau ke kanaka*" (Born was the land, born were the chiefs, born were the commoners), conveys the belief that all things of the land, including *kanaka,* were literally born, and are thus connected through kinship links that extend beyond the immediate family (Pukui 1983:57). *ʻĀina*, or land, was perhaps most revered, as another *ʻōlelo noʻeau* notes, "*He aliʻi ka ʻāina; he kauwā ke kanaka,*" which has been translated by Pukui (1983:62) as "[t]he land is a chief; man is its servant." The lifeways of early Kānaka Maoli, which depended upon the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an adaptable management system that integrated the watershed, freshwater, nearshore fisheries, all of which are connected through the many unique ecosystems that extend from the mountains to the sea (Jokiel et al. 2011). As evidenced by their understandings and use of this island environment, Kānaka Maoli were masters of exploring, utilizing, and maximizing the wide array of island resources. However, included in any form of traditional land use was the practice of *mālama*, meaning as "to take care of, tend, attend, care for, preserve, protect, beware, save, maintain; to keep or observe, as a taboo…" (Pukui and Elbert 1986:232). The nuanced practice of *mālama* was a shared responsibility that was reinforced at a personal, familial, and social level throughout the society. In traditional Hawaiian society, all persons who exercised their right to utilize a resource were also expected to follow social and customary rules and rituals, one of which included the ritualistic gifting of *hoʻokupu* to the many *akua*, who in their elemental form imparted abundance and fertility to the land and sea.

Hoʻokupu & *Pule*: Reciprocity as a Means to Maintaining Spiritual Balance and Abundance

While the people held the responsibility of tending to the land and sea, the *aliʻi* held the prerogative of caring for, and looking after, the solidarity of the land and people (Malo 1951). Maintaining a reciprocal relationship with the *kini akua* (the multitude of gods) and *ʻaumākua* (ancestral gods), however, was traditionally a task undertaken by all classes of people. This was accomplished through ritualistic processes, including *pule* (prayers), giving *hoʻokupu* in the form of physical offerings, and also maintaining *heiau* (temple) rituals (ibid.). While there were many *heiau* types, each dedicated for a specific purpose, those devoted specifically to the occupation of fishing included the *koʻa* and *kūʻula*, both of which are discussed in more detail in the ensuing paragraphs. Maintaining balance with the gods was a practice vital to the life of the Kānaka Maoli. Failure to provide an adequate tribute to the gods was believed to disrupt the solidarity of the land and people, thereby provoking the gods to unleash their elemental powers onto upon them. Early Missionary, William Ellis described how fish were used to appease *akua* associated with the volcanic activity of Hawaiʻi Island. Ellis writes:

> The whole island was considered as bound to pay them tribute, or support their heiaus, and kahu (devotees;) and whenever the chiefs or people failed to send the proper offerings, or incurred their displeasure by insulting them or their priest, or breaking the tabu (sacred restrictions) of their domains in the vicinity of the craters, they filled Kirauea [Kīlauea] with lava, and spouted it out, or, taking a subterranean passage, marched to some one of their houses (craters) in the neighbourhood where the offending parties dwelt, and from thence came down upon the delinquents with all their dreadful scourges.
>
> If a sufficient number of fish were not taken to them by the inhabitants of the sea-shore, they would go down, and with fire kill the fish, fill up with pahoehoe (lava) the shallow places, and destroy all the fishing grounds. (Ellis 1917:186)

In the Kekaha region of North Kona, historical accounts describe the destruction of great fishponds by Pelehonuamea, the fiery goddess of lava. Historical accounts describe Pelehonuamea, who after having been denied fish by the local fishermen, consumed the massive Pāʻaiea fishpond that belonged to Kamehameha. This fishpond was said to have extended for some three miles along the Kona coast from Kaʻelehuluhulu to Wāwāloli, at the boundary of ʻOʻoma Ahupuaʻa (Maguire 1926).

***Kilo*: Astute Observation of the Natural World**

Kilo or perceptive observation of the natural world was perhaps one of the most fundamental stewardship tools used by the Kānaka Maoli. The vast knowledge acquired through the practice of *kilo* enabled them to observe and record the subtlest changes, distinctions, and correlations in their natural world. Examples of their keen observations are evident in Hawaiian nomenclature, where numerous types of rains, clouds, winds, stones, terrestrial and oceanic environments, flora, and fauna—many of which are geographically unique and distinct—have been named. These names are recorded in centuries-old traditions such as *oli* (chants), *mele* (songs), *pule* (prayers), *inoa ʻāina* (place names), and *ʻōlelo noʻeau*, which were transmitted orally from one generation to the next. The Kānaka Maoli knowledge of the natural environment was further reinforced through other traditional practices and arts including, but not limited to, *lawaiʻa* (fishing) and *mahiʻai* (farming), both primary occupations, *hula* (traditional dance), and *lapaʻau* (traditional healing).

***Kapu* and *Noa*: Harvest Restrictions**

As discussed above, the dependency on a thriving, but finite, set of natural resources led the Kānaka Maoli to develop a sophisticated and comprehensive system of land stewardship in the Hawaiian Islands that was reinforced culturally through a strict adherence to terrestrial and marine management practices that were governed, and enhanced, by the dual concepts of *kapu* and *mana*. Kānaka Maoli believed that all things natural, places, and even people, especially those of high rank, possessed a certain degree of *mana* or "divine power" (Pukui et al. 1972; Pukui and Elbert 1986:235). The concept of *mana* is believed to be derived from the *kini akua*, or the multitude of Hawaiian gods, who were embodied in elemental forces, including the *kai* (ocean), the land and its natural resources, and certain material objects and persons as well (Crabbe et al. 2017). Buck (1993) expands upon this concept, noting that *mana* was associated with "the well-being of a community, in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather etc.)."

To ensure the *mana* of the resources, certain places, and people remained protected from over-exploitation and defilement, *kapu* of various kinds were implemented and strictly enforced. According to Elbert and Pukui (1986:132) *kapu* are defined as "taboo, prohibitions; special privilege or exemption..." Kepelino (1932) notes that *kapu* associated with the gods applied to all social classes, while the *kapu* associated with the chiefs were applied to the people. As the laws of *kapu* dictated social relationships, they also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). Standing in juxtaposition to the concept of *kapu* is the concept of *noa*, translated as "freed of taboo, released from restrictions, profane, freedom" (Pukui and Elbert 1986:268). Some *kapu*—particularly those associated with maintaining social hierarchy and gender differentiation—were unremitting, while other *kapu*, such as those placed on natural resources were applied and enforced according to seasonal changes.

The application of *kapu* to natural resources ensured that such were resources remained unspoiled and available for future use. When the *aliʻi* or the lesser chiefs (including *konohiki* and *poʻo lawaiʻa*) determined that a particular resource was to be made available to the native residents, a decree was proclaimed indicating that *kapu* had been lifted, thereby making it *noa*. Although transitioning a resource from a state of *kapu* to *noa* allowed for its use, native residents were still expected to practice sustainable harvesting methods and pay tribute to the ruling chief and the gods and goddesses associated with that resource. *Kapu* were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). Details about the *kapu* system and its use as a marine resource management strategy were described by early visitors and missionaries to the islands, including Scottish surgeon and naturalist Archibald Menzies, and British Missionary, William Ellis. Menzies was a surgeon and naturalist on board the *H.M.S. Discovery*. He visited Hawaiʻi Island on three separate occasions in 1792, 1793, and 1794 and recorded many observations of Hawaiian cultural in his journals, which were published in 1920. Ellis on the other hand, arrived first to Honolulu in 1822, and then returned to Hawaiʻi Island later in 1823, where he and other missionaries toured the island to identify potential locations for future mission stations.

Menzies, in his journal entry for February 24th, 1793, provides some insights into the traditional *kapu* system as it related to fishing practices, recording that a man had been put to death in South Kona, near Nāpoʻopoʻo Beach, for breaking a fish-related *kapu*. In the entry he writes:

> Close to the foot of the marae [heiau], some of the natives pointed out to us the grave of a man that had been put to death about a fortnight before on account of breaking the kapu, which was simply this: The bay had been tabooed some days on account of a large shoal of fish that appeared on the coast, at which time this unfortunate man was seen going across the entrance of it in a small canoe. He was immediately pursued, and when brought on shore, they first broke the bones of his arms and

> legs, and afterwards put an end to his miserable existence by stabbing his body with their pahoas [daggers]. (Menzies 1920:72)

Ellis too, recorded details about the traditional repercussions of breaking a *kapu*, which he referred to as “tabu,” writing in the 1820s that:,

> The flesh of hogs, fowls, turtle, and several other kinds of fish, cocoa-nuts, and almost every thing offered in sacrifice were *tabu* to the use of the gods and the men; hence the women were, except in cases of particular indulgence, restricted from using them. . . Particular fruits, animals, and the fish of certain places, were occasionally *tabu* for several months from both men and women (Ellis 1831:387).

Ellis continues that, “when the fish of a certain part are tabued, a small pole is fixed in the rocks on the coast, in the centre of the place, to which is tied a bunch of bamboo leaves, or a piece of white cloth” (ibid.:389). In relating some of the consequences of breaking a *kapu*, Ellis tells of the wife of Alapai, an *ali‘i* of Waimanu, “who was afflicted with an affection of the spine, which prevented her walking without support,” who told them, “she had incurred the displeasure of the gods by eating a fish that was *tabu*, or sacred, and that the disease which rendered her a cripple was her punishment” (ibid:375).

Violators of *kapu* who managed to escape death, either sought refuge at a *pu‘uhonua* (a designated place of refuge), or were sometimes freed by the word of certain chiefs (Kamakau 1992). At the *pu‘uhonua*, after completing the proper rituals, the violator was absolved of his, or her, crime and allowed to reintegrate back into society. One such *pu‘uhonua* was located at Hōnaunau in Kona, and was described by Ellis during the 1820s as follows:

> Adjoining the Hare of Keave [Hale o Keawe] to the southward, we found a Pahu tabu (sacred enclosure) of considerable extent, and were informed by our guide that it was one of the pohonuas [*sic*] of Hawaii, of which we had so often heard the chiefs and others speak. There are only two on the island; the one which we were then examining, and another at Waipio, on the north-east part of the island, in the district of Kohala.
>
> These Puhonuas were the Hawaiian cities of refuge, and afforded an inviolable sanctuary to the guilty fugitive, who, when flying from the avenging spear, was so favoured as to enter their precincts.
>
> This had several wide entrances, some on the side next the sea, the others facing the mountains. Hither the manslayer, the man who had broken a tabu, or failed in the observance of its rigid requirements, the thief, and even the murderer, fled from his incensed pursuers, and was secure.
>
> To whomsoever he belonged, and from whatever part he came, he was equally certain of admittance, though liable to be pursued even to the gates of the enclosure.
>
> Happily for him, those gates were perpetually open; and as soon as the fugitive had entered, he repaired to the presence of the idol, and made a short ejaculatory address, expressive of his obligations to him in reaching the place with security. (Ellis 1917:126–127)

The importance of fishing related *kapu* in traditional Hawaiian society, and the necessity for them, has been described by Manuia Maunupau, a native of O‘ahu and practitioner of traditional Hawaiian fishing methods, who was born in 1872 and spent his formative years fishing with his father, Maihui, in North Kona. Advocating for all those who fish the waters of Hawai‘i to maintain their *kuleana* and have respect for the resources, he states:

> The ancient Hawaiian did everything he could to preserve the fishing ground. No fishing ground can be preserved unless precautions such as the Hawaiians observed are taken. This is true not only of aku and ahi fishing but of every other kind of fishing. The Hawaiians had a kapu on alongshore fishing in certain places when deep sea fishing was open. The kapu places were marked with coconut leaves. In the case of inshore fishing, one place was kapu for a month; then this area was opened and the next was kapu. At certain times of the year, certain seaweeds were kapu, because when fish food was preserved by this means, the shore fishing was saved for the people. There used to be plenty of fish in Hawaiian waters, but these have to a great extend disappeared because constant fishing has wiped them out. The fish are gone for good unless we have closed and open seasons for different kinds of fishing. The government is trying to place certain restrictions on fishing. If the ancient form of kapu used by the old-time Hawaiians could be revived in these new governmental restrictions, we should again have plenty of fish, provided the restrictions were observed as were the kapus in the old days.

> The old Hawaiian fisherman was a skilled and selected person. He had knowledge of, and respect for, the traditions and customs of fishing. He was careful to observe these customs, because through them, fishing was preserved for the coming generations, and his children were trained in the skill they would need as they became fishermen. Fishing in those days was not a matter of getting all the fish and moving on to another fishing ground. The Hawaiian fisherman was much too clever to do this, and he respected the traditions of his people too much to do it. Laws today cannot help to preserve the fish in Hawaiian waters, unless in addition to the laws, we have a feeling of respect for them and observe them because we see that they are beneficial. (Maunupau in Handy et al. 1981)

Maunupau's sentiments are still echoed today amongst native fishing practitioners and should serve as a valued reminder of the importance of maintaining Hawaiʻi's precious fishing grounds. Another component of the traditional Hawaiian approach to marine resource management was maintaining designated fishing grounds, known as *koʻa*, where non-current swimming *iʻa* (fish) congregated, fed, and slept.

Koʻa

Koʻa fishing has a long standing history in West Hawaiʻi as a valued cultural practice. Even since the introduction of modern fishing technologies, fishing for *ʻōpelu* using *koʻa* remains a living cultural expression deeply anchored in familiar cultural mores. Accounts describing *ʻōpelu* fishing utilizing *koʻa* are well recorded in historical literature. Designated fishing grounds known as *koʻa*, often identified as either a depression or a mound on the floor of deep parts of the ocean, were places guaranteed to yield a great quantity of fish for *poʻe lawaiʻa* who fished there. However, in order to preserve the long-term integrity of the *koʻa, poʻe lawaiʻa* would only fish them selectively, ensuring that they did not overharvest them, lest they would be spoiled forever (Handy et al. 1981). Some *koʻa* were species-specific and bore the corresponding names of the species found at them, such as *ʻahi* (*koʻa hī ʻahi*), *ʻōpelu (koʻa ʻōpelu),* and *kāhala* (*koʻa hī kāhala*) (Kamakau 1976). Maunupau, the old Kona fisherman quoted above (in Handy et al. 1981:105), characterized *koʻa* as "an area in which fish were always found." He related that regarding *aku koʻa* in particular:

> It was a depression in the bottom of the ocean and was particularly deep. The Hawaiians knew just where to go to find fish. They did not fish just anywhere over the ocean, but only in those places where fish were always found. They found good fishing grounds, located them by certain marks, and never missed the place. The koa is not so important in aku fishing because aku swim with the current, but it is very important in deep sea fishing. However, the fisherman who knows where the koa is can always go there and get his fish. Today a person can watch from shore and see schools of aku going in a certain direction and disappearing at a certain spot. This is a koa. The fish either go to that hole and sleep or they simply remain there. At any rate, they may be found there the next day. The experienced Hawaiian fisherman of the present does not fish outside the koa. (ibid.)

As expressed by Kaʻelemakule, within Kekaha in North Kona, fishing for *aku*, *ʻahi*, and *ʻōpelu* was commonly practiced at the famed *koʻa* of Haleʻōhiʻu:

> . . . Among the important fishing practices of Kekaha, that I was taught in my youth were *aku* fishing, *ahi* fishing, and fishing for *opelu* with nets. These were the important fishing customs that I was taught...
>
> Fishing for these fish was done at the *koʻa ʻōpelu (ʻōpelu* fishing station or grounds), that was not too far out. And beyond that, was the *koʻa* for *aku* and *ʻahi* fishing. The *koʻa* for these fish (the *ʻahi* and *aku),* was the famous *koʻa lawaiʻa* (fishing ground) of Kekaha, known by the name, "Haleʻōhiu." (Kaʻelemakule in Handy et al. 1981:223)

Similarly, Issac W. H. Kihe also wrote about the famed fishing *koʻa* between Keāhole Point in North Kona and ʻUpolu Point in Kohala. Kihe, who often used the pen name Ka Ohu Haaheo i na Kuahiwi Ekolu, authored a series of articles that were published in the Hawaiian language newspaper, *Ka Hōkū O Hawaiʻi* between September 13th, 1923 and August 28th, 1924. An excerpt is taken from his October 11th, 1923, article in which Kihe described the location and names of these fishing *koʻa*:

> *Aia i mua o keia lae ma ka aoao maloko he ale hohonu a ma ia wahi e kahe mai ai ka wiliau me ka Ikaika a pii maluna o ua pohaku nei a kahi aku la me he waikahe ala no kekahi muliwai a loaa aku la na ko'a hi-aku, hi-ahi, kahala, opakapaka, a pela wale aku.*
>
> *O kekahi oia mau ko'a lawaia, o Paoo, o Opae, o Kahakai, o Kahakina, o Kahawai, o Kapapu, o Kanahahe, o Kaluahine, o Kanukuhale, o Kahoowaha, o Honu, o Muliwai, kiei i ka lepo o Haena i Kohala…* (Kihe 1923:1)

> Located in front of this point, on the inner side of the deep billows, where the current flows with force, ascending up over this rock and flowing out like a flood from a river mouth until reaching the fishing grounds for *aku*, *ahi*, *kahala*, *ʻōpakapaka*, and other such fish.
>
> Some of these fishing grounds were named Pāoʻo, ʻŌpae, Kahakai, Kahakina, Kahawai, Kapapu, Kanahahe, Kaluahine, Kanukuhale, Kahoʻowaha, Honu, Muliwai peering towards the land of Hāʻena in Kohala…

Although *ʻōpelu* fishing could be conducted in shallow waters, they were perhaps, more prevalent at offshore *koʻa* where they could be found in great abundance. In this manner, *ʻōpelu* were traditionally caught by net or by line using various types of bait including *ʻōpae ʻula* (a tiny endemic red shrimp). Within Kona, *ʻōpelu* were caught by the hundreds along the coastline of Kalaemanō (National Park Service Ala Kahakai National Historic Trail 2007). John Kaʻelemakule, Sr., who wrote a series of articles that were published in the Hawaiian language newspaper *Ka Hoku o Hawaii* between 1928 and 1930 describing life along the North Kona coast, related that fishing for *ʻōpelu* was of great importance to the Hawaiians, particularly within Kona, where this type of fish served as one of the primary sources of sustenance. Kaʻelemakule describes the practice and nuances of *ʻōpelu* fishing in the Kekaha region of Kona at a *koʻa ʻōpelu* called Kaloahale in Awalua during the calm season:

> *ʻŌpelu* fishing was another one of the important practices of these islands in ancient times; it was perhaps the foremost of the practices in the streaked sea *(kai māʻokʻioki)* of Kona. It became the type of fishing that contributed to the livelihood of the fishermen and their families... For *ʻōpelu* fishing, two men are adequate in going on the canoe to the place of the *koʻa ʻōpelu* which has been known since the days of the ancient people. It is at a place where one can look below and see the fish, that he prepares to feed the *ʻōpelu.* The man at the front of the canoe is the fisherman, the one who is prepared for this manner of fishing, he leads in all things for this kind of fishing.
>
> There in front of the fisherman was set out the bait of the *ʻōpelu,* that is the *ʻōpae ʻula* (red shrimp) and sometimes other baits as well. He'd give the man at the back of the canoe the bait, this man would do whatever the fisherman told him to. The man in the back had a stone weight, the black dirt, and the coconut sheath in which the *ʻōpae ʻula* or other bait would be placed and folded in. This would be wrapped with cordage and let down into the water about 2 or three fathoms deep, then the man would jerk the cord and the bait would be released. The water would be blackened by the dirt, and this would help the fisherman see the *ʻōpelu* eating in the water. . .When many *ʻōpelu* were seen, he would have the man feed the fish again and lower the net into the water. While the *ʻōpelu* were eating, the net was drawn up, and as the fish tried to swim down, they were caught in the net... While I was a youth living at my beloved land of Mahaiʻula, I fished for *ʻōpelu.* I went with my foster father, Kaʻaikaula, to fish for *ʻōpelu* at the *koʻa ʻōpelu (ʻōpelu* fishing ground) called "Kaloahale," it was directly seaward of the black sand shore of Awalua. . .
>
> ...When the calm weather returned to the land of Kekaha, that was the time that one saw the *lehua* blossoms return to the sea [a poetical description of the people from the uplands who dwelt in the area of growth of the *lehua* trees, and who returned to the shore for fishing in good weather]. It was then, that I would also see the fleets of canoes traveling from one extremity to the other upon the sea of my beloved land. At those times, people were also seen looking for *aku,* the fruit of the sea. It was at this time that I entered into the business of trading the fine dried fish of the land, taking them to Kawaihae and sending them to Honolulu. I continued this work for some time, moving forward without any problems befalling me. As a result, I accumulated quite a bit of money, which I kept hidden in one of the caves of the land. . .
>
> When my new house was completed, Poke, my foster mother, named the house "Kalāhikiola." We spoke about this and I desired to have a song for our house on the day of the feast for moving into the house. . .As we prepared for the feast to enter the house, there were not many things that would be set out, but they were things which we Hawaiians were accustomed to. It was *poi; kālua* (roast) pig; *poi palau* (taro pudding); and things of the ocean, like the *ʻōpihi* (limpets), *limu* (seaweeds), *wana* (urchins); and the fat *awa* (milkfish) that came from the fishpond of Makalawena *(awa momona o ka loko iʻa o Makalawena)*. . . (Kaʻelemakule in Maly and Maly 2003:224)

Theodore Kelsey, who spent his entire life recording Hawaiian traditions, further elaborated on the significance of the *ʻōpelu* to the *kanaka*, who regarded the fish as sacred (ibid.). This belief appears to have originated during the arrival of the 12th century Tahitian priest, Pāʻao, who while on his journey to Hawaiʻi encountered dreadful weather. Hapai (1920) relates that in an effort to placate the *akua* and calm the ocean, Pāʻao tossed his *aku* and *ʻōpelu* overboard, which almost immediately cleared the weather, making for a safe journey. Pāʻao then called the fish back to his boat and upon his arrival to Hawaii Island, he liberated the *aku* and the *ʻōpelu* in nearshore waters (ibid.). Titcomb (1972) relates that "at Kalae in Kaʻu, there was a special *heiau* called Kalalea for the *ʻopelu.*" Kelsey also describes a sacred feeding ceremony conducted by *poʻe lawaiʻa* during a span of four months in Kona, when the *ʻōpelu* were offered as tribute:

> By far the most important of the fishes thus fed was the sacred *ʻopelu*, which in turn with the *aku*-fish was tabued in ancient times for six months of the year. Next to the *ʻopelu* came the *nenue*, which congregated close inshore. For a few days it might be fed previous to catching it with net, fish-trap, or hook. The bait, cooked in an underground oven for the purpose, was a sea-moss known as *limu-ʻakiʻaki.* The *kala*-fish, found in the same locations as the *nenue,* was also fed at times. It was caught in basket-traps, using *limu-kala* sea-weed for bait. To a very limited extent eels were fattened on crushed *manini* or other fish. Fed on crabs, at times, were such charming pets as devil-fish. Sharks (*mano*), regarded as ancestral guardians known as ʻaumakuas, were sometimes reared from infancy. Like faithful dogs they would follow their masters while in or upon the ocean. Many a tale is told of how faithful sharks saved the lives of their keepers by bearing them ashore on their backs. A most interesting case of feeding, is such it may be called, was the insertion of pebbles into the mother-of-pearl bivalves known as *papaua* (pah-pah-ooʻ-wuh), which when matured were known as pas. The pebbles caused the shells to increase in size and strength for use as trolling-spoons, also known as pas, for catching *aku*-fish. The land of Kona, Hawaii, was particularly renowned for its excellent pas.
>
> Opelus, after the abrogation of the old tabu-system, were not fed and caught at any time. No indeed, there were special periods for these purposes. In Puna, Hawaii, the season of feeding and catching combined lasted from October through December. In Kona, where *ʻopelu* fishing assumed considerable proportions, the fish were fed from May to August. From August to December they repaid the hospitality of their hosts.
>
> At the opening of the *ʻopelu*-feeding season in Kona an interesting ancient ceremony, probably performed in the same manner in other localities, took place just before sunset on the night previous to setting forth. This was to secure the favor of the fish-god. To this deity, accompanied by weird chanting and prayer, were offered a cup of the divine *ʻawa,* a small sacred black pig cooked in an *imu,* and consecrated red fish, red *tapa,* and a red *malo* or loin-cloth.
>
> Imagine a fleet of graceful outrigger canoes paddled by stalwart brown fishermen, gliding swiftly, just before sunrise, over the tranquil sea, the beautiful variegated sea of Kona (Kona *kai malino, kai maʻokiʻoki*). With them, in gourd calabashes (*ipu pohue*), or open-mouthed food-containers of *lauhala (poho lauhala)* they bear a tempting repast for the *ʻopelus*. Rap! Rap! Rap! They strike the outsides of their canoes with their paddles, chanting impressively, perchance, the while. In this interesting manner fish were called to meals in olden days. A man in each canoe would rap a few handfuls of food, together with a flat stone for a sinker, in a piece of brown coconut-fibre cloth that grows at the base of the long crowning leaves. The parcels were then lowered into the sea to a depth of say two fathoms, to which the fish were to become accustomed, and released by a jerk of the line so that they showered downward in tasty morsels. Cloth and stone were then hauled in for another load. *ʻOpelu* breakfast was served. Toward sunset many of these fish-stewards provided supper for the ʻopelus. In most localities a few days of such stewardship were deemed sufficient. (Kelsey in Maly and Maly 2003:224)

While *koʻa* themselves were established as underwater fish habitats, they also had a connection to the land, for the locations of fishing *koʻa* were identified using markers on the shore. In some cases, these markers were geological features, such as *puʻu* (hills), but the markers could also be single stones or piles of rocks intentionally placed along the shore to coincide with the underwater location of the *koʻa*:

> Perhaps the most important stones in ancient times were the *kuʻula* and *koa* stones of the fishermen. *Koa* stones—either natural stone outcrops or stone piles used for marking and finding fishing grounds—could be located near fishing grounds or simply used to triangulate their location. Some *koa* were nothing more than piles of stones built up in the ocean by members of a fishing family. Such *koa* might be markers for a natural fishing ground or serve to attract a fish colony. (Gutmanis 1991:26)

Some of these markers also served as fishing shrines where Kānaka Maoli made offerings and recited prayers either hoping to secure a good catch, or expressing gratitude for the sea's bounty. Elbert and Pukui (1986) explain that these types of structural *ko'a* were utilized in ceremonies that would cause the fish to multiply. Malo relates the following details regarding how *kanaka* used two points on the land to triangulate the location of deep sea *ko'a*:

> These koa-lawaia were so deep under water that the eye failed to perceive them, nor could the fish be seen when swimming over them, nor when they seized the hook. In order to find them, it was necessary to take one's bearings from the land. Two bearings were required; and where these were found to intersect, there was the koa, and there the fisherman let down his hook or his net. (1951:211)

In the late 19th century publication *Hawaiian Fisheries and Methods of Fishing*, Beckley elaborates on how *kanaka* used their deep understanding of the Islands' terrain, both beneath the sea and on land, for fishing:

> . . . Every rocky protuberance from the bottom of the sea for miles out, in the waters surrounding the islands, was well known to the ancient fishermen, and so were the different kinds of rock fish likely to be met with on each separate rock. The ordinary habitat of every known species of Hawaiian fishes was also well known to them. They often went fishing so far out from land as to be entirely out of sight of the low lands and mountain slopes and took their bearing for the purpose of ascertaining the rock which was the habitat of the particular fish they were after, from the positions of the different mountain peaks. (1883:10)

Locating underwater *ko'a* was only one part of a successful catch. In order to ensure that they would return with food, *po'e lawai'a* had to combine their knowledge of each particular *i'a* sought with their understanding of the most practical materials, methods, and *palu* (bait) for catching them. They also had to observe very specific *kapu* that were dependent upon their particular *akua*, and spiritually express their intent and thankfulness through rituals conducted both prior to, and after, fishing. A *po'e lawai'a*'s success could be enhanced through the spiritual guidance provided by an *akua* that dwelled within a *ko'a* stone, which was sometimes associated with a *kū'ula* (discussed in the following section).

Kū'ula

A *kū'ula*, meaning "red Kū," is "any stone god used to attract fish, whether tiny or enormous, carved or natural, named for the god of fishermen;" (Figure 15) it is also a "heiau near the sea for worship of fish gods;" and a "hut where fish gear was kept with kū'ula images so that gear might be impregnated with kū'ula mana, usually inland and very taboo" (Pukui and Elbert 1986:187). Maunupau, who was intimately familiar with the various *ko'a* and their respective *kū'ula* situated along the Kona coastline, particularly those associated with Hale'ōhi'u, relates that "the fishermen of old Hawaii believed that they needed some supernatural power to aid them in their undertaking, and hence religion and fishing were closely connected by ceremonies and customs" (in Handy et al. 1981:106). Maunupau provides the following details about *kū'ula*:

> . . . In the olden days, every heiau or temple had in it a fish god or kuula. Each fisherman had his own kuula. Perhaps it might be a stone or image he had pulled up in the ocean, and which he regarded from then on as his kuula, or it might be the family god or aumakua. The kuula was supposed to bring luck and success in fishing. (ibid:105.)

In describing the purpose of the *kū'ula*, Kihe (1924:4) relates that "*…aia maia wahi he kuula, oia hoi, he wahi hooulu i'a a maia wahi e hanaia ai na hana hoomana hooulu i'a, a hoolaupa'i a hoomomona hoi i ka i'a…*[located at this place was a *kū'ula*, that is, a place to increase the fish and at the place is where ritual occurred to increase the fish, and multiply and fatten the fish…]." Large *kū'ula* were often "set up on promontories along the sea shores, or near streams and ponds…small *kū'ula* were carried to sea in the fishing canoes to attract fish" (2001:151). Some *kū'ula* were contained within *heiau* and "set in circular enclosures, nearly always built of limestone or coral," (ibid.). An altar (*ko'a*) consisting of a platform of stone placed before the *kū'ula*, was where the offerings were placed, and:

> Within the enclosure of the large shrine, sometimes called a heiau *ko'a*, an *imu* was kept. Here pigs were cooked and eaten, along with other feast foods, as part of the ceremony of dedicating a new fishnet. Also within the area was a *lele* altar where bananas were offered. These may be a tribute to Kanaloa who is associated with bananas. (These fruits were never carried to sea by fishermen.)
>
> The customs seem to have differed among the fishermen as to the number of fish that would be left on the fishing shrine when they returned from a successful catch. This is understandable since the fishermen prayed to and respected their own family *'aumakua* as well as Kū'ula.

> Upon returning from the sea some fishermen went to the *koʻa* with two fish in their right hand for the male *ʻaumākua* and two in their left hand for the female *ʻaumākua*. They addressed the gods and placed the fish on the altar. After the gods had received the "essence" (*aka*) of the offering the fishermen were free to take the fish away and add them to the catch for distribution and use.
>
> Maunupau wrote that the first fish caught was marked by cutting off its tail. It was placed in the bow of the canoe and was *kapu*. When ashore the fishermen placed this fish on the *kūʻula* for his *ʻaumakua*. (ibid.151–152)

The cycle of giving back to the *akua* was accomplished through regulatory tribute associated with the *kūʻula*. There are contrasting accounts as to how this was accomplished, but Maunupau relates that "the first fish caught was marked with a tail or fin mark and saved as an offering to the kuula" (Honolulu Star-Bulletin 1931). Similarly, Keliʻipio and Nakuina (1900:111), writing during the late 19th century, expanded upon this practice:

> The first fish caught by fishermen, or any one else, was marked and dedicated to Kuula. After this offering was made, Kuula's right therein being thus recognized, they were free from further oblations so far as that particular variety of fish offered was concerned. All fishermen, from Hawaii to Niihau, observed this custom religiously. When the fishermen caught a large supply, whether by the net, hook or shell, but one of a kind, as just stated, was reserved as an offering to Kuula; the remainder was then free to the people.

Offerings at the *kūʻula* were made immediately upon the return of the canoe to the shore:

> As soon as the fishing fleet reached the shore, the head fisherman stepped ashore holding an aku fish in each hand and went to the heiau of Kuʻula where he offered prayer; and when he had finished this worship of the god, he threw down the fishes for the male aumakua on one side and those for the female on the other. (Kamakau in Titcomb 1972:44)

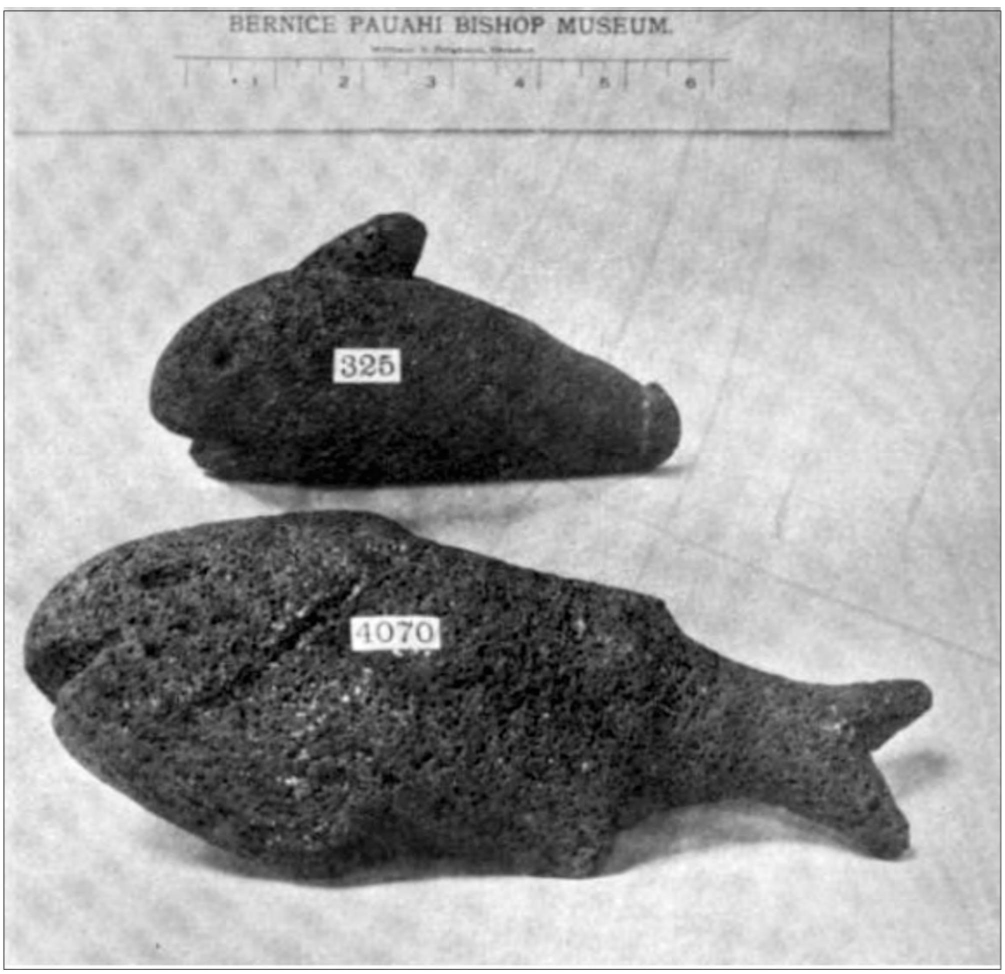

Figure 15. *Kūʻula* stones (Brigham 1902:94)

Kūʻula (lit. red Kū) bear the name of Kūkaʻilimoku, an *akua* traditionally associated with war. Fishermen often prayed, and still pray, to Kūkaʻilimoku and his wife Hina (Beckwith 1970:11). Kūkaʻilimoku, as the ruler over all of the male gods, had dominion over Kūʻulakai, an *aliʻi* and *akua* of Hānā, Maui, who himself controlled "all the gods of the sea" (ibid.:19). Valeri (1985:76) relates that Kūʻulakai married Hinapukuiʻa ("Hina gathering seafood"), whose dominion was over the shoreline, and to them was born their son ʻAiʻai ("eats food"). Fishing stones dedicated to Hina and ʻAiʻai were once utilized by the ancient fishers of Hawaiʻi. The *mana* of Hina was said to control certain fish, namely the *aku*, *akule*, *ʻōʻio*, *moi*, *aʻu*, and the *manini* (Fornander 1919–1920). Fornander relates that things that were reddish in color were considered sacred to Kū. Therefore, in addition to *ʻaumākua*, *kūʻula* stones were imbued with the spirit of their namesake Kūʻulakai as well as Kūkaʻilimoku. The following account, compiled by June Gutmanis (from George Ai, Louis Aila, Ned Burgess, Arthur K. Cathcart, Ah Sam Cheong, Thomas Maunupau, Kalahikiola Naluelua, Henry Young, and Maryknoll Kalahikiola Sotkaeff), details how *kūʻula* stones acquired the spirits within them. This account explains the mutually beneficial relationship between *kūʻula* and their *poʻe lawaiʻa* caretakers:

> *Kuʻula* stones were believed to contain a spirit that attracted fish and helped fishermen. They could be either naturally shaped stones or slightly worked. According to tradition, the naturally shaped stones contained a spirit, either placed there by the gods or there of its own choice. A man-made *kuʻula* was believed to receive its spirit only after appropriate prayers and offerings had been made. The *kuʻula* could be either of black- or light-colored stone; some said that the dark stones were male and the light ones female.
>
> A naturally formed *kuʻula* might be found by a fisherman realizing that the stone contained a spirit. Other times, it was believed, a stone chose a fisherman for its *kahu* (caretaker). It might come to him in a dream, saying, "I am cold, come and get me." The fisherman would ask, "What do you say? Where are you?" The stone would then describe just where it was and how to find it, what to bring as an offering, and when to come for it. Sometimes the stone would not reveal what it wanted the first time it appeared in a dream. It might take days, weeks, or even months before the stone revealed its whereabouts. If the stone was female and the dreamer a man, the stone might even flirt with him.
>
> The dreamer would search for the stone, carefully following all the directions given by the *kuʻula*. When found, the stone would have the mouth of a fish. It when then be taken home and put in a *kapu* (taboo) place where nothing could disturb it. Only the guardian chosen by the stone could handle it. It was believed that if others handled it and the stone did not wish them to, it would become hot like fire.
>
> Those who had *kuʻula* stones believed that caring for them was as serious as caring for a baby. The guardian would ask the *pohaku* (stone) what it wanted. The answer would come in a dream or vision. The *kuʻula* had to be fed three meals a day. If even one meal were missed, the guardian could be in for trouble. It also needed clothing—a *malo* (loincloth) that could be wrapped around the stone or used as a blanket. The *malo* had to be kept very clean.
>
> According to tradition, if the stone was well cared for and all of the requirements met, its guardian would profit richly. It was said that the more you gave the stone, the more fish you would catch. Lights, laughter, and activity would bless the home of the caretaker.
>
> Sometimes the *kuʻula* would vanish. Like a little child it would go out to play and disappear. But apparently it always knew when it was time to come home and would then reappear.
>
> A person in need of help would traditionally make offerings to the stone and wait. It might take days or even months, but when the stone was ready, it would give the location of a school of fish. It would also tell what time of day the fish would appear and what line or net and bait to use. When caught, the fish were to be shared with everyone. Pregnant women customarily received double the share of others. (Gutmanis 1991:26–28)

As Gutmanis goes on to relate, an important aspect of the keeping of *kūʻula* was that they were transferred from one generation to the next:

> A *kuʻula* could be used for generations. When the guardian had grown old, the stone would tell him who the next caretaker should be. It would know which child in the family should carry on the tradition. It was believed that the stone could "fall in love" with anyone.

> Sometimes the *ku'ula* would be given to a member of the family, but the guardian would not tell the chosen person the purpose of the stone. One night the stone would come to its new caretaker and reveal its name, its work, and how to care for it. It could be within a few days or it might take years.
>
> Belief in the *ku'ula* and *koa* stones continues. The traditions surrounding them are still practiced by some, and the recipient of such a stone must care for it. Its powers are unknown and untapped. The stone may be a source of power for good, and, if treated with respect, one that will reward its guardian richly. (Gutmanis 1991:26–28)

Thus, the continued care and worship of *kū'ula* by Hawaiian *po'e lawai'a* was a quintessential spiritual practice and heritable custom that endures as a tangible connection to the past. Drawing upon the knowledge of the ancient *po'e lawai'a*, whose spirits remain tied to the depths of the *kai* and the treasured *kai lawai'a* (fishing grounds), it is clear that the Kānaka Maoli revered all marine life and holistically managed the marine resources. Since becoming a *po'e lawai'a* was a privilege, each fisher felt a deep respect for the ocean's cosmic connection with the heavens and the earth, and while it was their job to provide food for their *'ohana* and *ali'i* on land, they made it their *kuleana* to protect and perpetuate the ancient fishing grounds. Although the *'ike* (knowledge) of Kānaka Maoli extended from the mountain tops to the depths of the ocean, for the purposes of the current study, the remaining discussion will focus on the traditional fishing methods, beliefs, and cultural practices associated with the nearshore fisheries that are within the study area vicinity.

Loko I 'a: Fishponds

Another method by which the Kānaka Maoli were able to sustainably support the population of these islands was through the creation of a distinctly Hawaiian aquaculture system, known as *loko i'a* (fishponds). *Loko* is the general term used to refer to any pond, lake or pool of water and *i'a* referring to the fish that were raised therein (Pukui and Elbert 1986). With respect to the study area, such features are concentrated primarily within the Kona and South Kohala portion of the WHRFMA. While the initial origins of *loko i'a* remain largely unknown, traditional lore associates this engineering feat with Kū'ulakai (Fornander 1919–1920; Valeri 1985). Kū'ulakai is said to have built a large fishpond next to his home that was filled with fish (ibid.). These fish were considered the bodies of Kū'ulakai, his wife Hinapukui'a, and their son 'Ai'ai, all of whom were important fishing gods (Fornander 1919–1920).

In their 1975 study, Apple and Kikuchi identified five primary types:1) *loko kuapā*, characterized by its seawall (*kuapā*) in which at least one *makahā* (sluice gate) was built; 2) *loko pu'uone* (or *loko hakuone*), identifiable by its natural elongated sand barrier that enclosed a body of water; 3) *loko wai*, a body of fresh water typically found inland from the shoreline; 4) *loko i'a kalo* (or *loko lo'i kalo*), a fishpond that utilized an irrigated taro plot; and 5) the *loko 'ume'iki*, a fish trap recognizable by its numerous stone-flanked lanes that allowed fish to move into or out of the trap with the ebb and flow of the tide. With the exception of *loko wai* and *loko i'a kalo*, which were inland freshwater ponds, all remaining fishponds were constructed within the littoral zone and were nourished from a mixture of freshwater (*wai*) and seawater (*kai*) (Keala et al. 2007).

Although *loko i'a* varied in shape and size, they were a component of the total food production system in Precontact times and their primary purpose, as purported by Apple and Kikuchi (1975:6), was to make "fresh food, available in quantity at call…" Keala et al. (2007) elaborate on this, noting that fishponds "…were used to provide a reliable, convenient, and every-ready supply of fresh seafood for the ruling ali'i (chief) and the royal court." During Precontact times, and even into the early Historic period, all *loko i'a* and their products were strictly controlled by the ruling class. In relating the importance of *loko i'a* to Hawaiian nobility and the indirect benefits to the general populace, Apple and Kikuchi write:

> Access to these ponds and their products was limited to the elite minority of the native population-- the chiefs and priest. Prehistoric ponds and pond products appear to have been taboo to the vast majority of Hawaiians and to have yielded them no direct benefit. However, indirect public benefit came from ownership by the chiefs of exclusive food sources. Royal fishponds and their terrestrial equivalents, the royal gardens (Kō'ele), insured less demand on the commoners' food production resources. Every fish taken from a royal fishpond left its counterpart in natural habitat available to lesser chiefs and commoners. Ownership of one or more fishponds was one of the ultimate, high-status symbols in the status-conscious Hawaiian culture. (Apple and Kikuchi 1975:2)

Traditionally, herbivores, specifically the *'ama'ama* (mullet; *Mugil cephalus*) and *awa* (milkfish; *Chanos chanos*) were the primary species raised with *loko i'a*. While grown primarily for food, these two species were part of a grouping of fish that were traditionally known as *pua'a kai*, literally translated as "sea pig," which were used as a substitute for pig offerings (Pukui and Elbert 1986:345). Other species of fish that were considered *pua'a kai* included the *āhole* (*Kuhlia sandvicensis*), *humuhumunukunukuapuaa'a* (*Rhinecanthus* sp.), *kūmū* (*Parupeneus porphyreus*), and *pualu* (*Acanthurus* sp.). Tribute to the respective gods was an important component of maintaining a fishpond and detailed in the account concerning the great fishpond of Pā'aiea which was consumed by Pele after being denied fish from the head fisherman (Maguire 1926).

Although fishponds and its products were closely guarded by the ruling *ali'i*, and practically off-limits to the common people, they provided for a sustainable and ever-ready supply of fish for the massive royal courts that were established along the coast of the current study area. While constructing a fishpond was an enormous undertaking, requiring the labor of many individuals, maintaining it did not require as much labor, unless the fishpond was impacted by severe weather or war (Apple and Kikuchi 1975). The use of fishponds was another component of the traditional marine management strategies employed by the Kānaka Maoli that helped reduce pressure on the nearshore resources, while at the same time providing a sustainable source of food.

TRADITIONAL HAWAIIAN NEARSHORE FISHING TECHNIQUES

Kānaka Maoli were tremendously adept *po'e lawai'a* (fishers) who were intimately connected to the *kai* and its underwater environment. They were innately adapted to its dynamic moods and were sensitive to the ocean's ever-changing conditions and, as a result, they developed a plethora of methods which they used to harvest its bounty wherever they lived. Fishing methods varied greatly within *nā papakū o ka moana* (the strata of the ocean), with "a different method in shallow water, and in deep water, and a different method again in the fishing grounds midocean" (Fornander 1920:174). While smaller reef fish, *limu*, shellfish, echinoids, and crabs could be gathered from shallow nearshore waters and along the rocky shoreline of the study area, to access the *kai lawai'a* within the open ocean, *kanaka* used *wa'a* (canoes) and specific fishing techniques designed to reach deep-sea fish. The larger deep-water fish species that were "treasured most for subsistence" included *'ahi*, *aku*, *a'u*, *mahimahi*, *nai'a*, *kumu*, *'ōpelu*, *pānuhunuhu*, *hala hala*, *uhu*, and *ulua* (Handy and Pukui 1998:223). Typically, deep-sea fishing was conducted during the summer months when particular types of *i'a* were more plentiful. Handy and Pukui (ibid.:176) also describe gender base division of labor associated with harvest zones of the ocean, noting that "offshore, reef and along-shore fishing was the function of men, while the collecting of shellfish, sea urchins, crabs and the like, and seaweed was done by women and children."

Traditional shallow water and intertidal marine zones identified by Malo (1951) and elaborated on by Fornander (1920) and Kamakau (1979) included the *'ae kai*, also referred to as *lihi kai* (water's edge), the *pāhola*, also known as the *hohola* or *pālaha* (where the water spread about), the *pu'eone*, (sand dunes), also the *po'ina nalu*, *po'ina a kai,* or *po'ina kai* (where the waves break). There were also places specifically designated for the catching of small black crabs known as the *kai 'elemihi* and *kai haha pāpa'i*, and for the gathering of cowry, or *leho* (*kai 'o leho*). Similarly, *uhu* (parrotfish) were gathered in the shallow waters known as *kai kākā uhu* with dip nets such as the *'upena pōuouo*, *'upena kākā uhu*, or *'upena kākā 'ōpule* often lured by another *pākali* (decoy) *uhu* (Kahā'uelio 2006). Pole fishing (*kā mākoi*) was conducted in shallower waters when the *kai paeaea* (calm seas) occurred (Kamakau 1979).

Fishing required careful preparation of not only the fishing tools, but also deliberate composure of the mind, body, and spirit to properly attune with nature (Handy et al. 1981). Careful protocol was observed in each step of the preparation for fishing from the shaping and lashing of *makau* (hooks) or *pā* (lures),to the sewing and weaving of *'upena* (nets) and *hīna'i* (baskets), to the shaping of *'ō* (spears), to the storing of the different fishing apparatuses, to the observation of *kapu* by members of the *'ohana* and the required silence prior to an expedition (ibid.). While the harvesting of nearshore marine resources was a year-round endeavor, offshore fishing was typically done when the sea was calm (Handy and Pukui 1998).

The methods used for fishing were dependent upon the type of fish, or intertidal species, that was sought. Some methods required nothing more than a gentle, but swift hand and a watchful eye, while other methods required specialized fishing apparatuses that were crafted from a blend of natural materials including, but not limited to, processed plant fibers, shell, bone, wood, stone, and yellowed foliage. Some fishing methods was done on an individual basis, but as demonstrated below, the traditional practice of near-shore fishing at times involved all able-bodied persons regardless of age or gender. Some of these methods are described by the honorable Daniel Kahā'ulelio, who recognized the immeasurable value of preserving, sustaining, and sharing generational knowledge of ancient Hawaiian fishing practices passed down from his *mākua* and *kūpuna*. After being approached by the editor of *Ka Nūpepa Kū'oko'a*, Kahā'ulelio consented to pen a series of columns detailing Hawaiian fishing methodology, the first of which was published on February 24th, 1902. Subsequent to his passing, Kahā'ulelio's articles, originally written in Hawaiian, were translated into the English language by Mary Kawena Pukui. Kahā'ulelio's comprehensive narratives offer precious insight into traditional methods of marine resource procurement, many of which are filled with personal recollections.

Twentieth-century scholar and *limu* expert, Isabella Abbott, in drawing from an assortment of manuscripts from early works of J. F. G. Stokes, W. T. Bringham, and native scholars like Kamakau, also compiled a great deal of information on traditional fishing methods that is summarized here. Her work focused more on the ethnobotanical uses of plants in Hawaiian culture, and was published in her book, *Lāʻau Hawaiʻi Traditional Hawaiian Uses of Plants*. The descriptions of near shore fishing methods recorded by Abbott are presented below.

In the late 1960s, Thomas S. Newman (1970) compiled information about nearshore fishing methods, which he published in his dissertation titled *Makai—Mauka: Fishing and Farming on the Island of Hawaii in A.D. 1778.* Newman (ibid.:49), who attempted to "reconstruct sea exploitation practices for specific time periods" compiled information from late 18th and 19th-century accounts. Newman relied almost exclusively on the works of Emma Metcalf Beckley (1883) and John Cobb (1902). Accordingly, 20th-century sources were omitted from his synopsis as, according to Newman (1970:49), these sources failed to provide "(1) demonstratable authority on the subject and (2) a careful delineation of the time period reflected in their descriptions." Cobb (1902), who worked for the United States Fish Commission, spent three months in 1901 gathering data on commercial fisheries in Hawaiʻi, which included observational research, interviews with local fisherman, and analysis of government documents newspapers and other pertinent records. Emma Metcalf Beckley Nakuina was an early Hawaiian female judge who presided over water rights cases. She also wrote extensively about Hawaiian culture and folklore (Hopkins 2012). Newman, in his work, provides a graphic (Figure 16) that shows the maritime econiches in Hawaiʻi during the 19th century. The nearshore fishing methods compiled by Newman are elaborated on in the ensuing paragraphs.

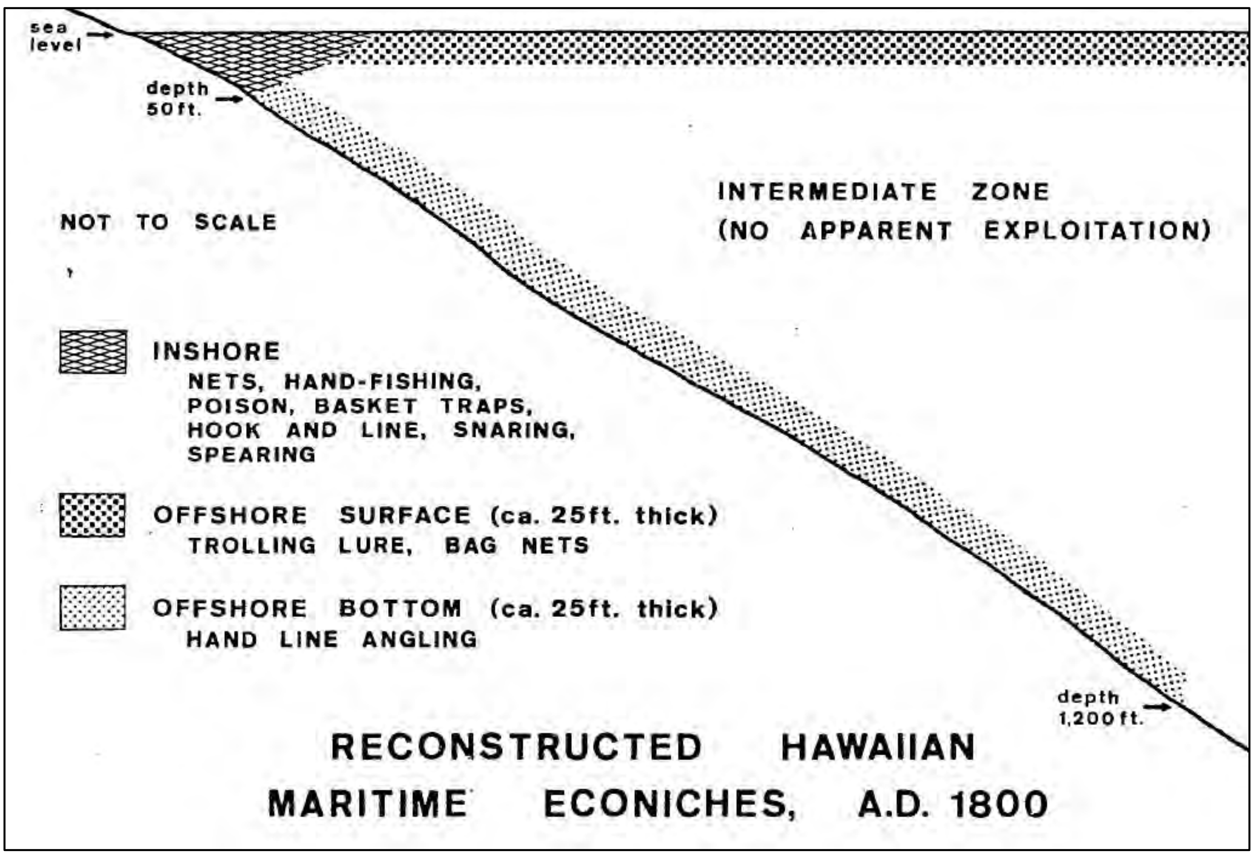

Figure 16. Diagram showing Hawaiian maritime econiches during A.D. 1800 (Newman 1970:92).

Basket Traps

Broadly known as *hīnaʻī*, basket traps (Figure 17) were created from the roots of climbing *ʻieʻie* (*Freycinetia arborea*) plant and crude versions of *hīnaʻī* were sometimes made from the vines of the *ʻāwikiwiki* (*Canavalia galeata*) (Abbott 1992). Abbott (ibid.:84) also relates that both "men and women alike laid traps in the reef shallows for small-to medium-sized fish such as *hīnālea*." *Hīnaʻi* were of various shapes and sizes and some were baited and weighted down with a sinker (see Figure 17). *Hīnaʻi* were also employed when catching freshwater stream fish including *ʻōpae* (shrimp) and *ʻoʻopu*, which was a practice done almost exclusively by women. Relating to basket traps, Newman (1970:52–53) related the following:

> Relatively few basket traps were made and most were used by women to catch ʻopae, hinalea, kala, and ʻuiʻui. The traps were woven from fresh vines or flexible branches into box-shaped designs. In one common technique, a simple basket was lowered to the bottom in shallow water, often with a bait of pounded shrimp inside and when fish entered the trap, the woman watching nearby would dive to bring the trap to the surface. A more sophisticated version had a conical woven entry protruding into the interior where it terminated in an opening only large enough for a fish to squeeze through. The trap, baited with seaweed, ripe bread- fruit or papayas, cooked pumpkins or sweet potatoes, was lowered to the bottom, and when the fish entered by the conical entry they were unable to find their way back again.

Figure 17. Example of *hīnaʻi* (Kahāʻuelio 2006:192).

Hand Collecting

Hand collecting, which often required nothing more than a swift hand and watchful eye and a storage vessel, was utilized to catch a variety of nearshore species. In describing the method of hand collecting, a practice that was done by scouring and or diving the nearshore areas, Newman writes:

> Collecting by hand was practiced in shallow water, both on the surface and by diving. Some types of fish were caught by hand in shallow pools as well as by divers in underwater caves while other food items collected by hand included crabs, lobsters, eels, sea urchins, sea cucumbers, shellfish,

> octopi, shrimp, and seaweed. Much of this type of exploitation was practiced at night, particularly for mobile fauna. No items of material culture were used except for fiber containers in which the organisms were placed, and perhaps the torches used at night to mesmerize fish (Newman 1970:51).

Hook and Line

Although the hook and line method of fishing was conducted in offshore waters, it was also employed in the nearshore waters, sometimes being attached to a long wood pole. Abbott (1992:83) notes that "hooks were mainly fabricated from non-plant materials—pearl shell, turtle shell, ivory, and bone—but hardwoods like *'alahe'e* and *koai'e* (*Acacia koaia*) also played a minor part." Abbott (ibid.) notes that "…wood served only for the shaft of the two-part hook, the second part being a sharp tip made of bone or another substance that would hold a fine edge." The fibers from the hardy *olonā* (*Touchardia latifolia*) were the choice material for fishing lines. To camouflage the white fibers, fishing lines as well as nets were often dyed a reddish brown by immersing it in a dye bath made of pounded *kukui* (*Aleurites mollucana*) bark (Langlas 2003). Along the high cliffs of the Puna District of Hawai'i Island, native residents employed a methods known as *kau lā'au* to catch large *ulua* (jacks). This method required a relatively long and straight *'ōhi'a* (*Metrosideros polymorpha*) pole, which was extended off the cliff with its base fastened into a crevice. The baited hook and line was then hung from the *'āmana* (Y-shaped cross piece) that was located at the tip of the pole down where it was suspended just above the water (ibid.). In some cases the fisher, using just a baited hook and line, simply cast the rig into the ocean from the shore. In describing the use of a hook and line attached to a pole, Newman (1970:62) explains:

> Sub-surface angling was done with a pole and line in shallow water and with hand lines for deep-water bottom fishing…Some were attached directly to the hook, while the palu [chum] bait was merely rubbed on the hook; often a bag of bait was lowered near the baited hooks and released underwater.

Newman also describes a slightly more complex hook and line contraption called *kākā*. In describing how this technique was carried out, he writes:

> Kākā Technique:-- Deep-water bottom fishing used a rig of multiple hooks attached by short leaders to the main 3/8th incl (1.7 cm.) fish line at intervals close to the bottom. Each short line with the hook attached was supported by a section of coconut midrib lashed perpendicular to the main fish line which served to keep the multiple hooks separated from one another and from the main line. (ibid.)

Lures

Fishing lures crafted from a combination of stone, shell, wood, and plant fibers were a popular method utilized in offshore trolling, as well as in the nearshore waters. While mother-of-pearl shell was the primary material used for trolling lures, which were attached to a line a dragged behind a canoe and used to catch offshore pelagic species, near shore lures were far more specialized, and often used to capture octopus. Octopus lures were known as *lūhe'e* (Figure 18) and in describing their composition, Abbott (1992:86) notes:

> In the pre-contact era, octopus was a very highly regarded food, and besides spearing these animals in their holes, Hawaiian fishermen caught them from canoes using two kinds of lures. The simple of the pair consisted of a hood of wood or bone lashed to a stick, a stone attached as a sinker, and a tuft of *tī* leaves to camouflage the hook. The second lure included all these elements but also incorporated the colorful, shiny shell of a Mauritius or tiger cowry (*leho*), bound back to back with the sinker. Since an octopus puts up a good fight, these lures were ruggedly built, tied with *olonā* cordage and perhaps secured with *kēpau* as well.
>
> Similar lures have been made and used throughout Polynesia since time immemorial and, in the hands of a skilled fisherman, are very effective. The octopus (today commonly referred to in Hawai'i as "squid") is a keen-eyed animal generally curious about objects introduced into its environment, and it feeds on cowries, so a *leho* lure presented it a double temptation as the fisherman slowly dragged it, cowrie side up, along the bottom.

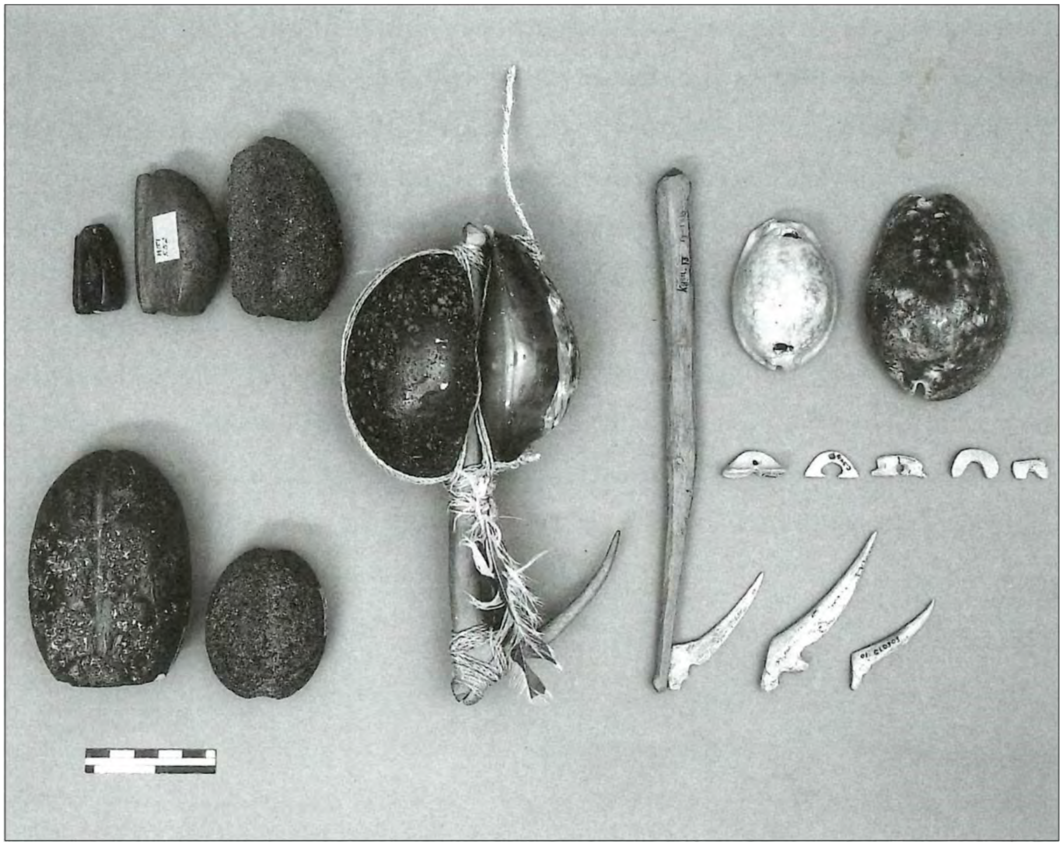

Figure 18. Complete *lūheʻe* (center) and associated components (Kahāʻuelio 2006:70).

Netting

ʻUpena (nets) of various shapes, mesh width, and sizes were widely used for traditional nearshore and offshore fishing. The fibers of *olonā* (*Touchardia latifolia*) were the primary material from which nets and fishing lines were made. *Olonā* required careful cultivation and could only be grown in the wetter upland areas. For the fishers who relied on these valued fibers, procuring such material necessitated exchange with those of the uplands—a hallmark activity of the *ahupuaʻa* system (Abbott 1992). Traveling along the coastal areas, it is common to see fishers perched low on the rocky reef with long cone shaped nets dangling around their bodies and hands. This type of cast net, although known in Hawaiian as *ʻupena hoʻolei*, was introduced by Asian migrants during the 19th century (Mitchell 2001). Elbert and Pukui (1986) list some thirty or so names that were used to distinguish net types. Abbott (1992), however, states that the myriad of nets that were traditionally employed can be categorized into four primary types: *ʻupena kuʻu* (gill nets); *ʻupena paloa* (seine nets); *hukilau* (long seine nets), and scoop nets. The amount of culture-historical information available regarding traditional net fishing suggests that these methods were perhaps one of the most popular fishing methods utilized by Kānaka Maoli for the capture of both near and offshore fish species. The different types of nets and netting strategies traditionally used for fishing are described in further detail below.

ʻUpena kuʻu (gill nets)

In describing the *ʻupena kuʻu* (Figure 19) Abbott writes:

> *ʻUpena Kuʻu* (gill nets): These larger nets, with mesh up to three centimers (one inch) in diameter, were set upright in the water to carch schools of fish such as *ʻōpelu*, and *ʻakule*, species related to the mackerel. They worked by entangling the fills of the swimming fish and ranged from as short as seven meters (twenty-three feet) to ten times that length. (Abbott 1992:83)

Newman (1970:53-54) also provided a late 19th century description of gill nets, noting:

> Gill nets were designed to entangle the fish in a net with a fairly large mesh instead of merely trapping them within an encircling small mesh net wall as was done with seines and bag nets. Gill nets were manufactured in different sizes according to the type of fish to be caught and the habitat

to be exploited, ranging in length from about 55 feet (17 meters) to over 1,200 feet (366 meters), in depth from seven feet (2 meters) to 25 feet (8 meters), with mesh size from one-half to seven inches (1.2 to 17.7 cm.).Three basic techniques were used in gill netting:

1. letting the net remain stationary and allowing the fish to entangle themselves in the mesh;
2. driving the fish into a stationary net; or
3. moving the gill net to encircle the fish and then scaring them into the entangling mesh.

Stationary gill nets were often placed at high tide across shallow openings in the coral reef at night to entangle any fish navigating the fish run. Nets used in this fashion usually had a mesh of two to two and one-half inches (5 to 6 cm.).

Drawn gill nets were used to either completely encircle fish or to arc a half-circle around them before the fish were scared into the net by fishermen beating and splashing he water from within the circle or across the open end of the semi-circle. Sometimes, the nets were·drawn up on the shore after the fish were meshed but at other times, the fish were taken out of the nets and put into canoes.

Lobsters were caught in a special gill net, with a seven-inch (18 cm.) mesh, by placing the net completely around a rock cluster and leaving it in place all night to entangle the lobsters as they came out of the rock cairn.

Gill nets used for specific fish included:

1. a net measuring some 1,200 feet (366 meters) in length, 25 feet (8 meters) in depth, with a mesh of four inches (10 cm.) used to encircle a school of akule, and
2. a gill net some 540 to 900 feet (165 to 275 meters) long, 12 to 18 feet (4 to 5 meters) deep with a three to four inch (8 to 10 cm.) mesh used just outside the reef or breakers to encircle larger fish such as the ‘o‘io.)

Figure 19. Girl with gill net, pre-1900s (Hawai‘i State Archives Call No. PP-34-8-008).

ʻUpena pāloa (seine nets)

In describing the *ʻupena paloa* Abbott writes:

> *ʻUpena Paloa* (seine nets) were similar nets, but usually longer, with a large midportion or "bag." Rather then capturing fish by entangling them in the mesh itself, seines encircled the prey. Like gill nets, they were held upright in the water, their upper edged suspended from floats made of *hau* wood, the lower portions weighted with stone sinkers. Using large gill nets and seines was a community operation, involving a large number of people, numerous small canoes, and a lot of cooperation. (Abbott 1992:83-84)

Adding to Abbott's discussion about the *ʻupena kuʻu*, Newman (1970:55) relates the following:

> A Hawaiian seine was a net deployed in the water and moved horizontally, trapping fish by impounding them within a complete circle formed by the net, or between the net and the shoreline. The fish were not normally entangled in the mesh as with a gill net, but rather were kept within a small circle by the net wall where they could be scooped out with small bag nets or dragged bodily onshore, net and all. A bag net was often used in conjunction with a seine and this combination will be discussed later. Seines varied in length from about six to over 350 feet (2 to 107 meters) in length, with the common large net measuring some 150 to 350 feet (46 to 107 meters) in length, about 10 feet (3 meters) in depth, with a mesh width of several inches. The net size and mesh type seem to have been dependent upon the particular types of fish to be caught and the habitats to be exploited.

Hukilau/Lau (long seine nets)

In detailing the use of long seine nets, which she referred to as *hukilau*, Abbott explains:

> *Hukilau* nets were used to capture smaller fish in shallow waters, usually in sandy-bottomed bays. The *hukilau* nets were shorter versions of the seine, with *tī* leaves tied along the top to alarm the fish and drive them into the center of the net. Setting a *hukilau* net, too, was a large, cooperative endeavor but with much of the work done by waders rather than from canoes. (Abbott 1992:84)

While Abbott refers to the large seine nets as *hukilau*, Kahāʻulelio (2006) uses the term *lau* to describe large seine nets, and notes that *hukilau* was a specific cooperative fishing method that involved the use of a *lau* net. Kahāʻulelio (ibid.) describes several cooperative fishing methods, which was done under the direct supervision of a *poʻo lawaiʻa* (head fishermen) and employed the effort of men, women, and children (Figure 20). Kahāʻulelio (2006:3) notes that "these people became the owners and shareholders in this kind of fishing." Although a great deal of labor and knowledge was involved in the preparation and execution of this method, it provided an abundance of reef fish such as *ʻōpule*, *moi liʻi*, *palapala*, *kūmū*, *weke*, *kala*, *manini*, *moano*, *uhu*, *ʻōʻio*, *hilu*, *ʻaʻawa* and others that were divided to feed multiple *ʻohana* (families). The type of fish caught, however, was dependent upon the nature of the area in which this type of fishing was performed. This method, known broadly as *lau*, is described by Kahāʻulelio as having two distinguishing types. The primary types, which included the methods known as *lau nui*, *lau lele*, *lau kapalili*, and *lau ʻapoʻapo*, utilized large draglines and were "done outside of the surf line, or where there was no surfline" (ibid.:3). The lesser types, which included the methods known as *lauahi*, *lau ʻōhua*, *lau ʻōhia liko*, *lau kō ʻupena pahu*, and the *lau kō pua liʻiliʻi*, utilized drag nets and were "done within the reef" (ibid.).

Kahāʻulelio (ibid.) describes the *lau* nets as being sewn together from at least three distinct nets that contained a different mesh width. These nets were traditionally crafted from the fibers harvested from *wauke* (*Broussonetia papyrifera*) and *olonā.* Once the net was crafted, men, women, and children were ordered to the uplands to gather yellowed foliage of plants such as *tī* or *maiʻa* (banana), along with dried *wiliwili* (*Erythrina sandwicensis*) wood, or dried gourds, for use as floats that were attached to the dragline and knotted with *tī* leaves.

In detailing the general nature of how the *lau* method was conducted, Kahāʻulelio (ibid.) explains that with the *lau nui* method the net, which was attached to the dragline was loaded onto a canoe along with divers who took the net out to a depth of about fifteen fathoms. At the command of the *poʻo lawai*ʻa (head fisherman), and with the aid of several other canoes, the divers carefully placed and arranged the net in the ocean and watched as the men in the canoe slowly paddled the canoes and net closer to shore. Explaining how the *lau* net was moved into shore, Kahāʻulelio writes:

> At that place, fifteen fathoms in depth, which I had mentioned before, the *lau* is let down to about half of the depth and is moved evenly up to a depth of four or five fathoms or less. The drag line goes almost to the sea floor but it doesn't completely touch, lest it snag on the corals or catch in hollows. When the stone anchors of the *lau* canoes are set, the men begin to pull the *lau* lines, six

or seven men per canoe. When the sun shines directly down on the line, the shadows of the *lau* drive the fish shoreward to the place where the lines are being drawn. (2006:5)

As the net was drawn closer to shore, the *po'o lawai'a* and divers continued to monitor and adjust the net. The *po'o lawai'a* then determined where to lay the *papa* net, which measured roughly six to seven fathoms in length. While the *lau* net was used to usher the fish closer to shore, the *papa* net was used to catch the fish that were brought in. As the fish came closer to shore, the *papa* net was placed at the opening end of the *lau* net. The divers continued to watch as the fish entered into the *papa* net, and when it was time the *po'o lawai'a* called for the lifting of the net into the canoe. Kahā'ulelio (ibid.:7) writes that "at this excited time, like a garden laden with flowers, such are the colors of the fish then as they surge excitedly to and fro, eager to find a way out." Kahā'ulelio (ibid.:7, 9) adds that "the canoe to hold the fish draws near and the man the head fisherman placed on that canoe is hard-hearted, cross and stingy so that people don't crowd about and their hands plow in, bringing misfortune to the group."

Kahā'ulelio (ibid.) goes on to describe the lesser types of *lau* fishing, one of which was *lau kapalili* (see Figure 20). Executed in a manner similar to the *lau nui* method, the *lau kapalili* technique utilized a much smaller net and was carried out in sandy areas and lagoons. The net was dragged shoreward and the people dragged the net from the shore to the beach, where the fish flapped (*kapalili*) on the sand.

Figure 20. *Lau kapalili* method of net fishing ca. 1930 (Kahā'uelio 2006:18).

The *lau ahi* fishing method was carried out during dark nights with no wave action. The net was drawn shoreward within the surf break into a sheltered bay. Kahā'ulelio (ibid.) describes the *lau 'ōhua* method as being carried out primarily by children and women, noting that the men aided only in drawing the *lau* net to shore. The fish caught using this method included juvenile wrasses such as the *'ōhua pa'awela* and *'akilolo*.

The *lau 'ōhua liko* method utilized a fine mesh net that measured roughly a fathom in length. The small mesh size allowed for the capturing of small shrimp and other small fish that lived around a heaped up cairn of rocks known as an *imu* or an *ahu*. The name used, however, varied from place to place. This method was typically employed in the early morning during low tides. Kahā'ulelio (ibid.) notes that when mosquito netting became available during the Historic Period it was also used in the *lau 'ōhua liko* method. The fine mesh net was placed around the stone cairn and people removed the stones one by one until none remained. The fleeing fish and shrimp were caught in the net then placed into a small pail and later consumed.

The *lau kō pua* method was done by children and adults during the wettest time of the rainy months when the streams were swollen, and the ponds near the beach would break open to the sea. This influx of freshwater attracted schools of tiny fish that were ushered into the sandy shore by children using yellowed banana leaves. The children and adults then picked up the small fish either by hand, or during the Historic Period by using mosquito netting. The captured fish were placed into a calabash and eaten later. In reflecting upon more recent fishing regulations of the 20th century, Kahāʻulelio (ibid.:13) laments that "because laws have been made about catching such small fish, this type of fishing is no longer seen."

The final of the lesser type of *lau* fishing detailed by Kahāʻulelio (ibid.:13) is the *lau kō pahu ʻanae*, which he describes as the "easiest kinds of fishing." This method was used to catch *ʻanae* and required the labor of four men, two of which kept control of the bag net while the other two controlled the *lau* dragline. The men worked in unison to bring the dragline and net together to draw in a school of *ʻanae*. This method was sometimes repeated four or five times, and as many as eighty or more fish could be caught.

Scoop Nets

The final net types recorded by Abbott (1992) are hand held scoop nets (Figure 21), which she describes as follows:

> …scoop nets with handles and sometimes with closure mechanisms served a variety of purposes, including catching fish attempting to leap out of seine or *hukilau* nets. These small, one-person nets were also employed to catch crabs and freshwater shrimp (*ʻōpae*), the latter being a speciality of women. Scoope net handles and closure were frequently made from the endemic shrub *ʻūlei* (*Osteomeles anthyllidifolia*), whose spreading branches can be easily bent into loops. The ends of the piece were lashed together with corn to form the handles of the net. (ibid.:84)

Newman (1970) also details the use of scoop nets, but he instead refers to them as "bag nets" with two specific types: hand held ones, and those that were manipulated by attached ropes. Newman's description of these nets reads thusly:

> Bag nets were made into an enclosed purse with only one open end; or alternately were flat pieces of netting that were closed into a self-contained bag by manipulating attached flexible sticks in a particular manner to seal it. Although bag nets were extensively used in conjunction with seines, there was a great diversity of bag nets used alone, and these seem to have been quite specialized by type of fish to be caught. An initial ordering of these different types may be made on the basis of use technique: (1) hand held, and (2) manipulated by attached ropes.
>
> Hand Held Bag Nets:--The hand-held bag nets were fine meshed small nets fitted on a flexible wooden hoop which held the mouth open, used for dipping out fish trapped by an encircling sein net; for scooping up fish at night in very shallow water areas, usually by torchlight which mesmerized the fish; or by being held across the opening of an underwater hole by a diver while the fish hiding inside were herded into the net with a stick.
>
> Rope Manipulated Bag Nets and Baits:--Bag nets manipulated by attached ropes were often used with some form of bait to draw the fish into the net. Common baits were cooked pumpkin, squash, sweet potatoes, kukui and coconut meat; raw mashed bananas, papaya, breadfruit or taro; pounded up fish, sea urchins, shrimp or eels; whole small fish such as nehu, ʻiao, and akule; or a special mixture called palu which was based on the cooked ink bag of the octopus pounded into a paste with ingredients added such as the juices of various plants, salt, spices, kerosene, tobacco juice, liquor, or Perry Davis Pain Killer. These different baits were often mixed with sand, to make the bait sink, and then placed in the water near as well as inside the bag net to attract fish. Some of these baits are obviously the result of European diffusion. When the fish, usually ʻopelu, were inside the bag, it was lifted to the surface by the attached ropes. (Newman 1970:56-57)

Figure 21. *Kanaka* with scoop net ca. 1925 (Cobb 1905:716).

Poisoning

The use of plant-based poisons for fishing in Hawai‘i involved the use of two primary agents, the *‘auhuhu* (*Tephrosia purpurea*) and *‘ākia* (Wikstroemia sp.). These agents, which can still be found within the study area today, “were crushed, either with a mortar and pestle or with rocks found by the shore,” and then scattered in tide pools, “and in a few minutes the small fish that were present would float to the surface and could be picked up.” (Abbott 1992:86). Abbott emphasizes that:

> This effect did not last more than twenty or so minutes, depending on the size of the tide pool and the speed with which fresh seawater entered in and diluted the toxin. Any fish that were washed out of the pools or overlooked in the gathering would recover and swim away, since the toxins merely stupefied the fish rather than killing them outright. In this sense, these old “poisons” more closely resembled modern fish anesthetics than the chemical rotenone, another plant derivative used to catch fish, from which fish do not recover. No data suggest that *‘auhuhu* or *‘ākia* toxins are transferred to humans through consumption of fish caught in this way. (Abbott 1992:86)

In relating his knowledge of plant-based poisons, which also describes the use of *‘auhuhu* (written by Newman as *ahuhu*) and *‘ākia*, Newman writes:

> Although fish poisoning was made a misdemeanor by legislation in 1850 (Jordan and Evermann 1902:365), it was still reported by Cobb in 1902. Poisons used were of plant origin and made of pounded ahuhu (<u>Tephrosia</u> <u>purpurea</u>) and ‘akia (<u>Diplomorpha</u> <u>sandwicensis</u>) to be inserted into underwater caves; the fish were not affected as a human food by it [*sic*]. For obvious reasons there are no data available on poisoned fish in the 1900 commercial market. (Newman 1970:51)

Newman also cites Campbell (1967), who described fish poisoning in the same manner as Cobb for the late nineteenth century, but notes that he stated that the fish were instantly gutted after being poisoned to keep the poison from affecting the quality of the flesh. Cobb (1902), on the otherhand, states that the poison did not affect the flesh.

Snaring

The use of snares is described by Newman as a nearshore fishing method employed only on Hawai‘i Island. In referencing the writing of Cobb (1902), Newman relates:

> Cobb notes that he only saw snares being used on Hawaii Island and not on any of the other major islands. He says that eels and lobsters were the primary objects of snaring. A noose on a pole was placed in front of an eel hole, bait placed outside and when the eel stuck its head outside the hole to get the bait, the noose was drawn tight and the eel brought to the surface with the pole. A noose attached to a long pole with a forked end was also lowered near bait and the line slipped under the tail of a lobster.(Newman 1970:51–52)

Abbott also describes snares being used to catch sharks using the *kūpalupalu manō* (shark chumming) method. Abbott notes that this method

> …was practiced only by *ali‘i* and only as a form of sport. The game sought—*niuhi*, “man-eating” sharks—were not eaten, although some other sharks were used as food. The snare was made of *hau* rope and baited with human flesh or decomposed pig. To successfully snare a shark and bring it to shore was considered to increase one’s *mana* (spiritual force). (Abbott 1992:86)

Spearing

Traditional *‘ō i‘a* or *pōluhi* (fish spears; Figures 22 and 23) used for catching fish were crafted from several types of hardwood species such as *kauila* (*Alphitonia ponderosa*), *uhiuhi* (*Caesalpinia kavaiensis*), and sometimes *koai‘e* (*Acacia sp.*), while spears used to catch the elusive *he‘e* (octopus) were made from *alahe‘e* (*Psydrax odorata*), *‘ūlei* (*Osteomeles anthyllidifolia*), *‘a‘ali‘i* (*Dodonaea viscosa*), and *uhiuhi* (Abbott 1992). Fish spears typically ranged in length from one to two meters; those used to catch *he‘e* were much longer, ranging anywhere from two to four meters in length (ibid.). Kahā‘ulelio (2006) reports that spear fishing was done either by swimming, or from canoes. Abbott (1992:86) relates that spears “saw heavy service in night-time torch fishing as well as during daylight hours… and were especially useful for picking up sea urchins with venomous spines (*wana*)…” Newman (1970:52) provides the following description of Hawaiian spear fishing, which during the Historic period also included the use of iron tipped spears:

> Fish spears were about six feet long (2 meters), made of a very hard wood tipped with an iron point, and used underwater by a diver who positioned himself on the bottom and impaled fish on the spear as they came close. It was possible to spear more than one fish per dive by allowing them to slip down the spear after they were pierced. Above surface use of spears was restricted to spearing turtles, octopi, ‘o‘opu-hue, and fish mesmerized by torchlight at night in shallow water. No mention was made of spears propelled by slings or elastic bands, such as the “Hawaiian sling,” and these are undoubtedly of twentieth century origin.

While the above-described traditional cultural fishing practices of trapping, hand-collecting, using hook and line, trolling with lures or using octopus lures, netting, poisoning, snaring, and spearing reflect the tangible methods used by *po‘e lawai‘a* to harvest marine resources, the following section will explore Hawaiian fish nomenclature, which then leads into a discussion of cultural uses of the “white-list” species. The Kānaka Maoli connection to the sea, and all its lifeforms, is further reinforced by ways in which fish were categorized, named, and used.

Figure 22. Spear fishing ca. 1890 (Kahāʻuelio 2006).

Figure 23. *Kanaka* diving into ocean with spear (Grosvenor 1909:11).

HAWAIIAN FISH NOMENCLATURE

Keen awareness of the natural world, coupled with their high degree of dependency upon marine resources, culminated over time in a complex naming system for Hawaiian marine resources that conveyed not just descriptive information, but other important cultural information as well. Hawaiian fish nomenclature mirrors other aspects of traditional Hawaiian society, where detailed naming practices helped to categorize the seemingly endless varieties of small reef fishes. Hawaiian fish nomenclature has endured to this day through its constant use—a practice that speaks to both the cultural value of fish, and the importance of intergenerational transmission of knowledge. Titcomb (1972:51) relates that "some names of fishes show the relationship of Hawaiians to other Polynesians, and are therefore very old," but that "many names are peculiar to Hawaii." Fish names were maintained through direct use, as well as through the creation of chants that served as a memory aid (ibid.).

According to Malo (1951) all products of the ocean and in freshwater streams and rivers, whether mobile or not, were considered *iʻa* (fish). For instance, the various species of *limu* (seaweed) were included in the category of *iʻa* (ibid.). Likewise, Titcomb (1972) conveys that the term *iʻa* was applied to vertebrates and invertebrates alike, even "those that were utterly useless as food and of no importance in any other way." Titcomb further relates that Hawaiians gave two names to most fish, one designating the kind (or species), the other designating a group characteristic. The names usually chosen for fish were descriptive of the colour, structure or habitat, such as "(1) colour: *lelo* (reddish), *mele* (yellow), *uli* or *uliuli* (blue, also means green, dark-coloured, that is, the colour of the deep blue sea), *kahauli* (dark-striped), *kea* (white); (2) form: *poʻonui* (large-headed), *waha nui* (large mouthed); (3) a special characteristic: *makaonaona* (bright-eyed); *moe* (sleeping), *holo* (travelling), *kaʻakaʻa lāʻau* (stick rolling), *pili koʻa* (coral clinging) (ibid.:50-51). This traditional system of nomenclature is exemplified in the naming of wrasses, which were known broadly as *hīnālea*, and triggerfish known as *humuhumu* (Pukui and Elbert 1986).

Qualifiers describing prominent traits were sometimes added after the general name to identify specific species. This rule was, however, not universally applied as indicated by other examples, which include surgeonfishes (inclusive of tangs and unicorn fish, identified by their sharp protuberances). In this case, individual species were known by specific names such as *manini* (*Acanthurus triostegus*; convict tang), *kala* (*Naso unicornis*; unicorn fish), *kole* (*Ctenochaetus strigosus*), *māʻiʻi* (*Acanthurus nigrofuscus*), and *palani* (*Acanthurus dussumieri*) (ibid.).

Similarly, names were given to distinguish the growth stages of fish, with the terms *ʻōhua* or *ʻāhua* being used to refer to the schooling of juvenile fish, especially the young of reef fish such as *hīnālea*, *humuhumu*, *kala*, *kūpou*, *manini*, *pualu*, and *uhu* (Pukui and Elbert 1986). Fish that were cultivated in fishponds, including the *ʻamaʻama* or mullet, were the subject of close observation, and the names given to these fish were based on size, with *pua* being used to refer to fish that were a finger length, and *kahaha* being used to refer to fish that had reached hand length (Titcomb 1972).

While *iʻa* was broadest term used to refer to all sorts of marine species, fish that dwelled on the coral reefs were termed *iʻa o ke koʻa* (lit. fish of the reef), while those that lived in deeper waters were referred to as *iʻa o ke kai uli* (lit. fish of the deep sea) (ibid.). Kānaka Maoli also distinguished and named the anatomical features of fish, both the exterior features as well as the principal internal organs. Titcomb (1972:54) provides a list of the anatomical terms that were given to the various parts of the fish, which is reproduced below in Table 2.While some fish names were widely used across all marine territories, Titcomb states that:

> In spite of conscious effort to hand down knowledge, names for some fish names did vary from island to island, and even from one part of an island to another. This may be due in part to faults of memory, though memories were trained to astonishing capacity, and in part to a conscious wish to call a fish by what seemed a more appropriate name. (ibid.:49)

Understanding how Kānaka Maoli categorized and named the various marine species provides insight into understanding the cultural value and uses were ascribed to them. The following section discusses the specific cultural uses of the forty fish species on the white-list for the WHFRMA.

Table 2. List of Hawaiian anatomical terms given various parts of the fish (from Titcomb 1972:54).

Hawaiian Term	*English Equivalent*	*Hawaiian Term*	*English Equivalent*
nuku, or *nukunuku*	nose	*kualā*	dorsal fin (same for soft dorsal)
lae	frontal region over eye	*unahi*	scales
alo	chest	*unahi kalakala*	the rough scales from mid-body to tail of certain fishes-scutes
alo piko	belly	*kakala*	knife-like cartilage near the tail (as in the surgeon fishes)
mahamaha	gill plate	*hi'u*	tail
api	gill opening	*pewa*	tail fin
pihapiha	gills	*umiumi*	barbels (same term as is used for beard of a man)
halo	gill fin	*kiwi*	the "unicorn" of the *kala* fish

CULTURAL USES OF THE "WHITE LIST" SPECIES

In an effort to identify any traditional cultural uses, practices, and beliefs associated with the forty fish species on the "white-list," the authors of this report began by identifying and compiling the Hawaiian name(s) associated with each of them (Table 3). To verify the accuracy, and to address any discrepancies in traditional naming practices, the Hawaiian names were cross-referenced using various primary and secondary sources, which are cited in the ensuing paragraphs. Once all known Hawaiian names were identified and correlated, additional cultural information was gathered for each of the forty species from various primary and secondary sources written in both the Hawaiian and English languages. The information compiled from these sources summarizes the continued cultural uses of these fish throughout the Precontact and Historic periods. Compiling the Hawaiian names for reef fish was approached with much caution and careful consideration, as the Hawaiian names for the fish in the written literature include many inconsistencies, as well as conflicting naming information. Many fish, especially wrasses and butterflyfishes were traditionally known by multiple names, some of which were qualifiers for specific characteristics. Additionally, Kānaka Maoli gave names to the different growth stages of certain fish, which further adds to the difficulty of understanding the conflicting nomenclature. Where known, the growth stage names are discussed below under the relevant fish subheading, but are not included in Table 3. The Hawaiian fish names presented in Table 3 should not be considered an exhaustive list, as it may not capture regional names, or names used locally by certain families or individuals.

Despite the challenges mentioned above, a significant amount of information was found with respect to traditional subsistence practices, beliefs, customs, and general cultural uses of the white-list species. Additionally, the origin status of each fish species—whether they are indigenous, endemic, or invasive—was categorized (see Table 3). This information from collected from Hoover (2007) and the Marine Life Photography database compiled by Keoki and Yuko Stander (www.marinelifephotography.com). Obviously. more culture-historical information is available for the indigenous and endemic fish species, than for invasive species, which arrived to these islands more recently.

Acanthurus achilles (*pākukui*, *pākuikui*, *pāku'iku'i*)

The Achilles tang (*Acanthurus achilles*), or *pāku'iku'i*, is a feisty surgeonfish that measures from six to eight inches long (Titcomb 1972). This fish is described by Hoover (2007:141) "as blueish black with an orange-red teardrop-shaped patch over the scalpel and a white-edged orange-red bar on the tail fin." Its fins are trimmed with white and white stripes are also observed near the mouth and under the eye (ibid.). The spelling and pronunciation of the Hawaiian names for this fish, which include *pākukui*, *pākuikui*, and *pāku'iku'i*, vary. Pukui and Elbert (1986:306) note that this fish was considered "good eating" and Titcomb (1972) adds that this fish was "always cooked" and was "excellent when broiled." An excerpt from a riddle published in the Hawaiian language newspaper *Ka Nūpepa Kū'oko'a* reads "…*Pakuikui, he wahi i'a ono i'o ano kupono keia kalele leo ana Halale ke kai i ka lehelehe*," which translates to "pakuikui, a truly delicious fish and is just right with a lip smacking sauce" (Kuhelemai Jr. 1907).

Table 3. "White-list" species with known Hawaiian name(s) and status.

Scientific Name	*Hawaiian Names*	*Common Name*	
Acanthurus achilles	*pākukui, pākuikui, pāku'iku'i*	Achilles tang	Indigenous
Acanthurus dussumieri	*palani*	eyestripe surgeonfish	Indigenous
Acanthurus nigricans	unknown	goldrim surgeonfish	Indigenous
Acanthurus nigrofuscus	*mā'i'i'i, mā'i'i*	brown surgeonfish, lavender tang	Indigenous
Acanthurus olivaceus	*na'ena'e*	orangeband surgeonfish	Indigenous
Acanthurus thompsoni	species of *kala*	Thompson's surgeonfish	Indigenous
Anampses chrysocephalus	species of *hīnālea*	psychedelic wrasse	Endemic
Canthigaster jactator	unknown	whitespotted Toby	Endemic
Centropyge fisheri	unknown	Fisher's angelfish	Indigenous
Centropyge potteri	unknown	Potter's angelfish	Endemic
Cephalopholis argus	unknown	peacock grouper, *roi*	Invasive
Chaetodon kleinii	*kīkākapu, kapuhili, lauhau, lauwiliwili*	blacklip butterflyfish	Indigenous
Chaetodon miliaris	*kīkākapu*	milletseed butterflyfish	Endemic
Chaetodon multicinctus	*kīkākapu*	multiband butterflyfish	Endemic
Chaetodon quadrimaculatus	*lauhau*	fourspot butterflyfish	Indigenous
Chaetodon tinkeri	*kīkākapu, kapuhili, lauhau, lauwiliwili*	Tinker's butterflyfish	Indigenous
Cirrhilabrus jordani	species of *hīnālea*	flame wrasse	Endemic
Cirrhitops fasciatus	*piliko'a*	redbarred hawkfish	Endemic
Coris gaimard	*hīnālea 'akilolo*	yellowtail Coris	Indigenous
Ctenochaetus hawaiiensis	species of *kole*	chevron tang	Indigenous
Ctenochaetus strigosus	*kole, kole makaonaona*	goldring surgeonfish	Endemic
Dascyllus albisella	*'ālo'ilo'i*	Hawaiian Dascyllus	Endemic
Forcipiger flavissimus	*lauwiliwili nukunuku 'oi'oi*	forcepsfish	Indigenous
Gomphosus varius	*hīnālea 'i'iwi*	bird wrasse	Indigenous
Halichoeres ornatissimus	*lā'ō*	ornate wrasse	Endemic
Hemitaurichthys polylepis	*kapuhili*	pyramid butterflyfish	Indigenous
Lutjanus kasmira	unknown	bluestripe snapper, *ta'ape*	Invasive
Macropharyngodon geoffroy	species of *hīnālea*	shortnose wrasse	Endemic
Melichthys niger	*humuhumu 'ele'ele*	black Durgon	Indigenous
Naso lituratus	*umaumalei, kala umaumalei*	orangespine unicornfish	Indigenous
Ostracion meleagris	*pahu, moa*	spotted boxfish	Indigenous
Paracirrhites forsteri	*hilu, hilu piliko'a*	blackside hawkfish	Indigenous
Pseudanthias hawaiiensis	unknown	Hawaiian longfin Anthias	Endemic
Pseudocheilinus octotaenia	species of *hīnālea*	eightline wrasse	Indigenous
Pseudocheilinus tetrataenia	species of *hīnālea*	fourlined wrasse	Indigenous
Pseudojuloides cerasinus	species of *hīnālea*	smalltail wrasse	Indigenous
Sufflamen bursa	*humuhumu lei, humuhumu umaumalei*	lei triggerfish	Indigenous
Thalassoma duperrey	*hīnālea lauwili*	saddle wrasse	Endemic
Xanthichthys auromarginatus	species of *humuhumu*	gilded triggerfish	Indigenous
Zebrasoma flavescens	*lā'ī pala, lau'ī pala*	yellow tang	Indigenous

The *pākuʻikuʻi* is also noted in a chant that appears in the epic saga of Hiʻiakaikapoliopele. The chant associates this fish with Hawaiʻi Island—an island celebrated for its black sands, black pigs, black garments, and the black *pākuikui*. The chant also draws a correlation between the *pākukui* and the *kukui* tree (*Aleurites moluccana*) that grows on land. The portion of the chant that describes the celebrated features of Hawaiʻi Island reads:

Kū i Hawaiʻi ke one	The sand is there at Hawaiʻi
He one ʻeleʻele ke one	The sand is black volcanic sand
He ʻaʻahu ʻeleʻele ka ʻaʻahu	Black garments are the attire
He puaʻa hiwa ka puaʻa	The pig is a black one
He ʻeho ka maʻi, he kukui ka lāʻau.	The sickness is a tumor, the kukui is the remedy.
Hoehaʻa ka uku na Haumea	Haumea's reward is uncertain
Hānau kukui aliʻi, hoʻopumehana i ka poli o Papa	Born is the chiefly kukui, warming Papa's bosom
Hānau ka iʻa, ʻo ka ***pākuikui***	Born is the fish, a **pākuikui**, a nibbling fish
Lilo i kai, kiaʻi ʻia e ke kukui noho i uka	Swept to sea, guarded by the kukui of the uplands
Hānau ka iʻa, o leho hua kukui	Born is the kukui-shell cowry
Lilo i kai, kiaʻi ke kukui i ka uka	Swept to sea, the kukui guards in the uplands
Hānau ka iʻa o ka uka, huahua kukui	Born is the fish of the uplands, fruitful kukui
Lilo i kai, hoʻokanaka kākou i uka nei.	Swept to sea, we populate these lands.
(Hoʻoulumāhiehie 2006a:67)	(Hoʻoulumāhiehie 2006b:64–65)

The *pākuʻikuʻi* is also noted in the second *wā* of the *Kumulipo*, which describes this fish as being the offspring of the *ʻaoʻaonui* (Beckwith 1951; Liliuokalani 1978). The *ʻaoʻaonui*, according to Elbert and Pukui (1986:27), is a juvenile *kūpīpī* (another tyoe of reef fish; *Abudefduf sordidus*). The *Kumulipo* chant also relates that the land counterpart of the *pākuʻikuʻi* is the *laukukui* or *kukui* tree (*Aleurites moluccana*) (Beckwith 1951; Liliuokalani 1978).

Acanthurus dussumieri (*palani*)

The eyestripe surgeonfish (*Acanthurus dussumieri*), commonly known as *palani*, is a popular reef fish that ranges from six to twelve inches in length (Titcomb 1972). *Palani* is characterized by its bright blue tail and underbody, with distinct yellow markings on the dorsal fin, tail, and a yellow band over the eye (Hoover 2007). Its caudal spine is bright white (ibid.). Titcomb (1972:138) reports that "some say that *maiko*, or *maikoiko* is the name of the young; other [*sic*] say *maiko* is a distinct fish.". The *palani* is also noted in the *Kumulipo* as being the fish that bore the *nuku momi*, which is described by Elbert and Pukui (1986:272) as "a variety of jackfish (*Caranx melampugus*)." Titcomb (1972:139). further details the color and markings of the *palani* as having "… a dull bluish olive color, with brassy and bluish markings and shades, a blue line along base of dorsal fin; caudal fin bluish with blackish olive spots."

Palani, meaning "to stink, smell sour or rancid" (Pukui and Elbert 1986:309), is a well-recognized trait of this fish that is documented in *moʻolelo* and *ʻōlelo noʻeau*. One such *ʻōlelo noʻeau* reads, "Hauna ke kai o ka palani," translated as "The *palani* makes a strong smelling soup." (Pukui 1983:59). Pukui (ibid.:59) indicates that this saying was used in reference to "a person of unsavory reputation [who] imparts it to all he does." Titcomb notes that despite its strong odor, the *palani* was a popular fish to eat and was most delightful when broiled (the best method to remove the odor) or cooked in a calabash. If the *palani* was eaten raw, the skin was always removed. In describing a traditional custom for removing the pungent smell, Titcomb referenced a practice that was reported by Lily Akuna, an informant from the Puna District. Akuna notes:

> To remove the odor from such fish as the *palani*, *kala*, or *puwalu*, which are good to eat but have a rank odour, lay the fish across the palms of both hands with the head resting in the left hand and the tail in the right. Inhale over the fish from left to right, and expel the breath violently. Turn the fish over and repeat. (Titcomb 1972:30)

The mythical origin of this fish's foul smell is detailed in the *moʻolelo* of Keʻemalu (also referenced as Keamalu), published in the January 3, 1917 version of the Hawaiian language newspaper, *Ka Hōkū O Hawaiʻi* and retold by Titcomb (1972). In relating this story, Titcomb writes:

> As she floated around in the ocean she recalled what her grandmother, Hina, had told her, that she had an ancestor among the fishes of the sea, named Palani-nui-mahaoʻo. She called to him an in a short time she found herself on her ancestor's back, being borne shoreward. As she was taken back to shore, she was seized with such a desire to urinate that she was unable to control herself and so she urinated on her ancestor. Her ancestor became very angry and left her out at sea. It is said that

> was how the *palani* got its strong odour. When she found herself deserted she chanted a chant of derision to this ancestor… (Titcomb 1972:139)

Handy and Handy (1972:262) named several types of fish, including *palani*, which were commonly raised in fishponds. These fish were raised particularly for ceremonial use, or were reserved for *ali'i*, and "were kept in the pond to breed," while the offspring were raised tame so that they could be removed easily from the pond by hand. During spawning seasons certain fish, one of which included the *palani* were prohibited from being caught or consumed. Additionally, *palani* were considered *kapu* to men (Titcomb 1972). In the March 8, 1923 issue of *Ka Nūpepa Ku'oko'a*, an article titled "*Ka Ho'opakele Ana I Nā I'a*," (Unknown 1923) offered insight into the traditional beliefs and Kānaka Maoli practices regarding the *palani* and other similar fish. Presented is a portion of this article concerning *palani* that was translated by Titcomb:

> Fish such as the manini, the kole, the uhu, the kumu and the **palani** and the kala and many others went into sea pools to live until the tiny fish were grown. No kapus were imposed on them at the spawning season. The mullet, squid, aku, opelu and other fish bore their young in a place that was not sheltered…They were made kapu when the spawning season was near until the months for this duty were over. (Titcomb 1972:14)

Acanthurus nigirican

Dwelling within the surge zone to about thirty feet, the goldrim tang is noted for its black body that bears small white markings below the eyes and behind the mouth (Hoover 2007). Bright yellow stripes are observed on the fin, caudal spine, as well as its dorsal and anal fins (ibid.). The review of historical literature conducted for this study did not reveal any specific Hawaiian name or any specific cultural information related to this species.

Acanthurus nigrofuscus (*mā'i'i'i*, *mā'i'i*)

Mā'i'i, shortened from *mā'i'i'i*, is a small reef fish commonly referred to as the brown surgeonfish or lavender tang (*Acanthurus nigrofuscus*). The name *mā'i'i'i* is also applied to a taro variety (Pukui and Elbert 1986). Its color varies from dark brown to light grayish brown with a lavender-colored tinge (Hoover 2007). Dull orange spots are also present below the eyes (ibid.). In the *Kumulipo*, the *mā'i'i* is noted as the parent fish of the *'ala'ihi*, which according to Elbert and Pukui (1986:17) is the name given to "various species of squirrelfishes of the family Holocentridae." According to Titcomb (1972), some accounts state that the *mā'i'i* is the name given to the juvenile *pualu* (sometimes spelled as *puwalu*) (Pukui and Elbert 1986:347), another species of surgeonfish (*Acanthurus xanthopterus and A. Mata*), but others argue that *mā'i'i* is its own variety of surgeonfish. Traditionally, the *mā'i'i* was considered a good eating fish that could be eaten both raw and cooked, but was best when broiled (Titcomb 1972).

Acanthurus olivaceus (*na'ena'e*)

The orangeband Surgeonfish (*Acanthurus olivaceus),* also referred to as *na'ena'e* meaning "quick, alert" (Pukui and Elbert 1986:258), is grayish-brown in color with an orange band trimmed with a purple streak that extends along its body. Kent (1986) reports that *na'ena'e* resides on the outer ends of the reef where waves and a sandy beach are present. The name *na'ena'e* is also applied to a native daisy known for its small yellow, orange, purple, or white flower (Pukui and Elbert 1986).

Anampses chrysocephalus, *Cirrhilabrus jordani*, *Macropharyngodon Geoffroy*, *Pseudocheilinus octotaenia*, *Pseudocheilinus tetrataenia*, *Pseudojuloides cerasinus* (*hīnālea*); *Coris gaimardi* (*hīnālea 'akilolo*); *Gomphosus varius* (*hīnālea 'i 'iwi*); *Thalassoma duperrey* (*hīnālea lauwili*);

Hīnālea, occasionally shortened to *ālea*, is a name broadly applied to various species known commonly as wrasses. These fish, distinguished by their elongated bodies, can range in size from three to ten inches long (Hoover 2007; Titcomb 1972). Its colors and attributes vary according to species. Hoover (2007:158) relates that "the general Hawaiian name hīnālea is applied to most, but not all; many of the smaller wrasses have no known Hawaiian names." Elbert and Pukui (1986:71) explain that "*hīnālea* may be qualified by the terms *'ele'ele*, *līpoa*, *lolo*, *nī'au*, *nuku 'i'iwi*, *nuku 'i'iwi 'ula*, *nuku 'i'iwi uli*, *nuku loa*, [and] *nuku loa 'ele'ele*." The *hīnālea* are found primarily in shallow waters, but are also known to live in waters that are as deep as seven to eight fathoms (Titcomb 1972). Their behavior, and the areas in which they dwell, are described in the *'ōlelo no'eau,* "*naueue ka hi'u o ka i'a lewa i ke kai*," literally translated as "the tails of the fish that move in the sea tremble" (Pukui 1983:250). Pukui (ibid.) goes on to explain that this expression was said of fish, such as the *hīnālea*, whose tails can be seen bending as they seek hollows in the corals for hiding during the cold month of Welehu (approximately Novemember). *Hīnālea* are also described in ethnographic literature as having sharp protuberances (Malo 1951).

Specific traditional fishing methods are associated with these fish, including one described by Kahāʻulelio (2006) as *melomelo*, which involved the use of a carefully curated stick used to attract fish (Figure 24). This method, decribed below, was effective in catching various fish including the *palani*, *mahamea*, *ʻōpelu*, *māʻiʻi*, *humuhumu*, and *hīnālea:*

> It was a smooth, black stick, as long as from the knuckles to the armpit. It was made black. It had a small knob at the top, around which the line was tied. The stick was constantly toasted over the fire and rubbed with the oil of dried coconuts. The rubbing was done with a piece of *kapa* made of *mamaki* until it shone; then it was wrapped and laid away in the trunk. If we were to smell it, it was heavily fragrant. The canoe went out before sunrise, just outside of the breakers. There were two of us who used to go, my father and I, with a net having meshes two fingers in width, ten fathoms long, and three wide. As soon as the stick was let down, these fishes gathered to the spot: the *palani, mahamea, ʻōpelu, māʻiʻi (palapala), humuhumu,* ***hīnālea*** and so on. The net was lowered from the back of the canoe, then with a cord of the net held fast in the hand, my father leaped overboard and swam. I, in turn, held the *melomelo* stick. He swam around the canoe, where he came to the sticks that held the nets open. He tied them together and went on board the canoe, where he watched the fish circling around the stick. He jumped back into the water and pulled the support sticks until they met. All the fish were caught and we turned shoreward. My father called this kind of fishing a "morning meal," a "cure for hunger," and when the chiefs wanted fish, it was no trouble to get them. (Kahāʻuelio 2006:111)

Figure 24. Assortment of *melomelo* sticks (Kahāʻuelio 2006:114).

Other traditional fishing methods used to catch *hīnālea* included the use of *hīnaʻi*, or basket traps woven from plant-based fibers. One such basket trap was called *hīnaʻi hoʻoluʻuluʻu* (a diving basket), which was made from the vines of the *ʻāwikiwiki (Canvalia galeata*). The method of using the *hīnaʻi hoʻoluʻuluʻu* is described in the book *Hawaiian Fishing Traditions* as follows:

> The hīnaʻi hoʻoluʻuluʻu [diving basket], used in catching hīnālea (a small species of Julis), is a small basket made from the vines of the ʻāwikiwiki (a convolvulus) and is made anew from day to day as wanted. A light framework of twigs is first tied together and then the ʻāwikiwiki vines, leaves and all, are wound in and out round and round till the baskets is of the requisite size, three or four feet around and about one and a half feet deep. Shrimp pounded and enclosed in coconut fibre [*sic*] is occasionally placed at the bottom of the basket for bait, but usually the scent of the bruised and withering ʻāwikiwiki leaves seems to be sufficient to attract the hīnālea. Women attend to this kind of fishing. They wade out to suitable places, generally small, sandy openings in coral ground or reef, and let the baskets down suitably weighted to keep them in position. The weights are attached in such a way as to be easily detached. Each woman then moves some distance away from her basket, from where she can watch the fish enter it.
>
> When all the fish in sight have entered, the woman takes the basket up, transfers the fish to a large, small-mouthed gourd, and moves the basket to a fresh place. This kind of fishing can only be done on calm, sunny days at low tide. Since the introduction of the weeping willow, the hīnaʻi hoʻoluʻuluʻu are sometimes made from willow twigs. Such baskets can be used over and over again. Men sometimes take such hīnaʻi and using wana (sea urchin) for bait, with the top of the shell broken to expose the meat, place them in comparatively deep water, piling stones around them to keep them in place. The men leave them for a day or two, and if the place is a good fishing ground, the baskets will be full by the time the men return. (Manu et al. 2006:95)

Manu et al. (2006) also describe the use of *kūkulu ʻupena* (standing nets) and *ke kāmākoi*—a fishing pole made of bamboo or *hau* (*Hibiscus tiliaceus*) measuring about eighteen feet long—for catching *hīnālea*. The *ke kāmākoi* method was used from the nearshore reefs where the fisher could cast a hook and line attached to the fishing pole into the sea from the shore. Another method employed traditionally for catching *hīnālea* was poisoning. ʻ*Upena holahola* was the name given to a net that was used in conjunction with certain piscicidal plants that were crushed and placed around a *hīnālea* fish hole. The toxins released from the crushed plants diffused throughout the water thereby paralyzing the trapped fish and causing the *hīnālea* to float to the surface into the *holahola* net (ibid).

Considered a popular fish of the Hawaiian diet, *hīnālea* are referenced in many *moʻolelo*. One origin story of this fish is associated with a female *ʻeʻepa*, or mystical being, who after being angered by two other supernatural beings for helping her unfaithful husband, tore her enemies to pieces and transformed the torn pieces into the *hīnālea* (Kamakau in Titcomb 1972). In the February 8, 1911, issue of *Ke Au Hou*, a Hawaiian language newspaper, John H. Wise published a *moʻolelo* that describes the importance of the *hīnālea* for the conception of a child. In these instances *hīnālea* were used as offerings to the *akua*, or gods, responsible for conceiving a child, namely Kū and Hina. The ceremony involved two *hīnālea* fish that were wrapped in *ti* leaves and cooked on coals. The first fish belonged to Kū, and a chant would be uttered to grant the woman an offspring. If a son was desired the chanter would mention the duties of a man. For a daughter, the duties of a woman would be mentioned. The second *hīnālea* was for Hina, Kū's wife, who was associated with the moon. Chants and prayers were to Hina were given in the same manner as the first fish (Wise 1911).

Hīnālea are also noted in the account of ʻAiʻai, who was the son of Kūʻulakai and Hinapukuiʻa, both of whom were key fishing deities worshiped by the ancient fishers of Hawaiʻi Nei (Fornander 1919–1920; Valeri 1985). Fornander (1919–1920) relates that in ʻAiʻai's attempt to replenish the fish that were taken from the sea by his parents—after being threatened by Kahoalii, a chief of Hāna, Maui—he seeks the help of his friend Pilihawawa. To restore the fish in the sea, ʻAiʻai orders his friend of weave a basket for catching *hīnālea*. After the basket was woven, it was taken to the rocky shore at which point ʻAiʻai summoned the help of his parents by chanting a song that called forth the young *hīnālea* and *ʻōpule* fish. After hearing the calls of her son, Hina ordered her husband Kū to send fish to their son, and as a result droves of fish came onshore, some of which were collected by Pilihawawa. Kūʻulakai then sent in the surf which carried the fish back into the sea.

Manu et al. (2006) also relate another story of the *hīnālea* that appears in the account of Kalamainuʻu, a *moʻo* (lizard) goddess. While on Oʻahu, Kalamainuʻu enticed a young *aliʻi*, Punaʻaikoaʻe, and lured him to her cave on the island of Molokaʻi. Drawn by the beauty of Kalamainuʻu, Punaʻaikoaʻe became her obedient captive and remained in the cave until one day he longed for freedom and to be amongst other people again. Punaʻaikoaʻe overheard the cheers of people down below and became intrigued asking Kalamainuʻu about what he heard. She explained that it was the sounds of people celebrating their victories in the *Makahiki* games. He then asked if he could leave the cave to see the festivities for himself, to which she consented. While mingling with the people, Punaʻaikoaʻe met a man by the name of Hinale, who was the brother of Kalamainuʻu. As they conversed, Hinale discovered that Punaʻaikoaʻe was Kalaimainuʻu's lover and immediately began plotting to free Punaʻaikoaʻe from his sister. As Punaʻaikoaʻe began to carry out his escape from Kalamainuʻu, the *moʻo* goddess learned that the plan had been initiated by her brother, Hinale, and she sought revenge. When Hinale discovered that his sister was after him, he fled to the ocean where he transformed into a *hīnālea*. Kalamainuʻu followed after him, but eventually lost Hinale. She then learned from a hermit crab how to entrap her brother, so she followed his instructions and constructed a basket trap made from the *ʻinalua* (*Cardiospermum halicacabum*) vine. After several attempts, Kalamainuʻu eventually captured her brother in the trap, which "has been the method of catching hīnālea ever since" (Manu et al. 2006:53).

The story titled *The Wind Gourd of Laʻamaomao* (Nakuina 2005) also makes reference to *hīnālea* and notes that it was the preferred fish to cut through the bitterness of the drink known as *ʻawa* (kava). This account relates how *hīnālea* were kept in small sea pools, and collected at the request of a chief. In the preamble to this story, Pākaʻa who was the beloved servant of Keawenuiaʻumi, a chief of Hawaiʻi Island, was unjustly cast out of the king's court and replaced by two new, but inept, servants named Hoʻokeleipuna and Hoʻokeleihilo. These two servants knew very little about the chief's likings, and overtime Keawenuiaʻumi became aware of their incompetence. Longing for his beloved servant, Keawenuiaʻumi and his entourage set out in search of Pākaʻa, who by this time had relocated to Molokaʻi with his wife and son, Kūapākaʻa. After the king's arrival on Molokaʻi, Kūapākaʻa invoked a mystical storm through the use of the sacred wind gourd of Laʻamaomao, which thwarted the king's plan to return to Hawaiʻi Island. To win the compassion of Keawenuiaʻumi, and to gain back his role in the king's court, Pākaʻa taught his son everything he knew about the chief, including his fondness for consuming *hīnālea* after downing a cup of *ʻawa*, his favorite beverage. The portion of the story describing the use of *hīnālea* is presented below (all mentions of *hīnālea* are presented in bold text for emphasis):

> When night fell and everyone was at ease, Keawenuiaʻumi reminisced: "My love for Pākaʻa wells up in me. On evenings like this, my kauwā would bring me my cup of ʻawa and live **hīnālea**, and the intoxication would take effect; I would sit enjoying the intoxication of the ʻawa until I fell asleep; then I would sleep soundly all night long. How I miss Pākaʻa!"
>
> Kūapākaʻa heard these words of the aliʻi and reported to his father: "Kā! My haku desires some ʻawa. He spoke of his love for you; when you were his kahu, you brough him his ʻawa. He misses it."
>
> Pākaʻa took out an ʻawa preparation bowl and a cup, some grass for straining the ʻawa, a piece of dried ʻawa root, and portions of ʻawa root already chewed, which he tied into bundles. He put everything into a piece of trimmed kapa, which he took out of the wind gourd of Laʻamaomao,, and told his keiki, "Take this dried ʻawa to your aliʻi and show it to him. If he tells you to chew it, look for a dark place and hide the dried ʻawa there, then strain this portion of already chewed ʻawa into the bowl. He'll be impressed with how quickly you've prepared the ʻawa for him. That's they way I did it when I was with him. After pouring the ʻawa into the cup, serve the ʻawa to him, then run quickly to the beach to get the live **hīnālea** we put into the small pond, and give them to your haku as pūpū to cut the bitterness of the ʻawa."
>
> When the aliʻi saw the large dried ʻawa root, he told the keiki, "You must chew my ʻawa." The keiki turned away to a corner of the room and dropped the dried ʻawa root there, then poured water into the preparation bowl and put into it the ʻawa Pākaʻa had already chewed. He strained the juice out of the chewed ʻawa with the grass, then poured the juice into the cup and gave the cup to the aliʻi. Then he ran to the beach and returned with two **hīnālea** wriggling about in his hands. He put them on a dish and placed the live **hīnālea** before the aliʻi. (Nakuina 2005:68–69)

Hīnālea ʻakilolo

The *hīnālea ʻakilolo* commonly known as yellowtail Coris (*Coris gaimardi*), ranges in size from five to twelve inches long and varies in color. This name is also applied to the shortnose wrasse (*Macropharyngodon geoffroyi*), and sometimes the bird wrasse (*Gomphosus varius*), which is also known more properly as *hīnālea ʻiʻiwi*, or *hīnālea nuku ʻiʻiwi*. There are, however, visible differences between these varieties, as *hīnālea ʻakilolo* are predominantly green in color with a blue underbody, brownish tints towards the tail, and greenish-blue fins, while the *hīnālea ʻiʻiwi* is predominantly blue (Titcomb 1972). *Hīnālea ʻakilolo* are also gray in color with white spots on their back and underbody. The *hīnālea ʻakilolo* is noted in the *Kumulipo* as being the offspring of the *ʻōʻō*, a fish whose specific type is unspecified, but may be a name of a "type of swordfish" (Beckwith 1951; Liliuokalani 1978; Pukui and Elbert 1986:290). The word *ʻakilolo*, literally translated as "brain biting," (Pukui and Elbert 1986:14) was used by *kahuna* (priests) as a *pani*, or closing medicine, for someone suffering from a head sickness or disease. This variety was also a highly favored delicacy for eating because of its sweet taste. It was traditionally "eaten with salt, dried, broiled over coals or wrapped in *ti* leaves and then baked or broiled" (Titcomb 1972:78).

Hīnālea lauwili

The *lauwili* variety of *hīnālea* (*Thalassoma duperrey*) is said to have been named in reference to the famed dryland tree termed *wiliwili* (*Erythrina sandwicensis*)—a tree whose flowers are of a bright orange hue. Often mentioned in *moʻolelo* and referenced in traditional fishing practices as "the proper fish to eat as an aftertaste to *ʻawa* [a mildly narcotic drink made from the chewed *Piper methysticum* plant]*"* (Titcomb 1972:77). This variety is said to be the most commonly observed of the *hīnālea* species. *Hīnālea lauwili* are small coral reef fish that are very abundant in Hawaiian waters. The scales of the fish were hard to remove so it was usually skinned, before or after cooking, or broiling, but was mostly favored when eaten raw. This type of fish was also good for *iʻa hoʻomelumelu*, which is the practice of removing the entrails, head, tail, and spine, followed by scraping off the scaly skin, then dressing it with condiments (ibid.).

Canthigaster jactator

Hoover (2007) reports that there are twelve known species of pufferfish that inhabit Hawaiʻi's waters of which three are endemic, including the Hawaiian whitespotted Toby (*Canthigaster jactator)*. The common name, Toby, originated from Australia is commonly used to identify these diminutive puffers that measure less than four inches long and have a slightly elongated snout. The *C. jactator* is the most common Toby in Hawaiʻi and is frequently seen in pairs. It is brown with white spots with a light green fluorescent color on the head and snout. These fish can be found in active reef areas or in "dead silty places where little else seems to live" (ibid.:109).

Tobys do not have any known specific Hawaiian names, but are sometimes referred to generally as *makimaki,* "a term apparently not used in ancient times," and possibly a variation of the word *make*, meaning death (Hoover 2007:107). Other names traditionally used for pufferfish were *ʻoʻopu hue*, possibly an alteration of *ōpūhue (*calabash, gourd*)* or *kēkē* (potbelly). However, the review of historical literature conducted for this study did not reveal any Hawaiian name or cultural information specifically related to *C. jactator*.

Centropyge fisheri; Centropyge potteri

Species of the genus *Centropyge*, popularly known as angelfish, typically have a large backward-pointing spine on the gill cover. Of the five species in Hawaiʻi, three are endemic, however, there are no known Hawaiian names for any of these species. The Fisher's angelfish (*Centropyge fisheri*), is a small orange-brown fish trimmed in iridescent blue with a translucent tail. These fish are typically found in finger coral (*Porites compressa*) at depths of 80 feet. Known to be quick moving, they tend to stay close to cover and are not frequently seen, but are found along the West coast of Hawaiʻi Island (Hoover 2007).

The well-known endemic Potter's angelfish (*Centropyge potteri*) is the most frequently spotted angelfish in Hawaiʻi. This species has a rusty orange color on its head and back, which transitions to a bluish black on the rest of the body. The body is "covered with irregular vertical gray-blue lines" with blue and black horizontal stripes on the rear fins (ibid:3). The males tend have more of a blue color than that of its female counterpart. These fish live in pairs or in small groups, and dwell in the clear water under ledges and on reef slopes with hollow spaces. The review of historical literature conducted for this study did not reveal any specific Hawaiian name or any specific cultural information related to this species.

Cephalopholis argus

More commonly known as the *roi*, or peacock grouper, this fish was introduced to Hawaiʻi from French Polynesia in 1956 to enhance local fisheries. *Roi* are known to contain a ciguatoxin which can be dangerous to human health when consumed. Because of this, these fish are a non-targeted species for local fishermen, which as a consequence has led to a significant population increase in the years since they were first introduced (Hoover 2007). It has become a dominant predator species in the main Hawaiian Islands, and is known to have negative ecological impacts on other endemic and culturally valued species (Dierking 2007). In recent years, efforts to minimize *roi* populations have led to statewide events often dubbed "*roi* round-ups," where local spear fishers are encouraged to catch and remove as many *roi* from the reefs as possible. Hoover (2007) notes that this fish is identifiable by its bright blue spots and dark blue spotted fins, the primary base color of this fish changes as it matures from dark brown to a lighter tan color with distinct light colored bans that extend vertically along the back half of the body. Because this species was so recently introduced to Hawaiian waters, the review of historical literature conducted for this study did not reveal any specific Hawaiian name or any specific cultural information related to it.

Chaetodon kleinii and *Chaetodon tinkeri,* (*kīkākapu*, *kapuhili*, *lauhau*, *lauwiliwili*); *Chaetodon miliaris* and *Chaetodon multicinctus* (*kīkākapu*); *Chaetodon quadrimaculatus* (*lauhau*); *Forcipiger flavissimus* (*lauwiliwili nuku ʻoi ʻoi*); *Hemitaurichthys polylepis* (*kapuhili*)

Members of the genus *Chaetodon*, are broadly referred to as butterflyfish and are usually yellow or white in color with distinct markings (Kent 1986; Titcomb 1972). They grow to about six inches in length, and are distinguished by their compressed bodies (ideal for navigating narrow reef spaces) and small pointed mouths. Butterflyfish are known by a number of Hawaiian names including *kapuhili, kihikihi*, *kīkākapu, lauhau, lauwiliwili, lauhau wiliwili,* and *nukunuku* (Titcomb 1972). While sometimes eaten, butterflyfish appear to have been more commonly caught and used for certain rituals and ceremonies. Specific information related to four types of butterflyfish found in the culture-historical literature, *kapuhili*, *kīkākapu*, *lauhau* and *lauhau wiliwili*, is presented below.

Kapuhili

The term *kapuhili* has been translated by Elbert and Pukui (1986:133) as "…many taboos inherited from chiefly ancestors or from the gods; person with many taboos." Titcomb reports on an account written by S. K. Kamakau in 1845 while he served at the Lahainaluna seminary on Maui that describes how these fish received their distinct marks. In this account, *kapuhili* is the name of the person, or perhaps the deity, who marked each fish with their distinct colors. Kamakau notes:

> These islands of Hawaii were created by Kumuhonua (whose wife was Haloiho). He slept and when he awoke, the earth turned and this was called an earthquake.
>
> At that time the duty of each creature had not been apportioned, nor were names given to each…So all things were gathered together—animals, birds, crawling things, winged things that fly through the air, and man. The work of each was assigned…It was as Molea in Hamakua that all the fishes gathered, the big fish and the little fish. It was there that all the fishes were marked, and streaked ones, the red ones, the white ones, the yellow ones and all the kinds found in the ocean. **Kapuhili** was the overseer who marked them. The unmarked fish were spotted simply by having ashes sprinkled over them. Then the proper names were given to each variety of all the fishes in the ocean. (Titcomb 1972:48)

Kīkākapu

The name *kīkākapu* is used to describe "various species of butterfly fishes of the genera *Chaetodon* and *Cheilodactylus*" and may be further qualified by terms such as "*alo lua* and *koʻa*" (ibid.:148). Titcomb (1972) relates that *kīkākapu* were also considered sacred, and makes reference to a chant presented in the account of Kihaapiʻilani, a 16th century chief of Maui (Fornander 1880). The portion of the chant referencing the *kīkākapu* (name bolded for emphasis) reads thusly:

He kakau kiko onio i ka lae,	With striped marks on the forehead,
Ke kiko o ke ***ki-kakapu****,*	Marks of the **kikakapu**,
O ka ia kapu hilia au awahia.	The sacred fish with the bitter gall.
(Fornander 1916–1917:241)	(Fornander 1916–1917:240)

Kīkākapu are also noted in a name chant composed for Kauikeaouli (Kamehameha III) that is duly titled *Mele no Kauikeaouli*. The portion of the *mele* that references both the *kīkākapu* and *kapuhili* (names bolded for reference) is presented below:

Ke kakau kiokii onio i ka lae	The forehead was marked with variegated stripes,
He kikoi kapu,	Indicating high kapu;
O ke ***kikakapu*** *o ku ia* ***kapuhili***	The **kikakapu** was substituted for **kapuhili**,
Au wahiawahi ia lani.	The time that chief ended.
(Fornander 1919–1920:485)	(ibid.)

The use of *kīkākapu* to signify one's intent to challenge a group of people is described in an account titled, *Kaʻao no Kaipalaoa, ke Keiki Hoʻopapa* (Legend of Kaipalaoa, the Hoʻopapa Youngster) (Fornander 1916–1917). As a preamble to this story, Fornander writes that Kaipalaoa was from Waiākea in Hilo and that his father, Halepaki, was killed by Kalaniali‘iloa, the *kapu* chief of that island who was also very skilled in *ho‘opāpā*—a traditional art of riddling and debate—after traveling to Kaua‘i. Kalaniali‘iloa was so accomplished at *ho‘opāpā* that the fence that surrounded his house was made entirely of the bones of those who he had defeated. To avenge his father's death, Kaipalaoa sought to master the art of *ho‘opāpā* and compete against Kalaniali‘iloa. To develop his skills, Kaipalaoa traveled first to the home of his aunt in Kohala, where she taught the young boy everything she knew about this art. Kaipalaoa continued to refine his skills, and eventually made his way to Kaua‘i where he landed his canoe in Hanalei. While at Hanalei, the boy came across two of the king's canoes that were filled with fish. The boy inquired of the king if he could have some fish, to which the king consented. The boy then grabbed two fish, an *oililepa* and a *kīkākapu*, and after an exchange of words with the king, Kaipalaoa continued on his way towards Wailua, where the *kapu* chief Kalaniali‘iloa lived. In writing about the portion of the story that describing the use of the *kīkākapu* (name bolded for emphasis), Fornander relates that:

> From this place he continued on to Anahola; thence on to Kealia and then on to Wailua where Kalanialiiloa resided, where was his bone fence, almost completed, built from human bones. When he arrived at the place he looked and saw the bones of Halepaki his father; they were still fresh, the bones not yet being bleached. At sight of this the boy bowed in sorrow and wept. After his weeping he approached the flagstaff and pushed it down and put up the oililepa, one of the fish brought along by him. He then next took the kapu stick and pushed it down and put up in its place the other fish, the **kikakapu**. By this action of the boy, it was meant as a challenge to the people that he saw come to meet them in a wrangling contest. When Kalanialiiloa and his instructor saw the action of the boy, they knew at once that he was challenging them to a contest of wits, so a messenger was dispatched to meet the boy showing the challenge was accepted. (Fornander 1916–1917:576)

Lauhau and Lauhau wiliwili

The term *lauhau* has been translated as "brightly colored butterfly fish (*Chaetodon quadrimaculatus* and *C. umimaculatus)*" and may also be "qualified by the terms *kapuhili*, *kīkākapu*, *maha uli*, *nuku ‘i‘iwi* or *nuku ‘iwi*, and *wiliwili*" (Elbert and Pukui 1986:195). The milletseed butterflyfish (*C. miliaris*) ranges in length from one to six inches and is pale yellow in color with a black band on the forehead and near the tail (Titcomb 1972). Black to blueish colored blotches also string downward on the body of the fish (ibid.). This variety of fish is known as *lau wiliwili* or *lauhau wiliwili*, meaning "*wiliwili* leaf," because its shape is believed to resemble the endemic *wiliwili* tree. The fourspot butterflyfish (*C. quadrimaculatus*) is termed *lauhau*. A characteristic of the *lauhau* is described in the *‘ōlelo no‘eau*, "*he lauhau, he i‘a hōkake kāheka*," which has been translated as "it is a lauhau, the fish that creates disturbances in sea pools" (Pukui 1983:80). Pukui (ibid.) goes on to elaborate on this saying, noting that it was in reference to "…a boisterous person." Manu et al. (2006) describe how *lauhau* were caught using the *kūkulu ‘upena* method, or a standing net, which was cast from the shore. They indicate that the types of fish commonly caught in the *kūkulu* nets were *‘ālo‘ilo‘i* (*Dascyllus albisella*), *hīnālea*, and *lauhau*.

With respect to its value as a food fish, Titcomb (1972:97) reports that there was some disagreement as some informants reported that this fish was "bony, not worth eating" while others contend "sweet flesh, broiled on charcoal immediately, without scaling or cleaning." Titcomb adds that the *lauhau* was used in the *ho‘omelumelu* style of preparation. Elbert and Pukui (1986:246) define *melu* as "…slightly decomposed, then salted and seasoned with kukui-nut relish, chili peppers, etc." This *ho‘omelumelu* preparation of fish was also applied to *hīnālea* (ibid.).

Cirrhitops fasciatus (*piliko‘a*)

The redbarred hawkfish (*Cirrhitops fasciatus*) is also known as *piliko‘a* (lit. clinging to coral) (Titcomb 1972). It is marked with five grayish red to brick red bands of color, separated by white stripes that extend along the width of the body (Hoover 2007). White spots are also observed near the face, which diffuse down the length of the body (ibid.). Titcomb (1972:124) notes that *piliko‘a* were sometimes grouped with *‘o‘opu kai* (sea gobies), but that they were "not true *‘o‘opu*."

Ctenochaetus hawaiiensis (*kole*) and *Ctenochaetus strigosus* (*kole*, *kole makaonaona*)

The black surgeonfish (*Ctenochaetus hawaiiensis*), or Chevron tang is a species of the *kole* famly. *Kole* (meaning "raw" or "red") are also called *ukole* or *pākole*. They range in size from four to six inches and are reddish-black in color (Pukui and Elbert 1986:162; Titcomb 1972). The *kole makaonaona* (*Ctenochaetus strigosus*), characterized by its yellow-ringed eyes, are the more popular eating variety. The eyes of this variety were described as beautiful and the name *kole maka onaona*, bright-eyed *kole*, was often applied to them (Pukui and Elbert 1986). *Kole* are often found traveling in schools, sometimes associating with the *pāku‘iku‘i*, or Achilles Tang (*Acanthurus achilles*), and are very abundant in Kona on Hawaiʻi Island. This fish has very small scales, but is known to have tough, thick skin. This trait has been poetically described in the *ʻōlelo noʻeau,* "*he nanea no ka lawaiʻa kole*,", meaning "it is interesting to fish for *kole*" (Pukui 1983:91). Pukui (ibid.) further explains that the Eglish word "story" was Hawaiianized to "*kole*," and that this proverbial saying uses *kole* as a metaphor for describing the excitement of getting together to share stories. This fish is also noted in the *moʻolelo* of Hiʻiakaikapoliopele, during the description of Hiʻiaka's journey from Kohala to Puna, when she was accompanied by Lohiʻau and Wahineʻōmaʻo, and the people they encountered fed them ocean delicacies that included the "sweet-eyed kole fish" (Hoʻoulumāhiehie 2006b:331).

Although the *kole* is known as being tough-skinned, it is considered a favorite fish to eat raw. *Kole* was also important for traditional practices and customs relating to the home, as it was believed to *hole*, or strip, the house of unwanted spiritual energy (Titcomb 1972). As documented by Titcomb, if a home that was under construction needed to be rid of "evil influences," *kole* or *ʻāholehole* (*Kuhlia xenura;* Hawaiian flagtail) were placed under the east-facing house post prior to it being set (ibid.:60).

In the March 8, 1923 issue of *Ka Nūpepa Kuʻokoʻa*, an article titled *Ka Hoʻopakele Ana I Nā Iʻa*, offers insights into the traditional beliefs and practices related to catching *kole* and other similar fish. Presented below is a portion of this article concerning *kole* (bolded for emphasis), translated by Titcomb:

> Fish such as the Manini, the **kole**, the uhu, the kumu and the palani and the kala and many others went into sea pools to live until the tiny fish were grown. No kapus were imposed on them at the spawning season. The mullet, squid, aku, opelu and other fish bore their young in a place that was not sheltered…They were made kapu when the spawning season was near until the months for this duty were over. (Titcomb 1972:14).

Dascyllus abisella (*ʻāloʻiloʻi*)

The common name for the *ʻāloʻiloʻi* is the Hawaiian Dascyllus (*Dascyllus Abisella*). Titcomb (1972) describes the *ʻāloʻiloʻi* as a "bright and sparkling" demoiselle fish that is brown in color with large white scales extending along the width of the body. Titcomb (1972:64) presents a brief narrative from Kepelino, a Native Hawaiian cultural historian, who described the colors of the *ʻāloʻiloʻi* as being of "two colours, like mixed paint over the entire body, reddish-brown and black in equal degree." The middle dorsal area of the body is lighter in color with whitish scales on the dorsal fin, while the rest of the fins are darker in color (ibid.). *ʻĀloʻiloʻi* typically range from five to eight inches long and have a flat body (Malo 1951; Titcomb 1972). The young stages of the fish are called *ʻa*, or *ʻaʻa* and are also referred to as *ʻaʻakimakau* (bait nibbling), which "is a term for a variety or perhaps an alternative name" (ibid:63). The *ʻāloʻiloʻi* is referenced in the *ʻōlelo noʻeau*, "*he ʻāloʻiloʻi, ka iʻa waha iki o ke kai*," literally translated as "an ʻāloʻiloʻi, a fish of the sea that has a small mouth" (Pukui 1983:63). Pukui (ibid.) relates that this was "said of one who always has little to say." *ʻĀloʻiloʻi* were considered "a tasty fish," and were preferred "eaten raw or cooked on hot ashes" (Titcomb 1972:63–64). A method of collecting *ʻāloʻiloʻi* for consumption was done by using the *kūkulu ʻupena*, or a standing net, which was cast from shore. The types of fish commonly caught in these nets were, *ʻāloʻiloʻi*, *hīnālea* (wrasses), and *lauhau* (butterflyfish) (Manu et al. 2006).

Halichoeres ornatissimus (lāʻō)

The Ornate Wrasse (Pinkface), referred to in Hawaiian as *lāʻō*, is a small slender fish that ranges from five to six inches in length. Bright in color, *lāʻō* are distinguished by their salmon hue and iridescent green stripes that extend across the face (Hoover 2007). The dorsal, anal, and tail fins are blueish with green spots and stripes. Juvenile *lāʻō* are dark reddish brown with light green stripes and brown spots. The review of culture-historical literature conducted for this study did not reveal any specific cultural information related to this species.

Lutjanus kasmira

Introduced initially from the Marquesas to the Hawaiian Islands in 1958 for commercial fishing purposes, *Lutjanus kasmira*, more commonly known as *taʻape*, or bluestriped snapper, has not fared well in Hawaiʻi's fish consumer market. These fish, which tend to school in great numbers, are often regarded by local fishermen as pest. The name *taʻape* is a Tahitian name that is commonly used in Hawaiʻi (Hoover 2007). *Taʻape* are easily identified by their predominately yellow body and four blue stripes that extend along the length of the body (ibid.). Given that it arrived in Hawaiian waters so recently, there are currently no known Hawaiian names for this fish nor any traditional cultural uses, other than it being eaten at times.

***Melichthys niger* (*humuhumu ʻeleʻele*) and *Sufflamen bursa* (*humuhumu lei, humuhumu umaumalei*)**

The *humuhumu*, meaning "to sew, stitch," is a general name used to refer to many different varieties of trigger fish, including (but are not limited to) the *humuhumu ʻeleʻele*, or the Black Durgeon (*Melichthys niger*), and the *humuhumu lei or humuhumu umaumalei,* or the Lei Triggerfish (*Sufflamen bursa*) (Titcomb 1972:79). The *humuhumu ʻeleʻele*, is recognizable by its predominately black colored body with blue iridescent stripes on the head and white stripes at the base of its dorsal and anal fins (Hoover 2007). The *humuhumu lei*, on the other hand, is grayish-brown and white, but washed with a yellow color on its back (ibid.). The *humuhumu lei* is said "to have a bad odour" (Titcomb 1972:79).

In providing information on the preparation of *humuhumu*, Titcomb (1972) notes that the skin is tough and hard. She adds that when being prepared, the skin was removed and the flesh salted, and that it was sometimes eaten with *limu manauea*. The skin is described as having a rank odor which necessitated its removal prior to eating. Traditionally, the *humuhumu* was broiled in *ti* leaves, but it is now more typically fried (ibid.). In conveying sentiments about the tastiness of this fish, Titcomb (ibid.:81) states, "Kepelino (52) says the flesh is good, better than *manini*; another says it is too bony to be considered a good food fish. Japanese in Hawaii are fond of it, and it therefore brings a good price in the market." Additionally, if the *humuhumu* were caught in large numbers, then the remains, particularly the head, would be tossed into the fire to help keep the fire burning because of its oils.

Titcomb (1972) documents a gathering method for these fish that involved lowering a basket with cooked pumpkins or sweet potatoes as bait onto a school of fish. While the fish attacked the bait in a frenzy the basket would be hoisted up and the fish caught.

***Naso lituratus* (*umaumalei, kala umaumalei*) and *Acanthurus thompsoni* (*kala*)**

A member of the surgeonfish family (*Acenthuridae*), the Orangespine Unicornfish (*Naso lituratus*), known in Hawaiʻi as *umaumalei*, is common in shallow waters where it feeds upon algae, sometimes in schools. In describing the most prominent features of this fish, Hoover (2007:148) writes that it has "bright orange lips, a graceful curve of yellow from eye to mouth (somewhat like a lei), and orange caudal spine identifies this attractive hornless unicorn fish." The orange markings tend to brighten in color when hunting. The colors are dull when these fish are in their juvenile stage, while large males are distinguished by thin tail streamers (ibid.). This species ranges in size from fourteen to eighteen inches long, but they have yellow tails when they are four to five inches long, and a spike near the caudal fin used as a defense mechanism (Titcomb 1972). A chant submitted by S. Z. Kalaaukumuole (1866) to the November 24, 1866 edition of *Ka Nūpepa Kūʻokoʻa* states, "*O ka Umaumalei ke lii*," which translates as "the *umaumalei* is chief." The *umaumalei* is also referenced in the Kumulipo (Beckwith 1951; Liliuokalani 1978), where it is paired with its land counterpart the *ʻūlei* (*Osteomeles anthyllidifolia*).While the *umaumalei* is a specific species within the family *Acenthuridae*, some traditional accounts classify them under the name *kala* or *kala umaumalei* (Ka Nupepa Kuokoa 1867; Titcomb 1972). *Kala,* although distinguished more by their protruding horn, also have a caudal spine. One such *ʻōlelo noʻeau* describing this unique trait states, "*mālama i ke kala ka iʻa hiʻu ʻoi*," translated as "watch out for the *kala*, the fish with a sharp tail," which is said as "a warning to beware of a person who is well equipped to defend himself" (Pukui 1983:230).

Kala in all of its forms was a popular Hawaiian delicacy, containing white meat and usually eaten broiled over coals and rarely eaten raw. The soft parts of the fish are described as good *palu* (fish bait). This fish is sometimes dried with the tough skin stripped whole, the flesh then cut off in strips and dried, or the meat cut away from the spine and dried with the skin. If the skin is left on, the flesh is cut down to the skin, after the bones are removed, so that the salt will absorb well into the flesh. According to Titcomb (1972), an informant described this fish as best when broiled or baked, after it was about three-quarters dried, and not too stiff or hard. *Kala* is very abundant and easy to catch which is why it is eaten often (ibid.).

The skin of the *kala* is tough and has no scales which made it ideal for the covering on the *pūniu*, a small drum that was lashed onto the thigh of a *hula* dancer. The skin also produces a pungent odor, but its strong smell varied depending on the region it was from, which is a result of their diet. A traditional custom to rid the pungent smell, was done in the same manner as for the *palani*, which was to lay the fish across both hands with the head on the left palm and the tail on the right palm, then breathe in over the fish, while turning the head from left to right, and then breathe out violently. This process was repeated on the other side of the fish (Titcomb 1972).

During the spawning seasons, certain fish were prohibited from being caught and consumed, which included *kala* (ibid.). In the March 8, 1923 issue of *Ka Nūpepa Kuʻokoʻa*, an article titled "*Ka Hoʻopakele Ana I Nā Iʻa*," offered insight into the traditional beliefs and sustainable practices of *kala* and other similar fish. Presented is a portion of this article concerning *kala*, translated by Titcomb:

> Fish such as the Manini, the kole, the uhu, the kumu and the palani and the **kala** and many others went into sea pools to live until the tiny fish were grown. No kapus were imposed on them at the spawning season. The mullet, squid, aku, opelu and other fish bore their young in a place that was not sheltered…They were made kapu when the spawning season was near until the months for this duty were over. (Titcomb 1972:14).

Manu et al. (2006) described the *'ie kala* (lit. *kala* basket) as the largest type of *hīna'i* (basket fish trap). These baskets were round and flat, and about four to five feet long and two and a half to three feet deep with a one and a half foot opening. Near the large end of the opening, a small wicker cylinder or cone is attached and turned inwards towards the bottom of the basket with the free end of the cone small enough for the *kala* to fit through. Use of the *'ie kala* is described as follows:

> Immediately below the end of this cone, on the bottom of this basket, is placed the bait, properly secured, which in the case of the **kala** is limu kala (a course brownish-yellow algae on which this fish feeds and from which it takes its name), ripe breadfruit, cooked pumpkins, half-roasted sweet potatoes, and papayas. This basket is called 'ie lawe (taking basket). The fishermen generally feed the fish at a given place for a week or more before taking any, using large feeding baskets, similar to the 'ie lawe, but without the inverted cylinder and wider at the mouth to allow the fish free entry and exit. After a week or two of feeding, the fish become very fat and fine-flavored, and also very tame, so that baskets full of fish can be drawn up in the 'ie lawe without in the least disturbing the fish which are still greedily feeding in the feeding baskets. The 'ie kala are occasionally used to catch other kinds of fish, substituting bait known to attract particular kinds, but the technique is never as successful as with **kala**. (Manu el al. 2006:96)

Additional methods for catching *kala* included the use of a *holoholo*, a net tied to a twelve-foot-long piece of *alahe'e* (*Canthium odoratum*) wood. The net was lowered down in an area with swift-ebbing tides with one person holding the net and the other corralling fish into it (Manu et al. 2006). *Hina'i pai kala*, was a method of using a plaited basket as a net. The basket was filled with *limu kala* (seaweed), *kalo* (taro) and pumpkin and then let down for the fish to feed. This process was continued until the fish became plump and accustomed to feeding in the basket, then a "catching net" was lowered down to collect *kala*.

Ostracion meleagris (*pahu*, *moa*)

The Spotted Boxfish (*Ostracion Meleagris*) or trunkfish, is a commonly known as *pahu*, meaning "box," a name likely applied because of puffy triangular shaped body (Pukui and Elbert 1986:300). This fish is also known as *moa*, which is noted as a Proto Polynesian word (ibid.). The *pahu*, identifiable by its brownish colored body with white spots, can grow up to nine inches long and prefers living in quiet waters along the shoreline (Hoover 2007). If it is disturbed it emits a poison from the skin. Traditionally, these fish were *kapu* (forbidden) to women. (Kent 1986). Titcomb (1972) adds that there was little flesh on this fish and that they were not eaten.

Paracirrhites forsetri (*hilu*, *hilu piliko 'a*)

The blackside hawkfish (*Paracirrhites forsetri)* is known by many names, including *hilu, 'ele'ele, lauwili, melemele, moelola, pano, pāni'o, piliko'a, 'ula* and *uli,* but is most commonly referred to as *hilu* (Pukui and Elbert 1986). The *hilu* is a brightly colored fish with prominent white and black stripes running horizontally across its body and a speckled face (Hoover 2007). It ranges in size from twelve to eighteen inches long (Titcomb 1972). Juvenile *hilu* are often tricolored, with bands of yellow, black, and white (Hoover 2007). Malo (1951) describes *hilu* as having eminences, or *kino 'oe'oe* (sharp protuberances). Titcomb (1972:75) relates that "they are found in crevices of the reef, under large projecting *limu*-covered rocks, or asleep in the sandy bottom, completely hidden." This species prefers to keep out of sight but they are sometimes seen associating with other species of the wrasse family such as the *'a'awa* (ibid.). Considered an "excellent eating" fish, *hilu* was traditionally either eaten raw, dried or salted and baked or broiled (Malo 1951:46). It is said that an expectant mother that craved *hilu*, "a small bright fish that feeds busily about coral heads, foretold a quiet, industrious child" (Handy and Pukui 1998:77). Titcomb (1972:75) adds that, "all Hawaiian informants remark upon the "quiet, ladylike" demeanour of the *hilu*. A child that is quiet from childhood, is called a *hilu*, a pregnant woman who eats *hilu* will have a quiet, dignified child." Likewise, Pukui related several *'ōlelo no'eau* that liken the demeanor of the *hilu* to that of a quiet child:

He hilu na ke aliʻi.

A *hilu* belonging to a chief

When a pregnant woman longed for a *hilu* fsh, the child born to her would be a very quiet, well-behaved person. Because chiefs liked reserved, well-mannered people, such persons were often found in the royal courts and were referred to as the chief's *hilu* fish. (Pukui 1983:67)

Hilu ka iʻa, he iʻa noʻenoʻe.

The fish is the *hilu*, an attractive one.

A quiet, well-behaved person. When a pregnant woman longed for *hilu* fish, the child born to her would be well-mannered, quiet, and unobtrusive. (ibid.:108)

Another *ʻōlelo noʻeau* that mentions *hilu* is given in references to a story known as "*Ka hilu pani wai o Hauʻula*," literally translated as "The water-damming *hilu* fish of Hauʻula." (Pukui 1983:143). The version of the story related by Titcomb (1972) is taken from an article titled, "*Ka Huakaʻi Pokole i Koʻolauloa*" (The short trip to Koʻolauloa), which appeared in the September 25, 1896 issue of the Hawaiian language newspaper, *Ka Nūpepa Kūʻokoʻa*. The story relates that the *hilu* was a *kinolau* (physical embodiment) of two supernatural brothers, Kaululena and Maʻiʻo, and an event that resulted in fish acquiring its distinct stripes. Kaululena and Maʻiʻo were able to assume various forms but they traveled frequently in their *hilu* form. Kaululena had the ability to become either a *hilu*, *manō* (shark) or *kanaka* (human) while Maʻiʻo could transform into a *hilu* or *kanaka*. The two brothers traveled to Oʻahu as *hilu* and as they neared Kawaihoa, Oʻahu they separated. Maʻiʻo headed towards the Koʻolau (windward) region and Kaululena, towards the Kona (leeward) region. While traveling through the Koʻolau region, Maʻiʻo came upon an area named Hauʻula where a fisherman and the chief of Hauʻula, Makaliʻi, caught a glimpse of Maʻiʻo swimming along the shore. Enthralled by his size, the men quickly cast their nets and ensnared him. As they pulled Maʻiʻo on shore the people of the village watched in amazement, excited to reap their share of the days catch. The fisherman and the Hauʻula chief quickly collected their catch and cut Maʻiʻo into pieces to divide him amongst the people. While they relentlessly worked to divvy the cut pieces, the blood of Maʻiʻo spilled slowly into the ocean. It spread so far that the sky reflected its redness.

Meanwhile, Kaululena reached Kaʻena when he saw the red sky. He immediately knew his brother had been killed. Woeful for his brother's unfortunate fate, Kaululena took his human form and walked to Hauʻula to confirm his brother's death. As Kaululena arrived at Hauʻula, he came upon a house that was broiling a piece of *hilu* and very discreetly, picked it up and threw it back into the sea. He continued to do this at every home that he encountered until he came upon the house of an elderly man. There Kaululena witnessed the elder performing a ceremony for him and his brother before drinking his *ʻawa*. When the elderly man finished his prayer, Kaululena was certain this man was their *kahu,* or mortal guardian. Kaululena then approached the man and asked him if he knew of Kaululena and Maʻiʻo to whom he prayed, to which the man replied that he had never seen Kaululena and Maʻiʻo, but that he was raised by his parents and grandparents to place a *kapu* (sacred oath) on himself pertaining to the matter of eating *hilu*. He continued to explain that he performed the ceremony because when the chief, Makaliʻi and his fishermen caught a large fish he did not accept the bounties of the catch, for *hilu* was sacred and forbidden to him. After explaining his customs, Kaululena revealed himself to the man and provided him with strict orders. He advised him to place *lepa* (sacred flags) around his home and when he was done he was to gather his family and keep them safe within those boundaries. Kaululena counseled the man to ensure his survival, for the land and its people who ate the flesh of the *hilu* would be severely punished by a great flood. Kaululena left these instructions with the man and continued on his quest to find the remaining pieces of his brother's body.

After locating all the remains of Maʻiʻo, Kaululena then traveled upland to Kipapaʻu stream, where he prayed for the rains to pour down onto the homes of those who had his brother's remains. The heavens responded to Kaululena's prayer and the water continued to rise in a hollow area surrounded by the hills. He then transformed into his *hilu* form and as the rain and water hit his body, he grew bigger and bigger until he created a barrier that prevented the water from flowing out. When the water finally filled up to the top of the basin, Kaululena quickly leaped out of the way of the gushing water and sought shelter in a cave within one of the surrounding hills. The waters raged down the stream bed and destroyed everyone and everything in its path except where the *lepa* were placed. Following the advice of Kaululena, the elderly man and his family were spared. It is said that Maʻiʻo regained his life and did so in the form of a striped *hilu* fish. The stripes, a dominant trait seen on the majority of *hilu* today, symbolize the parts of Maʻiʻo's body that were seared by fire or sliced for salting (Titcomb 1972).

Pseudanthias hawaiiensis

The brightly colored Hawaiian longfin Anthias is distinguished by its hues of pink, yellow, and orange. Males are characterized by their yellow heads and reddish-orange bodies, lavender-hued tails, and long wispy pectoral fins. Females are mostly yellow on the head and back with a pinkish body (Hoover 2007). Although endemic to the islands, the review of culture-historical literature conducted for this study did not identify any Hawaiian name or traditional cultural uses.

Zebrasoma flavescens (*lā ʻī pala, lauʻīpala*)

The fish commonly known as yellow tang (*Zebrasoma flavescens*) is known in Hawaiian as *lauʻīpala* or *lāʻī pala*. It is an inshore fish that grows up to approximately seven inches. A bright-colored yellow, the *lāʻī pala* has no scales with a combination of rough and soft skin. This fish although small was a delicacy and was preferred to be broiled. The skin was edible when cooked but was removed if eaten raw. This reef fish is known to school and are be beautiful in numbers (Titcomb 1972). They are common in most coastal regions, particularly in Kealakekua Bay (ibid.). In *The Epic Tale of Hiʻiakaikapoliopele*, Hiʻiaka spoke of a healing ritual that includes the consumption of the *lauʻīpala* (bolded for emphasis):

> Listen to me, this grandchild of ours will be troubled no more. When we depart, you fetch the blossoms of the maʻo in abundance, then mash them soft, make a ball of it, and affix it to the soft spot on the head of our grandchild. Before high noon, he will awaken, and will be healed. And if he hungers for food, then feed him warm potato, along with ***lauʻipala***, the fish called the yellow tang. That fish will make for abundance of food, like the bounty of Makaʻukiu. This grandchild of ours is no longer ill. (Hoʻoulumāhiehie 2006b:131–132)

It is evident from the information presented above that a large majority of these species were utilized throughout the Precontact and Historic era as they are mentioned in traditional legendary narratives and a variety of historical accounts. Collectively, these narratives provide at the very least, a baseline understanding of the ways in which these fish have been utilized in Hawaiian culture.

THE ARRIVAL OF WESTERNERS AND THE TRANSFORMATION OF MARINE RESOURCE MANAGEMENT PRACTICES IN HAWAIʻI

By the mid-18th century, the young and determined Kamehameha had directed his efforts towards consolidating Hawaiʻi Island under his rule. To accomplish this feat, Kamehameha continued to train under his more experienced kin, namely Kalaniʻōpuʻu, who held the title of *aliʻi nui* of Hawaiʻi Island (ʻĪʻī 1959). During Kalaniʻōpuʻu's reign, the first foreign vessels captained by the British explorer, James Cook arrived in Hawaiian waters. Cook first landed at Waimea, Kauaʻi in 1778 and on January 17, 1779, he anchored in Kaʻawaloa Bay, Kona within the study area (Kamakau 1992). Aboard these foreign ships were innovative technologies and diseases unknown to the original inhabitants of the Hawaiian Islands. Items such as metal, nails, guns, canons, and the large foreign vessels themselves, stirred the interest of the Kānaka Maoli. Acquisition of these technological advancements came through barter. This ultimately resulted in the *aliʻi* gaining possession of foreign items that ultimately set traditional Hawaiian warfare in new trajectory, one forged by Kamehameha himself. By the late 18th century, wars were occurring regularly between intra-island and inter-island polities, and by 1810, Kamehameha had unified all of the Hawaiian Islands under his rule. Following this unification, Kamakahonu in Kailua, Kona became his seat of government until his death in 1819 (Kamakau 1992).

The year 1778 marks the end of what is often referred to as Hawaiʻi's Precontact Period and the beginning of the Historic Period. While 1778 signifies an important date in Hawaiian history, it is vital to note that throughout the Early Historic Period, even with Western influences, the Hawaiian chiefs still held outright rule over the land and its resources, and that they maintained strict adherence to the *kapu* system—the very system from which their power was derived. At the outset of the Historic Period, there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The veneration of traditional gods and the strict observation of the *kapu* system were also at their peaks (Kent 1983; Kirch 1985).

The abrogation of the *kapu* system in 1819, under the rule of Kamehameha's son, ʻIolani Liholiho (Kamehameha II) also marks significant date of socio-religious change in the Hawaiian Islands. Some researchers have argued that the abolishment of the *kapu* system undermined the very foundation upon which traditional Hawaiian society was built, thereby altering the relationship between the chiefs and the people, as well as their relationship to the land (Else

2004; Kame‘eleihiwa 1992). Such cultural changes were further endorsed by early Missionaries who arrived in March of 1820 off the coast of Kawaihae, and anchored in Kailua Bay a month later. These early missionaries introduced monotheistic Christian beliefs, established Hawaiian orthography, and generally promoted a Euro-American lifestyle and political system of governance. During this same time period, the first commercial fishing ventures were underway in the islands as British and American whaling fleets began to arrive in Hawaiian waters. These early whalers established Hawai‘i as the provisioning and trading headquarters (Schug 2001). The whaling industry lasted for several decades, and by the 1850s had reached its peak, with some five hundred whaling vessels operating out of the various island ports. Many Kānaka Maoli men, who were skillful on the ocean, had become employed in this industry.

With the influx of foreigners, many of whom were quick to introduce the idea of trade for profit and later fee simple ownership of land, Hawai‘i's traditional culture, and the sociopolitical economy began to shift to meet the growing demands of the foreign populations. As early as 1832, fish markets had become formally established, which were supplied with various marine products caught by Kānaka Maoli (Schug 2001). As Schug (ibid.:17) explains, "commercial fishing provided Hawaiians an early opportunity to participate in the new island economy with a relatively small capital outlay and without abandoning their own customs and skills." In describing their adaption to newly introduced Western materials, Schug (2001:17) writes:

> As new goods and materials became available, Hawaiian fishermen modified their fishing accoutrements. Steel hooks, for example, replaced those carved from pearl-shell, and wooden spears were tipped with iron. But the Hawaiian retained many of the long-established fishing techniques that were so well adapted to Hawai‘i's marine environment. Also retained were various ancient rituals to ensure safety at sea and a bountiful catch. Fishermen continued to pray to the traditional deities for success and appease them with offerings of fish.

In 1839, under the administration of Kamehameha III (Kauikeaouli) a set of laws were drafted that were known as *Ke Kumukānāwai, a me Nā Kānāwai O Ko Hawai‘i Pae ‘Āina* (The Constitution and Laws of the Hawaiian Islands). These laws proclaimed the rights of the people, and ensured equitable protection for the people and chiefs (Achiu 2002). By October 8th, 1840, Kamehameha III and Kekāuluohi, the *Kuhina Nui* (Premier), had enacted the 1840 constitution that "…organized the parts and the functions of government at that time," and included the creation of the *‘Aha‘ōlelo* (House of Representatives) as part of the legislative body, thereby allowing the voice of the people to be heard in governmental matters (ibid.:35).

Fishing Rights Codified in the Hawaiian Kingdom Government Constitutional Laws of 1839 and 1840

Traditionally, Hawaiian land stewardship practices and philosophies were centered around the natural resources that extended from the mountain tops to the deep ocean, which were held in "trust" by the *mō‘ī* (King) and his *ali‘i* (Maly and Maly 2003). Under the ancient system, land use rights included access to fisheries and natural resources that were within the lands, which were then given to the *hoa‘āina* (native tenants). Kamehameha III officially defined the ancient fishing rights and practices of the people in the Constitution and Laws of 1839 and reconfirmed them in 1840 (ibid:26). With respect to the fisheries, these laws permitted Kamehameha III to distribute the fishing grounds and resources between the *ali‘i* and the people of the land. Maly and Maly (2003:243), further emphasizes that "fisheries on coral reefs fronting various lands were for the landlords (*konohiki*) and the people who lived on their given lands (*ahupua‘a*) under the *konohiki.*" The laws were established to identify traditional fishing values and practices, while acknowledging the influences of western property rights. Maly and Maly (ibid.) have compiled the Hawaiian laws enacted between the years of 1833-1842 from archival records located at the Hawai‘i State Archives. Extracted from Maly and Maly (ibid.:244-246), those laws pertaining to fishing rights are detailed below:

> **No na Kai noa, a me na Kai kapu.**
>
> **(Of free and prohibited fishing grounds) (1839-1841)**
> **I. —Of free fishing grounds. (No ka noa ana o ke kai)**
> His majesty the King hereby takes the fishing grounds from those who now possess them, from Hawaii to Kauai, and gives one portion of them to the common people, another portion to the land-lords, and a portion he reserves to himself. These are the fishing grounds which his Majesty the King takes and gives to the people; the fishing grounds without the coral reef. viz. the Kilohee grounds, the Luhee ground, the Malolo ground, together with the ocean beyond.
>
> But the fishing grounds from the coral reefs to the sea beach are for the landlords, and for the tenants of their several lands, but not for others. But if that species of fish which the landlord selects as his own personal portion, should go onto the grounds which are given to the common people, then that

species of fish and that only is taboo. If the squid, then the squid only; or if some other species of fish, that only and [1842:36] not the squid. And thus it shall be in all places all over the islands; if the squid, that only; and if in some other place it be another fish, then that only and not the squid.

If any of the people take the fish which the landlord taboos for himself, this is the penalty, for two years he shall not fish at all on any fishing ground. And the several landlords shall give immediate notice respecting said fisherman, that the landlords may protect their fishing grounds, lest he go and take fish on other grounds.

If there be a variety of fish on the ground where the landlord taboos his particular fish, then the tenants of his own land may take them, but not the tenants of other lands, lest they take also the fish tabooed by the landlord. The people shall give to the landlord one third of the fish thus taken. Furthermore, there shall no duty whatever be laid on the fish taken by the people on grounds given to them, nor shall any canoe be taxed or taboo'd.

If a landlord having fishing grounds lay any duty on the fish taken by the people on their own fishing grounds, the penalty shall be as follows: for one full year his own fish shall be taboo'd for the tenants of his own particular land, and notice shall be given of the same, so that a landlord who lays a duty on the fish of the people may be known.

If any of the landlords lay a protective taboo on their fish, when the proper fishing season arrives all the people may take fish, and when the fish are collected, they shall be divided—one third to the fishermen, and two thirds to the landlord. If there is a canoe full, one third part shall belong to the fishermen, and two [1842:37] thirds to the landlord. If the landlord seize all the fish and leave none for the fishermen, the punishment is the same as that of the landlords who lay a duty on the fish of the people.

If, however, there is any plantation having fishing grounds belonging to it, but no reef, the sea being deep, it shall be proper for the landlord to lay a taboo on one species of fish for himself, but one species only. If the parrot fish, then the parrot fish only; but if some other fish, then that only and not the parrot fish. These are the enactments respecting the free fishing grounds, and respecting the taking of fish.

2.—Respecting the taboo'd fishing grounds. (No na kai kapu)

Those fishing grounds which are known by the people to have shoals of fish remaining upon them, shall at the proper season for fishing be placed under the protective taboo of *the tax officers, for the King*. The fishing grounds on Oahu thus protected, are 1, Kalia; 2, Keehi; 3, Kapapa; 4, Malaeakuli; 5, Pahihi. On Molokai, as follows: I, Punalau; 2, Ooia; 3, Kawai; 4, Koholanui; 5, Kaonini; 6, Aikoolua; 7, Waiokama; 8, Heleiki. On Lanai the Bonito and the Parrot fish. On Maui, the Kuleku of Honuaula and other places.

On Hawaii, the Albicore.

On Kauai, the Mullet of Huleia, Anehola [Anahola], Kahili and Hanalei, and the squid and fresh water fish of Mana, the permanent shoal fish of Niihau, and all the transient shoal fish from Hawaii to Niihau, if in sufficient quantity to fill two or more canoes, but not so small a quantity as to fill one canoe only. But if the fishermen go and borrow a large canoe, that all the fish may be put into one, then there shall be a duty upon them. [1842:38]

On the above conditions there shall be a government duty on all the transient shoal fish of the islands. The tax officer shall lay a protective taboo on these fish for his Majesty the King, and when the proper time for taking the fish arrives, then the fish shall be divided in the same manner as those which are under the protective taboo of the landlords.

If the tax officer seize all the fish of the fisherman, and leave none for those who take them, then he shall pay a fine of ten dollars, and shall have nothing more to say respecting the royal taxes. But if the order for seizing all the fish of the fishermen was from the Governor, then he shall no longer be Governor, though he may hold his own lands, and the tax officer shall not be turned out of office. At the proper time the tax officer may lay a protective taboo on all the King's fish, and the landlords' all around the island. But it is not proper that the officer should lay the taboo for a long time. The best course is for the officer to give previous notice to the fishermen, and then the common people and the landlords to fish on the same day. Thus the rights of all will be protected.

But no restrictions whatever shall by any means be laid on the sea without the reef even to the deepest ocean. Though the particular fish which the general tax officer prohibits, and those of the landlords which swim into those seas, are taboo. The fine of those who take prohibited fish is specified above. [1842:39]

Maly and Maly (2003) also report that on May 31st, 1841, several changes were made and signed into the law on fisheries by the King and *ali'i*. One such section revised the punishment of a fisherman to state, "for two years he shall not fish at all on any fishing ground" and "if he take one fish criminally he shall pay five, and always at that rate. And if a canoe full be taken then five canoes full shall [1842:85] be paid, according to the amount taken, even to the farthest extent [1842:86]" (ibid.:245-246). In 1846, Article V of the "Statute Laws of His Majesty Kamehameha III" was published. These laws identified the responsibilities and rights of the *konohiki* and the people pertaining to various types of fishing grounds and resources. As can be seen below, the laws also acknowledged the practice of *kapu,* or restrictions, with respect to fishing customs and specific fisheries:

ARTICLE V.—OF THE PUBLIC AND PRIVATE RIGHTS OF PISCARY (1846)

SECTION I. The entire marine space, without and seaward of the reefs, upon the coasts of the several islands, comprising the several fishing grounds commonly known as the *Kilohee grounds*—the *Luhee grounds*—the *Malolo ground*, and the fishery of the ocean, from said reefs to the limit of the marine jurisdiction in the first article of this chapter defined, shall be free to the people of these islands. The people shall not be molested in the enjoyment thereof except as hereinafter provided.

SECTION II. The fishing grounds from the reefs, and where there happen to be no reefs from the distance of one geographical mile seaward to the beach at low water mark, shall in law be considered the private property of the landlords whose lands, by ancient regulation, belong to the same; in the possession of which private fisheries, the said landholders shall not be molested except to the extent of the reservations and prohibitions hereinafter set forth.

SECTION III. The landholders shall be considered in law to hold said private fisheries for the equal use of themselves and the [1846:90] tenants on their respective lands; and the tenants shall be at liberty to use the fisheries of their landlords, subject to the restrictions in this article imposed.

SECTION IV. The landlords shall have power, each year, to set apart for themselves one given species or variety of fish natural to their respective fisheries, giving public notice by *viva voce* proclamation to their tenants and others residing on their lands, and signifying to the minister of the interior, in writing, through his agents in their districts, the kind and description of fish which they have chosen to set apart for themselves. The landlords shall respectively pay for such notification, the fees prescribed by the third part of this act; and it shall be the duty of the minister of the interior yearly to furnish the director of the government press with a list of said landlords, the districts and island of their residence, and the kind of fish specially set apart by each, in the form of a catalogue; which catalogue the said director shall cause to be once inserted in Hawaiian and English languages, in the Polynesian newspaper, for public information, at the expense of said minister to be included by him, according to a fixed rate, in the fees to be received at his department from the respective landlords.

SECTION V. The specific fish so set apart shall be exclusively for use of the landlords, if caught within the bounds of his fishery, and neither his tenants nor others shall be at liberty to appropriate such reserved fish to their private use; but when caught, such reserved fish shall be the property of the landlord, for which he shall be at liberty to sue and recover the value from any fisherman appropriating the same; and more over, if he take one fish criminally he shall pay five, and in the proportion shall he pay to the full amount of what he may have taken wrongfully. Whoever may have taken fish in violation of this law, without paying as about, shall be fined fifty dollars for each offence.

SECTION VI. The landlords shall not have power to lay any tax or impose any other restriction upon their tenants regarding the private fisheries that is in the preceding section prescribed, neither shall such further restrictions be valid. [1846:91]

SECTION VII. It shall be competent to the landlords, on consultation with the tenants of their lands, in lieu of setting apart some peculiar fish to their exclusive use, as hereinbefore allowed, to prohibit during certain indicated months of the year, all fishing of every description upon their fisheries; and, during the fishing season to exact of each fisherman among their tenants, one thirds part of all the fish taken upon their private fishing grounds. In every such case it shall be incumbent on the landlords to comply in like manner with the requirements of the fourth section of this article.

SECTION VIII. The royal fish shall appertain to the Hawaiian government, and shall be the following, viz:

1st. The bonito when off any part of the coast of Lanai.

2nd. The albicore of Hawaii.

3rd. The mullet of Huleia, Anehola [Anahola], and Hanalei; the squid and freshwater fish of Mana on Kauai.

4th. The shoal fish taken at the following places, noted for the abundance of fish frequenting them; off Oahu: 1, Kalia; 2, Keehi; 3, Kapapa; 4, Malaeakuli, and 5, Pahihi.

5th. Off Molokai: 1, Punalau; 2, Ooia; 3, Kawai; 4, Koholanui; 5, Kaonini; 6, Aikoolua; 7, Waiokama, and 8, Heleiki.

6th. And off Maui; the *kuleku* of Honuaula; and the same whenever found off said island.

7th. All the following transient fish, viz:—1, the *kule*; 2, the *anaeholo*; 3, the *alalauwa*; 4, the *uhukai*; 5, the *kawelea*; 6, the *kawakawa*; 7, the *kalaku*.

These shall be divided equally between the king and fishermen. But on all the prohibited fishing grounds the landlords shall be entitled to one species of fish, and those who have walled fish ponds shall be allowed to scoop up small fish to replenish their ponds. If the prohibited fish of the landlord be mingled with the royal fish, then the landlord shall be entitled to one third of the whole of the fish taken, though this applies only to Molokai, Oahu and the rivers of Kauai.

All which shall be yearly protected by the king's taboo, to be imposed by the minister of the interior, by means of circular from his department, as prescribed in the act to organize the executive ministry; and during the specified season of taboo they shall not be subject to be taken by the people. [1846:92]

SECTION IX. At the expiration of the taboo seasons, all persons inhabiting these islands shall be at liberty to take the protected fish, accounting to the fishery agents of the respective districts off which the same shall have been caught, for the half or portion, so taken; and the minister of the interior shall make known through his agents by *viva voce* proclamation, the respective months or seasons of the year during which the said royal fisheries may be used and the said protected fish taken.

SECTION X. The minister of the interior shall appoint suitable and proper fishing agents in the several coast districts of the respective islands, to superintend the fisheries aforesaid, to whom he shall from time to time give directions through the respective governors, in regard to the sale or other disposition of the share of fish accruing to the government.

SECTION XI. It shall be the duty of the agents appointed, to exact and receive of all fishermen, for the use of the royal exchequer, during the legalized fishing seasons the one half part, or portion of all protected fish taken without the reefs, whether at the respective places in the eighth section of this article indicated, or in the channels and enclosed seas dividing these islands, or upon the high seas within the marine jurisdiction of this country. And if any officer or agent of this government shall exact more fish of the people than is in and by this section expressly allowed, he shall on conviction, forfeit his office, and be liable to pecuniary fine, in the discretion of the court, before which he shall have been convicted.

SECTION XII. It shall be competent for His Majesty, by an order in council, from time to time, to set apart any given portion, or any definite kind of the said protected fish, or any proportional part of the avails therefrom arising, for the use of the royal palace, to be delivered or paid over to the chamberlain of his household, created by the third part of this act.

SECTION XIII. It shall be incumbent on the minister of the interior to provide, by instructions to the respective governors, for the sale and disposal of all fish received by the said fishing agents, and to pay the avails thereof to the minister of finance. [1846:93]

SECTION XIV. If any person shall, in violation of this article, take out of season the fish protected by the king's taboo, or if any person shall, within the free fishing seasons, take any of the protected fish, without delivering to the agent appointed for that purpose the proportion accruing to the royal exchequer, he shall, on conviction, forfeit all fish found in his possession, and shall, in addition, pay fivefold for all fish thus taken, or he may be put in confinement, at the discretion of the court condemning him. [1846:94; HSA collection KFH 25 .A24 1825/46] (Maly and Maly 2003:246-248)

THE LEGACY OF THE *MĀHELE ʻĀINA* OF 1848

By the mid-19th century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840 the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, the King (Kamehameha III/Kauikeaouli) and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This period of land tenure transformation is known as the *Māhele ʻĀina*. The change in land tenure was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be taken from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the King, the chiefs and *konohiki*, and their tenants (the *makaʻāinana* or common people) (Chinen 1958). Prior to the 1848 *Māhele ʻĀina*, in 1845 the legislature created the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission), first to adopt guiding principles and procedures for dividing the lands and granting land titles, and then to act as a court of record to investigate and ultimately award or reject all claims of private individuals brought before them (Cannelora 1974). All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The work of hearing, adjudicating, and surveying the claims required more time than was prescribed by the two-year term, and the deadline was extended several times, not for new claims, but for the Land Commission to finish its work (Alexander 1920). This deadline was also extended several times for chiefs and *konohiki*, but not for commoners (Soehren 2004)

The *Mōʻī* (King) and some 245 *aliʻi* (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the *Mōʻī* and his *aliʻi* accepted the principles of the Privy Council, the *Māhele ʻĀina* was completed in just forty days (on March 7, 1848), and the names of all of the *ahupuaʻa* and *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*) of the Hawaiian Islands and the *aliʻi* who claimed them, were recorded in the *Buke Māhele* (1848) (also known as the *Māhele* Book) (Soehren 2005b). As this process unfolded the *Mōʻī*, Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division when the name the last chief was recorded in the *Buke Māhele*, the *Mōʻī,* Kamehameha III commuted about two-thirds of the lands awarded to him to the Hawaiian Kingdom Government (King n.d.). Unlike the *Mōʻī*, the *aliʻi* and *konohiki* were required to present their claims to the Land Commission to receive their land awards (known as Land Commission Awards or LCAw). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the *Mōʻī* and *aliʻi* became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii, 1961:13). To expedite the work of the Land Commission, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be formally surveyed.

During the *Māhele*, native tenants residing on the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work. In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*.

Early in this process, questions concerning the rights of the *konohiki* and their imposing of restrictions upon the *hoa'āina* in the matters of fisheries arose. Maly and Maly (2003:250) relate that "a number of communications clarifying the Laws cited above, were published." Among the communications was an Interior Department document (detailed below), which sought to resolve the issue:

> FISHING RIGHTS, RESTRICTIONS AND LIBERATION
> Interior Department Document Number 148
>
> That, to whomsoever it may concern, the catching with hands of fishes and shrimps, etc., from the specified seas call, "Fishing grounds", for human consumption only are hereby liberated.
>
> That, is the King or the *Konohiki* are lack in having the catch of a certain fish and wish to prohibit some of these fishes (unspecified fish: but freely given to citizens), it is well in doing so.
>
> That, the *Konohiki* is hereby ordered to take only one fish; and that the main coral fishing grounds, or other coral fishing grounds are under the jurisdiction of the government. That, the *Konohiki* is hereby allowed to take only one fish from these coral fishing grounds; and that he is not to take two or three; not that much.
>
> If the overseer or the *Konohiki* who is in charge of a fishing right knows that he is out of fish, and wishes to have some by sending his brother out to fish, it is at his discretion in doing so; but, not to accuse him after the fish is caught. (Maly and Maly 2003:250–251)

As a result of the *Māhele 'Āina,* all lands (specifically *ahupua'a* and *'ili kūpono*) within Hawai'i were placed into one of three categories: Crown lands, Government lands, and *Ali'i-Konohiki* lands. With respect to those lands within the current study area, Kamehameha III retained for himself (Crown lands) eight lands, three of which are within Kohala District (Kawaihae Komohana, Pu'ukapu, and Waimea), and the remaining five are within the Kona District (Hale'ōhiu, Honomalino, Onouli 2, Pua'a 2, and Pu'u Wa'awa'a). A total of 185 lands eventually became a part of the Government land holdings with 105 of those located in the Kona District, 69 lands in the Kohala District, and the remaining 11 situated in the Ka'ū District. A total of 111 lands were claimed by the *ali'i-konohiki*, with 71 located in the Kona District, 37 in the Kohala District, and the remaining 3 in the Ka'ū District. In all, some 302 lands located within the study area were claimed during the *Māhele 'Āina* of 1848 (Soehren 2004, 2005b, 2005a).

Fisheries and Fishing Rights Recorded During the *Māhele 'Āina*

The plethora of documents that were generated as a result of the *Māhele 'Āina* contain vital information pertaining not only to land use and practices, but fisheries and fishing rights that extended out to sea as well. In gathering information on fishery rights, Maly and Maly (2003) summarized the claims made by the *ali'i-konohiki*, and *hoa'āina*. While they compiled the fishery rights information for all of the major Hawaiian Islands, only those specific to the current study area are presented below. Given that many of the *ali'i-konohiki* land claims encompassed lands on multiple islands, it is difficult to ascertain those claims specific to the current study area. Many of these claims make broad references to fisheries and do not give specific details regarding fishery types. Nonetheless, the information presented below provides an overview of claims made by the *ali'i-konohiki*, and demonstrates the abundance and importance applied by Kānaka Maoli to maintaining traditional fishing rights following the *Māhele 'Āina* of 1848. With respect to the *ali'i-konohiki* claims, Maly and Maly (2003:253-254) write:

Helu [LCAw.]	**Claimant; Location; and Resource Claimed**
4452	H. Kalama (wife of Kamehameha III). Fourteen lands and fisheries on Hawaii, Maui, and Oahu.
5368	Akahi (w.) Land and fisheries of: Kealia, Makalawena and Keei iki, Kona, Hawaii; and Puuepa and Ulupaalua, Kohala, Hawaii; and Kaaipu, Waikiki, Oahu.

5525	L. Konia (w). Ten lands and fisheries at: Keei, Kona, Hawaii; Lumahai, Kauai; Napili, Honokeana, Alaeloa, and Mailepai, Kaanapali, Maui; and Kalauao, Oahu.
7712	M. Kekuanaoa. Six lands and fisheries on Hawaii, Kauai, and Oahu.
7713	Victoria Kamamalu. Fifty-three lands and fisheries on Hawaii, Kauai, Lanai, Maui, Molokai, and Oahu.
7714 B	Moses Kekuaiwa. Twelve lands and fisheries on Hawaii, Kauai, Lanai, Maui, and Oahu.
7715	Lot Kapuaiwa Kamehameha. Sixteen lands and fisheries on Hawaii, Maui, and Oahu.
7716	R. Keelikolani (w.). Twelve lands and fisheries on Hawaii, Kauai, Maui and Oahu.
8452	A. Keohokalole (w.). Thirty-seven lands and fisheries on Hawaii, Maui, and Oahu.
8515	Keoni Ana. Lands and fisheries of: Kawaihae, Kohala, Hawaii; Kukuau, Hilo, Hawaii; and Halehaku, Maui.
8516 B	Kamaikui (w.). Lands and fisheries at: Waiaka 1st, Kohala Hawaii; Kalama, Kona, Hawaii; Kahului, Kona, Hawaii; Halawa, Ewa, Oahu.
8518 B	James Young Kanehoa. Lands and fisheries at: Ouli, Kohala, Hawaii; Ulaino, Maui; and Lawai, Kauai.
8519 B	Fanny Young (w.) Kiiokalani, Kohala; and Pahoehoe, Kona, Hawaii; Maunalei, Lanai; and Haleu, Lahaina, Maui.
8520	Iosua Kaeo. Five lands and fisheries on Hawaiʻi; Kealia, Lanai; Maui, and Oahu.
8520 B	Gini Lahilahi (w.) Lands and fisheries at: Waiaka 2nd and Waika, Kohala, Hawaii; Pahoehoe, Hawaiʻi; Waikahekahe, Hawaii; and Puunoa, Lahaina, Maui.
8521 B	G. Davis Hueu. Lands and fisheries of: Kukuau 2, Hilo, Hawaii; and Kiilae, Kona, Hawaii.
8522 B	Kale Davis (w.). Lands and fisheries at: Honokahua, Maui; Kapaa, Kohala, Hawaii; and Waikahekahe, Puna, Hawaii.
8559	C. Kanaina. Thirteen lands and fisheries on Hawaii, Maui and Oahu.
8559 B	Wm. Lunalilo. Sixty-three lands and fisheries on Hawaii, Kauai, Maui, Molokai, and Oahu.
9971	Wm. P. Leleiohoku. Thirty-five lands and fisheries on Hawaii, Lanai, Maui, Molokai and Oahu.
10474	N. Namauu for M. Kekuanaoa. Twelve lands and fisheries on Hawaii, Maui, and Oahu.
10613	A. Paki. Six lands and fisheries on Hawaii, Kauai, Maui, and Oahu.
10806	Iona Piikoi for Kauikeaouli, Kamehameha III; and unnumbered lands described in Buke Mahele (1848). At least 159 Crown Lands covering Hawaii, Maui, Molokai, Oahu, and Kauai, with fisheries rights on all island.
11215	Kealiiahonui. Three lands and fisheries on Hawaii, Kauai, and Oahu.
11216	M. Kekauonohi (w). Fifty-seven lands and fisheries on Hawaii, Kauai, Lanai, Maui, Molokai, and Oahu

In summarizing the land claims made by the *hoa'āina* (native tenants), Maly and Maly (2003) clarify that there were some seventy-six claims that made explicit reference to fishery-related activities for the entirety of Hawai'i Island, of which twenty-three are specific to the current study area. Unlike the claims made by the *ali'i-konohiki*, which are far more vague (described in the previous section), the claims made by the *hoa'āina* provide a little more detail on the the fisheries within the current study area during the mid-19th century. These claims include references to fishponds, anchialine ponds, salt production areas, *umu 'ōhua* (stone mound fry fisheries), anchialine shrimp ponds, as well as general references to coastal fisheries. Several land claims make explicit reference to the fish that were reserved for the *konohiki* of specific lands. While the claims presented below do not reflect all possible fishery-related activities that were occurring during the mid-19th century, they do provide a glimpse into nature and location in which such activities occurred. Those fishing rights claimed by the native tenants along the coast of Hawaii Island during the *Māhele 'Āina* of 1848 have been extracted from Maly and Maly (2003:254-256) and are presented below:

Helu [LCAw.]	**Claimant; Location; and Resource Claimed**
817	Heirs of George Beckley at Kealahewa, Kohala, Hawaii. A farm and fishing grounds, given by Kamehameha I about 1811.
3480	Kauwe at Kauhako, Kapalilua, Kona, Hawaii. A *kupono* ocean fishery, like a pond.
4012	Thomas Hopu (Hooper) at Kailua, Kona, Hawaii. "Seashore *kihapai*, it is a salt pond, 17 fathoms by 27 fathoms."
4099	Keawekuloa at Puako, Waimea, Hawaii. Five *kaheka loko* (anchialine fishponds).
4140	Kamanawa at Kaloko, Kona, Hawaii. A lot bounded on side by Kaloko pond.
4452	Hazaleleponi Kalama at Kalahuipuaa and Anaehoomalu, *ili* of Waimea, Kohala, Hawaii. Lands including approximately twelve fish ponds.
5317	Kaawa at Lanihau, Hawaii. A lot in the *ili* of Kaluaolike, bounded on Kau side by pond of Alanaio.
5759	Kapule at Pahoehoe, North Kona. *Kala* is the fish to be taken by *konohiki*.
5759	Kapule at Pahoehoe, North Kona, Hawaii. "…Here is a second thought, about the fish of the *konohiki*, it is the *kala* in the fishery; and the *ulu* is the tree on the land..."
5778	Kaai at Pakini, Kau. A protected fish.
5874	Keohokalole at Kaawaloa, Kona, Hawaii. Fisheries and ponds at Hanapahoehoe, Awili, Kalaemamo, and Haliilua.
5874	Keohokalole at Kealakekua, Kona, Hawaii. Fish pond of Wailokoalii.
6230	J. A. Kuakini at Puuanahulu, Hawaii. Fifteen salt ponds and three fish ponds.
6235	Kapaakea at Kaapuna, Kona, Hawaii. Some protected fish.
7277	Kaieie at Keei, Hawaii. One pond at Kalaeohia.
7702	Kooka at Kealia, Kona, Hawaii. An *umu ohua* (stone mound fry fishery).
8773 B	Haumea at Kahuku, Kau, Hawaii. The protected fish of the Konohiki is the *opelu*, the tree is the *mamaki*.
9251	Kaea at Lanihau, Kona, Hawaii. Seven *wai opae* (anchialine shrimp ponds) at shore.

10000	Lukehiwa at Honomalino, Hawaii. "…An *ahupuaa*, received from Unualoha, from the sea to the upland *koa* forest. The *opelu* is its fish which is taken, and the *koko* is its wood which is taken…"
10264	Mahi at Hoopuloa, Hawaii. The ocean fishery of Kipehu.
10340	Namalo at Kamaoa, Kau, Hawaii. "…A fishing right is at the sea in Kawela, Puueo and Waiopua…"
10527	Namaielua at Kapua, Hawaii. A fish pond in the *ili* of Kailiohia.
10913	Uahine at Kamaoa, Kau, Hawaii. A salt land; and fishing rights in Kawela, Waiopua and Mohoae.

PROCEEDINGS OF THE BOUNDARY COMMISSION: *AHUPUA'A* BOUNDARIES AND FISHING RIGHTS ALONG THE WESTERN COAST OF HAWAI'I ISLAND

Although the entwined relationship of terrestrial and oceanic resources within the *ahupua'a* system were traditionally recognized by Kānaka Maoli, who considered the sea an extension of land, differing perceptions and realities of the ocean as it pertained to the *ahupua'a* unit began to arise during the mid-nineteenth century. With the establishment of the Commission of Boundaries (Boundary Commission) in the Kingdom of Hawai'i in 1862, boundaries of all *ahupua'a* that were awarded as part of the *Māhele 'Āina* were legally set. The boundaries of the lands were subsequently certified by the Commissioners of Boundaries in 1874. The primary informants for the boundary descriptions were old native residents of the lands, many of whom had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and transcribed into English as it occurred. Hearings for most *ahupua'a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, many of whom were accompanied and guided by *Kānaka* who related the boundaries as passed down to them through their *kupuna*. Conversely, in some instances, *ahupua'a* boundaries were established through a combination of other methods such as conducting surveys on adjacent *ahupua'a*. Or in cases where the entire *ahupua'a* was divided and awarded as Land Claim Awards (LCAw.), and or Government issued Land Grants (both which required formal surveys), the Boundary Commission relied on those surveys to establish the boundaries for that *ahupua'a*.

Surveying land boundaries was a tough and methodical task, centered primarily around the accurate location, recordation, and triangulation of prominent geographic and cultural features, however it "was not merely a matter of measuring angles and lines, it involved listening to people about their use of land and making judgements that would affect the quality of their lives" (Moffat and Fitzpatrick 1995:60). Therefore, in order to accurately ascertain the boundaries of the *ahupua'a*, it was crucial to combine scientific concepts and procedures with generational knowledge held by the Kānaka Maoli. Some of the Kānaka Maoli who accompanied foreign surveyors even took up the practice of surveying themselves. Although these surveys aided in establishing the *ahupua'a* boundaries, the maps produced present only a basic outline of the land divisions, and they lack the cultural knowledge of the landscape presented during the Boundary Commission hearings. Generally, there was great emphasis placed on the identification of terrestrial features along, and adjacent to, *ahupua'a* boundaries that demarcated them from the next. However, many *ahupua'a* boundaries traditionally extended offshore into the *kai*. The tightly woven interconnection between *mauka* and *makai* resources, spanning from the uplands to the sea, was largely overlooked by the surveyors who sought primarily to record the boundaries of *ahupua'a* based upon physical features of the land. These differing perceptions of *ahupua'a* boundaries and resource procurement areas, whether marine or terrestrial-based, are evident in the Boundary Commission testimonies, most notably in those provided by land surveyors, rather than *kama'āina* informants, where intangible oceanic boundaries are disregarded.

While rare, testimonies presented by surveyors in lieu of *kama'āina* informants (e.g. 'Upolu Ahupua'a in North Kohala) were markedly fixated on discerning boundaries based on earthly attributes, and were non-inclusive of information pertaining to intangible *ahupua'a* boundaries that extended past the shoreline and into the sea. Alternatively, Boundary Commission testimonies provided by natives were infused with meticulous recollections of not only tangible earthly features, but also those which were imperceptible except to those who had intimate knowledge of the land, sea, and customary practices that occurred in these places. Native testimonies often preserve crucial culture-historical information related whether or not *ahupua'a* boundaries extended out to the sea, the distance to which they extended, and the fishing rights of the people therein.

The analysis of 107 *ahupuaʻa*—extending from Kahei in North Kohala to Kamāʻoa in Kaʻū—that were surveyed and testified about as part of the Boundary Commission process, reveals that seventy-four of these land divisions had boundaries extending out into sea, sixty-seven of which claimed fishing rights to those waters. The disparity between the amount of surveyed *ahupuaʻa* and those that claimed fishing rights (roughly 63%) is not necessarily an accurate representation of the general scope of traditional *ahupuaʻa* boundaries or access to fishing rights along the western coast of Hawaiʻi Island, nor is it indicative of patterns island-wide. In some cases (thirty-one total *ahupuaʻa*, roughly 29%), the extent of an *ahupuaʻa* boundary into the sea was simply not specified or discussed. It is also imperative to note that Boundary Commission testimony was not presented for every *ahupuaʻa* that claimed traditional fishing rights, and that ambiguity regarding the details of the rights of an *ahupuaʻa* often arose from the fact that the boundaries could not be clarified, either because of a total lack of testimony or because of the omission of crucial detail within existing testimonies. The Boundary Commission information for the study area *ahupuaʻa* within North Kohala, South Kohala, North Kona, South Kona, and Kaʻū presented below provides a glimpse into how the traditional *ahupuaʻa* system operated with respect to intangible seaward boundaries and access to the fishing access rights therein.

North Kohala District

Twenty *ahupuaʻa* in North Kohala stretching southward from Kahei to Waikā, the southernmost limit of the district, were surveyed for their boundaries (Table 4 and Figure 25). Of these, fourteen had boundaries that extended out to sea, and eleven were identified as having ancient fishing rights. The particulars of the extent of the fishing grounds of five of the *ahupuaʻa* (Kaiholena 1st and 2nd, Kamano, Puaʻa 1st, and Puʻuepa 1st) were elaborated upon by those who provided Boundary Commission testimony, and testimony provided for two additional *ahupuaʻa* (Kiʻiokalani and Kehena 2nd) related that fishing rights and resources were reserved for the *konohiki* or that the *konohiki* had right to collect monetary taxes for the aquatic resources obtained.

The testimonies given for *ahupuaʻa* in North Kohala with more detailed explanations of fishing rights varied in extent. In one case, fishing privileges were only permitted to as far as the bottom of the ocean that could be seen, or to indeterminable depths that were not elaborated upon, while other *ahupuaʻa* retained a broader expanse from which to gather resources, extending from near shore out into deep water. For some *ahupuaʻa* the boundaries were delineated by traditional fishing grounds, like in the case of Puaʻa 1st whose fishing rights terminated at the place where squid could be caught. In another case, the fishing rights were limited to roughly 5/8 of a mile offshore in the deep sea. Excerpts of Boundary Commission testimonies for the *ahupuaʻa* of North Kohala that discuss ancient fishing rights and boundaries are presented below (underlining and italicization added for emphasis and clarity).

Kaiholena 1st and 2nd

> Kama, sworn: . . . My parents now dead, were *kamaaina* of Kohala, and pointed out the boundaries of the lands to me. The sea bounds these two lands on the *makai* side. <u>These lands had ancient fishing rights extending out to the deep sea</u>. The land Makeanehu 1st bounds Kaiholena 2nd on the south side. The lands Kaiholena 1st and 2nd lay side and side from the shore to the end of both lands. The boundary between Kaiholena 2nd and Makeanehu 1st at the sea shore is a long rocky point, narrow near the main land and growing wider a little way from the shore called Honoaumi. . . (Volume A No. 1:80)

> Hauli, sworn: . . . The sea bounds Kaiholena 1st and 2nd on the *makai* side. <u>The fisheries belonging to these lands used to extend out to sea as far as from here to Kama's house (about 5/8 of a mile).</u> A point at the sea shore on south side of land is the boundary between Kaiholena 2d and Makeanehu 1. There is a *pali* called Nohonaumi just *mauka* of this point. . . (Volume A No. 1:81)

Kamano

> Palua, sworn: . . . Thence *makai* to Puopahoaakahi, a resting place. From thence to Kaaka, a place where the natives tied their ropes when they were fishing. <u>Bounded *makai* by the sea. Ancient fishing rights extending out as far as you can see bottom.</u> (Volume B:143)

Kehena 2nd

> Kikalaeka, sworn: . . . Hauli, now present in Court, showed me the *makai* boundaries of Kehena 2nd. I went with Wiltse several years ago when he was surveying on the sea shore. I do not know the boundaries. Do not know whether Kehena 2nd had any fishing rights or not. . . [Volume A No. 1:75]

> Hauli, sworn: . . .A water spring named Maue on the north side of Keawanui is the boundary at the shore between Kehena 1st and Kehena 2d. The sea bounds Kehena 2d on the *makai* side. <u>I have</u>

always heard that Kehena 2d had ancient fishing rights extending out a good way into the sea. Nakapauluhua, father of Pohakuuli, was *Konohiki* of Kehena, and always charged people for fishing on the sea belonging to Kehena and collected the pay. . . (Volume A No. 1:75)

Ki'iokalani

Kekuaaea, sworn. . . thence to Ahuliilii, a resting place. The compass was put here to sight to Puulepo; thence *makai* to Pukoae, a resting place; thence to Malae, a point at the shore; Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:276)

Pohakuauli, sworn. . . Bounded *makai* by the sea, where we went fishing; we had to give fish to the Konohiki. . . (Volume B:277)

Kukuipahu

Ku, sworn. . . From the shore to Kepioholowai is as far as I know the boundaries. Ancient fishing rights extending out to sea. . . (Volume B:135)

Kaneihalau, sworn. . . I have heard that Kaauhuhu and Kukuipahu join. Bounded on the *makai* side by the sea. Ancient fishing rights extending out to sea. This is all I know of the boundaries of Kukuipahu. . . (Volume B:137)

Māhukona 2nd

Palua, sworn: . . Poupou is the point at shore between Mahukona 1st and Mahukona 2nd. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. Kaheana's *kuleana* joins Mahukona 1st at the sea shore. (Volume B:141)

Pua'a 1st

Kauua, sworn. . . I was born at Puaa, North Kona Hawaii, at the time of Keoua, and have always lived there, and am acquainted with the boundaries of the land. . . Puaa is bounded *makai* by the sea and the land has ancient fishing rights near the shore but not extending out to sea. . . Puaa has ancient fishing rights extending to the squid grounds. (Volume A No 1:376)

Puanui

Kanaha, sworn: . . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:130)

Paahao, sworn: . . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:130)

Pu'uepa 1st

Pahiha, sworn: . . . Hukiaa 3d bounds Puuepa 1st on the east side; Kukuipahu *mauka* and Puuepa 2d on the north side and *makai* by the sea. Puuepa 1st always had a fishing right, extending out into deep water. A long rock in the sea called Pohakuloa is the boundary at shore between Puuepa 1st, Hukiaa 3d there is a large rock on shore marked P & H; thence the boundary runs up *iwi aina* (a ridge of small stones which the natives formed in clearing their potato and *kalo* patches) to stones set in the ground and marked P. . . (Volume A No. 1:163-164)

Waikā

Puhi, sworn: . . . A rocky point, named Oneloa, is the boundary of Waika where Kawaihae joins it. I do not know about fishing rights. . . (Volume A No. 1:171)

Kaohia, sworn: . . . The sea is the *makai* boundary, and the land had an ancient fishing right extending out to sea. Oneloa is the boundary between Kawaihae and Waika; thence up a small *awaawa* to a point *makai* of Maaukaa. . . (Volume A No. 1:172)

Table 4. Oceanic boundaries and fishing rights in the North Kohala District.

Ahupua‘a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Awalua	No	-	-	-
Hā‘ena	No	-	-	-
Honoipu	No	-	-	-
Kāhei, Hualua	No	-	-	-
Kahuā Li‘ili‘i (1st)	Yes	Not specified	Not specified	-
Kahuā Nui (2nd)	Yes	Not specified	Not specified	-
Kaiholena 1st and 2nd	Yes	Yes	Yes	Roughly 5/8 of a mile into the deep sea
Kaiho‘onā	No	-	-	-
Kaipuha‘a, Lamaloloa	No	-	-	-
Kalala 1st and 2nd, Koki‘o	No	-	-	-
Kamano	Yes	Yes	Yes	As far as can see bottom
Kapa‘a	No	-	-	-
Kapa‘a Iki	No	-	-	-
Kapa‘a Nui	Yes	Yes	Not specified	No testimony given
Kapunapuna	No	-	-	-
Kaupalaoa	No	-	-	-
Kealahewa 1st	Yes	Not specified	Not specified	-
Kealahewa 3rd	Yes	Yes	Not specified	-
Kehena, Kipi	No	-	-	-
Kehena 2nd	Yes	Yes	Yes	Extended out to undetermined depth, *Konohiki* collected money from those who fished there
Ki‘iokalani	Yes	Yes	Yes	*Konohiki* fishing rights
Kokoiki	No	-	-	-
Kou	No	-	-	-
Kukuipahu	Yes	Yes	Yes	-
Māhukona 1st	Yes	Not specified	Not specified	No testimony given
Māhukona 2nd	Yes	Yes	Yes	-
Makeanehu	No	-	-	-
Makiloa, Pahinahina	No	-	-	-
Opihipau, Hukia‘a	No	-	-	-
Pōhakulua, Ahulua	No	-	-	-
Pua‘a 1st	Yes	Yes	Yes	Near shore fishing only extending to squid grounds
Puaiki	No	-	-	-
Puakea	No	-	-	-
Puanui	Yes	Yes	Yes	-
Pu‘uepa 1st	Yes	Yes	Yes	To deep water
Pu‘uepa 2nd	Yes	Yes	Not specified	-
Pu‘ukole, Koea, Lapakahi	No	-	-	-
‘Upolu 1st and 2nd	Yes	Not specified	Not specified	Testimony given by surveyors only
Waikā	Yes	Yes	Yes	-

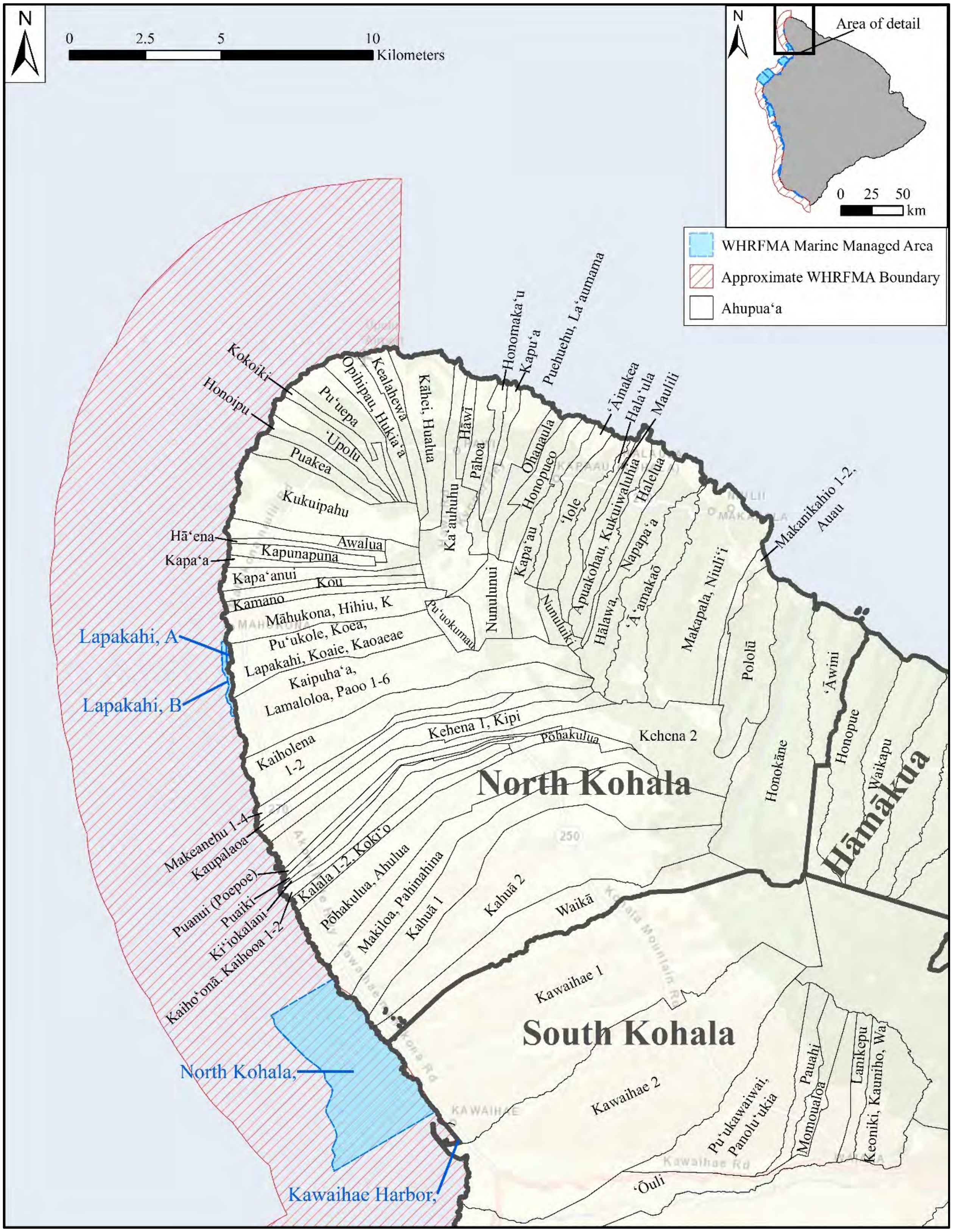

Figure 25. *Ahupua‘a* of the North Kohala District.

South Kohala District

Ten *ahupua'a* of south Kohala were surveyed for their boundaries, seven of which had boundaries that extended out to sea and claimed ancient fishing rights (Table 5 and Figure 26). Of these, details are presented for only two of the *ahupua'a* (Kawaihae Akau [1st] and Hikina [2nd]). Fishing grounds for Kawaihae Akau extended from Pōki'i'āhua to Kawaihae Hikina, and the grounds for Kawaihae Hikina extended from the shore to the Kona side of Kauhuhu and Pokiiahua, although the testimony reveals that part of the catch from Kawaihae Hikina was to be given to John Young and the *konohiki* for Kawaihae Akau. Both *ahupua'a* also had rights to *poho pa'akai* (salt collection areas), particularly Kawaihae Akau, which according to the testimony had the rights to the majority of the salt. While fishing rights were also claimed by Lālāmilo, the testimony for that *ahupua'a* does not elaborate on specifics. Information presented for Puakō, however, relates that Lālāmilo had rights over Puakō's waters. The excerpts of Boundary Commission testimonies for the *ahupua'a* of South Kohala that discussed ancient fishing rights and boundaries are presented below (underlining and italicization added for emphasis and clarity).

> ***'Anaeho'omalu***
>
> George Kaukuna, sworn: . . . Know the land of Anaehoomalu in South Kohala. Puanahulu, a land in North Kona bounds it on the Southwest side; this land used to bound it on the *mauka* side also, but I am told that Waikoloa now bounds it from the South corner, bounded on the North side by Kalahuipuaa; and by the sea on the *makai* side. The land has ancient fishing rights extending out to sea. . . (Volume A No. 1:386)
>
> Naauhau, sworn: . . . Waikoloa is said to bound Anaehoomalu *mauka to* Kepani; just before you can see the trees at the shore, on Kalahuipuaa, coming towards Kawaihae. There turn *makai* along Kalahuipuaa to lliilinehe at Pohakuloa, on the sea shore. Ancient fishing rights extending out to sea. . . (Volume A No. 1:387)
>
> ***Kalāhuipua'a***
>
> George Kaukuna, sworn: . . . a place called Milokukahi; a grove of Milo trees, where the boundary turns *makai,* along Waimea to seashore. Between the seashore and Milokukahi there is a place on the boundary called Keahaaha on *aa.* Pohakupuka, a rock in the sea, is the boundary at shore. Ancient fishing rights extending out to sea. . . (Volume A No. 1:384)
>
> Naauhau, sworn: . . . thence to Pohakupuka, a large rock in the sea with holes through it. Ancient fishing rights extending out to sea. . . (Volume A No. 1:385)
>
> ***Kawaihae Akau (1st)***
>
> Kalua, sworn: . . . The boundary runs down Keawewai gulch to Keanakawaha; thence down the gulch to Pohakuloa and thence follows the gulch to the sea. Kawaihae 1st is bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . . (Volume B:148)
>
> ***Kawaihae Hikina (2nd)***
>
> Kahiahikela, sworn: . . . Kawaihae is bounded *makai* by the sea, and has ancient fishing rights extending out to sea; bounded on the Kona side by the *Ahupuaa* of Waimea. In Kamehameha I time, I heard from my parents that he gave the land adjoining Kawaihae at the sea shore to Ouli; thereby making that land extend to the sea, before that time, Ouli stopped at Puuiki. Davis and John Young were great favorites of Kamehameha I and he gave them the land, thereby making Ouli (*ili* of Waimea) bound Kawaihae at the sea shore... [Volume B:74]
>
> Kaneahiku, sworn: . . . I have been away from here 40 or 50 years, and have forgotten the boundaries. John Young was alive when I moved away. The beach and sea on the Kona side of Kauhuhu belonged to Kawaihae Hikina [Kawaihae 2]. When we came from the other Kawaihae on to this place to fish, we had to give part of our fish to Olohana [John Young]. . . (Volume B:390)
>
> Kamoehau, sworn: . . . The sea from Pokiiahua to Kauhuhu belonged to Kawaihae Akau [Kawaihae 1], and the sea on the Kona side of Pokiiahua to Kawaihae Hikina. Mahi lived on the tract of land between Pokiiahua and Kauhuhu, but was *Konohiki* under Kalaimoku, and not under Olohana. He used to divide the fish and give part to Olohana. Olohana and Kalaimoku were *noho like* [lived under same privileges], so they used to give him part of the fish. . .

Part of the *poho paakai* [salt pans] belong to Kawaihae Hikina, but most of them belong to Kawaihae 1st. The boundary between the two lands is where I stated before. The folks living *mauka* on Kawaihae 2d used to go after salt at the shore to the salt works near Kauhuhu. The *poho paakai* Pohakuloa, Kaholei, Piipepii, Nupaa belong to Kawaihae Hikina, the other *poho paakai to* Kawaihae 1st. They are *lele* of Kawaihae Hikina. Kaneloa is on Kawaihae Hikina, and I know of *poho paakai* called Kaneloa. Know of place of Kawaihae Hikina called Makela, but do not know of salt piece of that name.

Malahuehue is an *ili* of Kawaihae Hikina, and I know of salt place at shore by that name, and it belongs to Kawaihae Hikina. Kukui is an *ili aina* of Kawaihae Hikina; I do not know of any salt place of that name. Kapahukapu is an *ili* of Kawaihae Hikina, I do not know of any *poho paakai* of that name. The places I have mentioned are *ili aina* of Kawaihae Hikina, and the *poho paakai* of the same names belong to it also. . . (Volume B:391-392)

J.P. Parker, Jr., sworn: . . . I know the lands of Kawaihae 1st and Kawaihae 2d, and have heard where the boundary is between them from Hueu, Kini Keoke and Kauwe. They told me that the fishing rights belong to the King's Kawaihae and that the gulch between my house at the shore and John Young's old house was the boundary. The gulch is on the Kona side of my house. . . (Volume B:392)

S.P. Wahinenui, sworn: . . . When we used to catch fish Olohana's man used to take part, and the *Konohiki* of Kawaihae 1st a part. I do not know why. I have always heard from Hueu (George Davis) that the fishing rights belonged to Kawaihae 1st. I have heard that the places for making salt belonged to both lands. The *poho paakai* have the same names as the *ili aina* to which they belong on both Kawaihae. The *makaha* of the fish pond is called Kukui and belonged to Kawaihae 2nd. I never heard any dispute about the *poho paakai,* but the dispute was about the land on the Kona side of them to Pokiahua gulch. (Volume B:393)

Lālāmilo

Kauuewahine, sworn. . . C. Kanaina only claims the beach and fishing rights. Lalamilo had ancient fishing rights, extending out to sea. . .

'Ōuli

Pupuka, sworn: . . . I was born on Ouli, and was quite large at the building of Kiholo [ca. 1812], but do not know the date of my birth. I have lived on Ouli and adjoining lands. I know all the boundaries of said land, used to *mahiai* on the *makai* portion of it. Ouli is bounded *makai* by the sea, and has ancient fishing rights; it is bounded on the Kona side by Waimea.

The boundary at seashore is at Kaihumoku, a point of stones in the sea, or the middle of the sand beach; thence direct to Ahuahaloo, the boundary following an old trail to this place. . . (Volume B:64)

Kalua, sworn. . . I was born in Waimea, South Kohala Hawaii at the time of the plague (1804), and have lived in Waimea and Kapia, a land near Ouli. I am a *kamaaina* and know the boundaries of Ouli. Kauhine[k] a konohiki (now dead) showed them to me. The sea bounds it *makai* and the land has ancient fishing rights. . . (Volume 1:120)

Puakō

Kauwewahine, sworn: . . . Lalamilo bounds Puako on the Kawaihae side (or North side) a wall at the dam of a fishing pond at a place called Makaha is the boundary. Thence along the stream from the pond to a place called Kaekuakapuaa, a wall at the shore; Thence along shore towards Kona to a large rock on the sand beach called Kapelekaaha. The sea belongs to Lalamilo. Thence *mauka* along Lalamilo to Puapuaa passing from the Kona side to the *mauka* side of the pond. Thence towards Kohala hills to Piikoele, an old pond now filled with sand, on the *mauka* side of the present pond; thence to the *Makaha.* These are the boundaries of Puako as told me by my parents. . . (Volume B:296)

Table 5. Oceanic boundaries and fishing rights in the South Kohala District.

Ahupua‘a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Ala‘ōhi‘a	No	-	-	-
‘Ānaeho‘omalu	Yes	Yes	Yes	-
Hale‘aha	No	-	-	-
Hale‘aha	No	-	-	-
Kalāhuipua‘a	Yes	Yes	Yes	-
Kanakanaka	No	-	-	-
Kapia	No	-	-	-
Kauniho	No	-	-	-
Kaupo	No	-	-	-
Kawaihae Akau	Yes	Yes	Yes	From Pokiiahua to Kawaihae Hikina or to Kauhuhu. Had *poho pa‘akai* rights
Kawaihae Hikina	Yes	Yes	Yes	Beach and Kona side of Kauhuhu/Pokiiahua. Had *poho pa‘akai* rights in *‘ili* of Pohakuloa, Kaholei, Kaneloa, Malahuehue, Pi‘ipepi‘i, Nupa‘a. Part of fish catch went to John Young and to *konohiki* of Kawaihae Akau
Keoniki	No	-	-	-
Lālāmilo	Yes	Yes	Yes	-
Lanikepu	No	-	-	-
Momoualoa	No	-	-	-
‘Ōuli	Yes	Yes	Yes	-
Pahipa	No	-	-	-
Panoluukia	No	-	-	-
Pauahi	No	-	-	-
Paulama	No	-	-	-
Puakō	Yes	No	No	Sea belonged to Lālāmilo
Pu‘ukalani (Pukalani)	No	-	-	-
Pu‘ukapu	No	-	-	-
Puu Kawaiwai	No	-	-	-
Pu‘u Ki	No	-	-	-
Waawaa	No	-	-	-
Wai‘aka	Yes	Not specified	Not specified	-
Waikōloa	Yes	No	No	-
Waima‘a	Yes	Yes	Yes	-
Waiauia	No	-	-	-
Waiauia	No	-	-	-

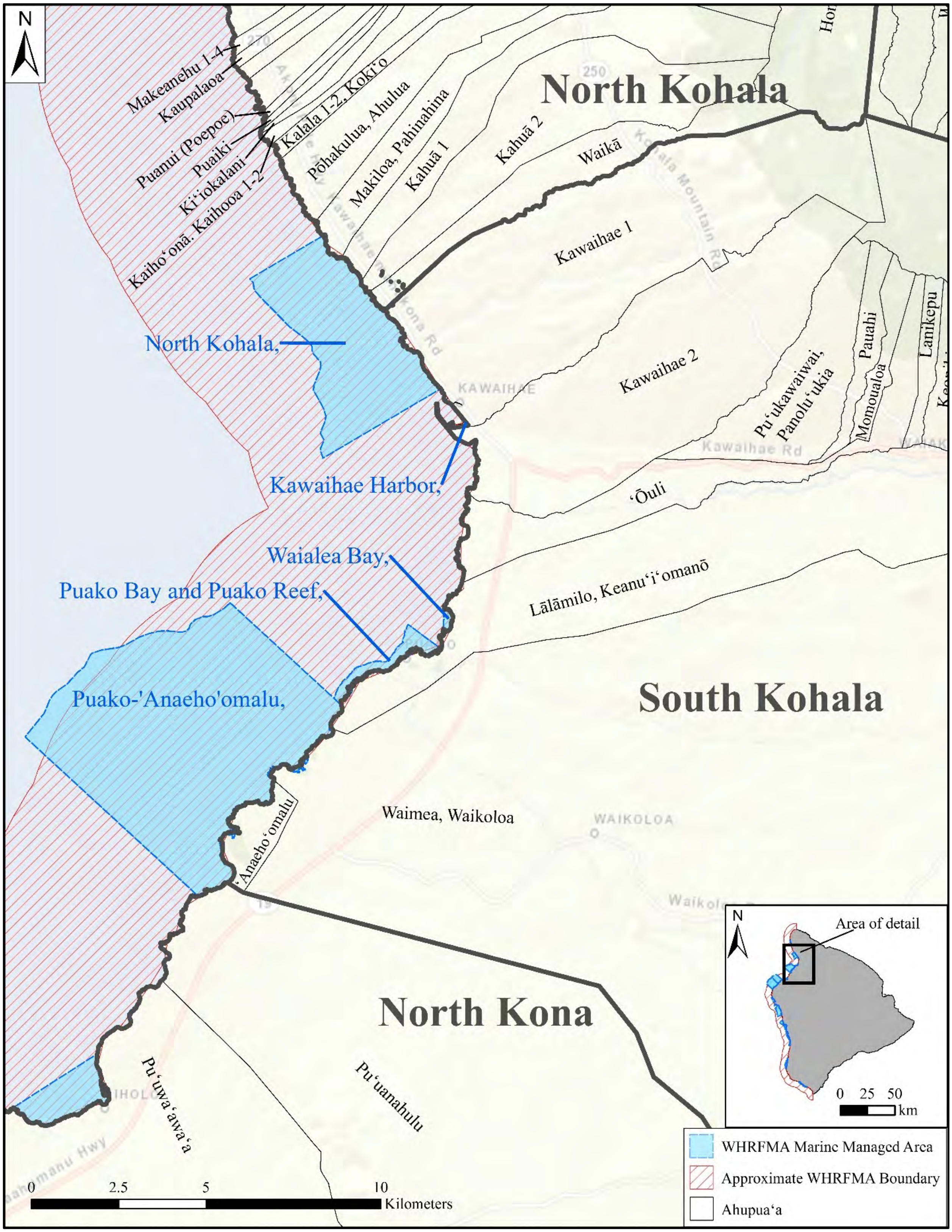

Figure 26. *Ahupua'a* of the South Kohala District.

Waikōloa

Mi, sworn: . . . Waimea is a Kalana. – which is the same as an island divided in to districts. – there are eight Okana in Waimea. In those Okana are those lands said to extend out *(hele mawaho).* These lands came in to the possession of Kamehameha I who said to Kupapaulu, go and look out to of the large lands running to the sea, for John Young and Isaac Davis. Kupapaulu went to Keawekuloa, the *haku aina,* who said if we give Waikoloa to the foreigners they will get Kalahuipua [Kalāhuipua'a] and Anaiomalu [Anaehoomalu] (two lands at the beach) then your master will have no fish. So they kept the sea lands and gave Waikoloa to Isaac Davis. John Young asked my parents if it was a large land they said, the black *aa* was Napuu, and the good land Waimea. . . (Volume A No. 1:7)

Moolau, sworn: . . . all the plain was given to Waikoloa, and Keanakaloa secured the fish lands at the shore. All the *pili* from Ouli to the *aa* of Kona belonged to Waikoloa. . . (Volume A No. 1:8)

Waima'a

Kaahumoku, sworn. . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea. (Volume B:298)

North Kona District

In North Kona, forth-five *ahupua'a* were surveyed for their boundaries as a result of the Boundary Commission proceedings (Table 6 and Figure 27). Of these, twenty-seven had boundaries that extended out to sea, and all of those were identified in the testimony as retaining ancient fishing rights. There were twelve total *ahupua'a* whose specific fishing rights were described in detail as part of the testimony including Hale'ōhi'u, Hāmanamana, Hōlualoa 4th, Honokōhau Iki (1st), Honokōhau Nui (2nd), Kaloko, Ka'ūpūlehu, Keahuolū, Keauhou 1st, Keauhou 2nd, Keōpū 3rd, and Pua'a 1st. Within North Kona there were several *ahupua'a* that either had fishing rights to waters in a neighboring *ahupua'a*, or shared fishing rights with another *ahupua'a*.

With respect to the fishing rights of Honokōhau Nui and Keauhou 2nd, testimonies did not specify whether the boundaries of the former extended out to sea nor whether there were any ancient fishing rights belonging to its inhabitants. However, testimony relates that residents of Honokōhau Nui did have permission to fish within the waters of Honokōhau Iki, and that the fishing rights within Honokōhau Iki were small, extending only from Maliu to Kananaka, where they were truncated by the seas belonging to Kealakehe and Honokōhau. While Honokōhau Iki held these shared fishing rights with Honokōhau Nui, there was some controversy over a *ko'a 'ōpelu* which was claimed and fished by the people belonging to Kaloko Ahupua'a. Also of note in the testimony are the chronological limitations of *akule* fishing rights as they pertain to Keauhou 1st and 2nd, as the latter possessed fishing rights to *akule* during the reign of Ke'eaumoku, but following the end of his reign (and the marital union of chiefs belonging to both Keauhou *ahupua'a*), rights to the *akule* (and *'ahi*) transferred to Keauhou 1st, and Keauhou 2nd only retained rights to bird hunting in the *mauka* lands. In the case of Hale'ōhi'u Ahupua'a, fishing encompassed the waters of neighboring Hāmanamana Ahupua'a, where residents were restricted to shoreline fishing only.

Table 6. Oceanic boundaries and fishing rights in the North Kona District.

Ahupua'a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
'Auhaukea'ē 1st	Yes	Yes	Yes	-
Awake'e	No	-	-	-
Awalua	No	-	-	-
Elepaio	No	-	-	-
Haleki'i	Yes	Not specified	Not specified	No testimony given
Hale'ōhi'u	Yes	Yes	Yes	Also held fishing rights to Hāmanamana

Table 6 continued on next page.

Table 6.continued.

Ahupua'a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Hāmanamana	Yes	Yes	Yes	Rights belonged to Hale'ōhi'u, fishing confined to rocks on shore
Haukalua 2nd	Yes	Yes	Yes	-
Hienaloli 1st	Yes	Not specified	Not specified	No testimony given
Hienaloli 2nd	Yes	Not specified	Not specified	-
Hienaloli 3rd	No	-	-	-
Hienaloli 4th	Yes	Yes	Yes	-
Hōlualoa 1st	Yes	Yes	Yes	-
Hōlualoa 2nd	Yes	Not specified	Not specified	-
Hōlualoa 3rd	Yes	Not located	-	-
Hōlualoa 4th	Yes	Yes	Yes	Only out until one couldn't see the sea floor
Honalo	No	-	-	-
Hōnauau	Yes	Yes	Yes	-
Honokōhau Iki	Yes	Yes	Yes	Small fishing rights extending from Maliu to Kananaka limited by the sea belonging to Kealakehe and Honokohau. May have jurisdiction over a *ko'a 'ōpelu* which was also fished and claimed by natives of Kaloko. Fishing also allowed here by natives of Honokōhau Nui.
Honokōhau Nui	Yes	Not specified	Not specified	Testimony for Honokōhau Iki relates Honokōhau Nui had fishing rights there
Honua'ino 1st	Yes	Not specified	Not specified	-
Honua'ula	No	-	-	-
Hokukano, Kalukalu	Yes	Not specified	Not specified	No testimony given
Kahalu'u	Yes	Yes	Yes	-
Kahului 1st	Yes	Not specified	Not specified	No testimony given
Kahului 2nd	Yes	Yes	Yes	-
Kalaoa 1st - 5th	No	-	-	-
Kaloko	Yes	Yes	Yes	Claimed fishing rights to the *ko'a 'ōpelu* in Honokōhau Iki
Kanaueue	No	-	-	-
Kapalaaea 1st	Yes	Not specified	Not specified	No testimony given
Kau	No	-	-	-

Table 6 continued on next page.

Table 6. continued.

Ahupua'a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Kaulana, Awalua, ʻŌhiki	No	-	-	-
Kaulehua	No	-	-	-
Kawanui Iki	Yes	Not specified	Not specified	No testimony given
Keahuolū	Yes	Yes	Yes	Keahuolū claimed the *ʻōpelu*
Kealakehe	No	-	-	-
Keauhou 1st	Yes	Yes	Yes	*Akule* and *ʻahi* belonged to Keauhou 1st after Keʻeaumoku's reign
Keauhou 2nd	Yes	Not specified	Yes	*Akule* belonged to Keauhou 2nd during Keʻeaumoku's reign. No fishing rights after his reign following the marriage of two chiefs of Keauhou 1st and 2nd
Keōpū 1st	Yes	Not specified	Not specified	No testimony given
Keōpū 2nd	No	-	-	-
Keōpū 3rd	Yes	Yes	Yes	Small fishing rights cut off by Honuaʻula, limited to Okolepohopohu
Kohanaiki	No	-	-	-
Kuamoʻo	No	-	-	-
Kūkiʻo, Maniniʻōwali	No	-	-	-
Laʻaloa 1st	Yes	Yes	Yes	-
Lanihau Iki (1st)	No	-	-	-
Lanihau Nui (2nd)	Yes	Yes	Yes	-
Laula	No	-	-	-
Lehuula Iki	Yes	Not specified	Not specified	No testimony given
Lehuula Nui	Yes	Yes	Yes	-
Mahaiʻula	No	-	-	-
Māʻihi 1st	Yes	Yes	Yes	-
Makalawena	Yes	Yes	Yes	-
Makaʻula	No	-	-	-
Maniniowali	No	-	-	-
Moeauoa 2nd	Yes	Not specified	Not specified	-
Ohiki	No	-	-	-
ʻOʻoma 1st and 2nd	No	-	-	-
Onouli Iki (1st)	Yes	Not specified	Not specified	No testimony given

Table 6 continued on next page.

Table 6. continued.

Ahupua'a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Onouli Nui (2nd)	Yes	Not specified	Not specified	-
Pāhoehoe 2nd	Yes	Not specified	Not specified	No testimony given
Puaʻa 1st	Yes	Yes	Yes	Near shore and possibly to squid grounds
Puaʻa 2nd and 3rd	No	-	-	-
Puapuaʻa 2nd	No	-	-	-
Puapuaʻa Nui	Yes	Yes	Yes	-
Puʻu Anahulu	No	-	-	-
Puʻu Kala	No	-	-	-
Puʻu Waʻawaʻa	Yes	Yes	Yes	-
Waiʻaha 1st	No	-	-	-
Waiʻaha 2nd	Yes	Yes	Yes	-

End of Table 6.

Collectively, the testimonies provided for the remaining *ahupuaʻa* of North Kona relay little detail, particularly with regard to distance offshore. The fishing rights of Kaʻūpūlehu were spatially restricted between Keawaiki and Popoʻomino. Similarly, the fishing rights of Keōpū 3rd were cut off by the waters of Honuaʻula, seemingly limited to the a stone on the shoreline called Okolepohopohu. The fishing grounds for Puaʻa 1st expanded out a bit further to encompass the near shore fisheryand the squid fishing grounds, while the rights of Hōlualoa 4th extended out as far as the ocean floor was visible from land. Excerpts of Boundary Commission testimonies for the *ahupuaʻa* of North Kona that discussed ancient fishing rights and boundaries are presented below (underlining and italicization added for emphasis and clarity).

ʻAuhaukeaʻē 1st

Kekoanui, sworn: . . . Kailianu w. was the *kamaaina* at the shore; she lived near the land; she pointed out the boundaries on both sides of the land at the shore; I marked the corner of the land on the South side, cut into a large rock X; on the North side is a ridge of rock in the sea by a sand beach; did not mark that. That land always had undisputed fishing right in the sea. . . (Volume B:450)

Haleʻōhiʻu

Kanehailua, sworn: [near the southern boundary, *makai*] . . . thence to Kuula [a near shore hill], a *puu pohaku,* where we used to worship. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:266)

Hāmanamana

Kaukaliinea, sworn: . . . thence to Kahua, a *lae* at the seashore. Bounded *makai* by the sea. I have heard that the Ancient fishing rights belonged to Haleohiu. The people from Hamanamana had their fishing confined to the rocks. . . (Volume B:264)

Kanehailua, sworn: thence *makai* to Kahua at the seashore. Bounded *makai* by the sea. The ancient fishing rights was limited to the rocks at shore. The sea belonging to Haleohiu. . . (Volume B:264)

Haukalua 2nd

Hoolau, sworn: . . . Bounded on the *makai* side by the sea. Ancient fishing rights extending out to sea. . . (Volume B:214)

Hienaloli 4th

Haleokane, sworn: I was born at Hianaloli, North Kona, Hawaii and have lived here ever since. I was quite large when Mr. Thurston arrived [1820], know the boundaries of the land, my *makua* (now dead) pointed them out to me. The sea is the *makai* boundary and the land has ancient fishing rights extending out to sea. . . (Volume A No. 1:346)

Figure 27. *Ahupua'a* of the North Kona District.

Hōlualoa 1st

Keliikanakaole, sworn: . . . thence *makai* following an *iwi aina* to a place at shore called Kuapae, a rocky point in the sea, with sand each side of it. The boundary at shore between Puapuaa and Holualoa 1st. Ancient fishing rights extending out to sea. . . (Volume A No. 1:337)

lhihi, sworn: . . . thence *makai* to Puuopelu, an *oioina kukui* [trail side resting place, shade by *kukui* trees]; thence *makai* along the *iwi aina* to Kuapae, a *puu pahoehoe* with sand on Kailua side and sea on the *makai* side. Ancient fishing rights extending out to sea. . . (Volume A No. 1:338)

Hōlualoa 4th

Kea, sworn: ...My parents (now dead) who were also *kamaainas*, pointed out the boundaries to me. At that time all lands had different *Konohiki.* Kaumalumalu bounds Holualoa 4th on the South side; the sea on the *makai* side. Ancient fishing rights extending out to where it is hard to see bottom. . . (Volume A No. 1: 343)

Haleokane, sworn: . . . The sea is the *makai* boundary and the land has ancient fishing rights extending out to sea. Hienaloli 5th is on the South side, the boundary at shore between Hianaloli 4th and Hianaloli 5th is Okikau, a water hole and bathing place. . . (Volume A No. 1: 346)

Hōnaunau

Kila, sworn: . . . Ancient fishing rights extending out to sea. . . (Volume A No. 1:282)

Kuiline, sworn: . . . Know a place called Anapuka; it is way on Honaunau. The boundary as it was told to me runs from Anapukalua to Puulehu, and then to Mahana. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:223)

Honokōhau Iki (1st)

Hoohio, sworn: . . . Thence *makai* to Maliu a lae, the sea bounds the land *makai*; and there is a very small fishing right cut off by the sea of Kealakehe and Honokohaunui. . . (Volume A No. 1:364)

Kamohai, sworn: . . . Thence to a *heiau* named Halekuo thence to Maliu a *lae* in the sea; on the North side of the point. Ancient fishing rights extend from Maliu to Kananaka; a ledge of rocks in the sea, which looks red from the water is next to Honokohaunui. . . (Volume A No. 1:365)

Kekoanui, sworn: I am a *kamaaina* of Honokohau, and live there. I went with Mr. Hitchcock to survey the land. We commenced at the corner marked by Brown, at the seashore. Kaloko, said to be Keelikolani's land, is on the North side of the land. Kaohi w. and Kailioha kane were our *kamaainas* in the surveying; they pointed out the boundaries, a large rock in the sea, over which the waves break; it is quite a little distance off from the shore. There is a "*Koa Opelu*" in the sea, the *kamaainas* say it belongs to this land. Kaohi is a very old woman and is feeble, as is the man; they said that the people of Kaloko fish in the *Koa Opelu*, as formerly the *Konohiki* of Honokohau was a woman, who married a man who was the Konohiki of Kaloko, and allowed him to fish on her grounds. . . Honokohau nui has fishing right in the sea. . . (Volume B:452-453)

D.H. Hitchcock, sworn: I marked the North *mauka* corner by the aa, as near as I could tell from what the natives told me of the boundary. . . According to the boundaries of Honokohau the "*Koa Opelu*" is entirely within the land, as the old woman said it belonged. . . From the beach up the North side of the land, the boundary line strikes up onto the *aa* to an *Ahu*, and on to a stone wall, said to be the boundary. The South side was surveyed by J.F. Brown, as far up as Honokohau iki extends, and we found his corner… The only disputed point was about the "Koa Opelu," which the Kaloko people claim. . . (Volume B:453)

Kahaluʻu

Papa, sworn: . . . The sea bounds it *makai,* and it has ancient fishing rights extending out to sea. Keauhou bounds Kahaluu on the Southern side; at the sea shore the boundary between these two places is at Ohiki, a point on the South side of Paaniau, and near to it. . . (Volume A No. 1:321)

Kaahuna, sworn: . . . Keauhou bounds Kahaluu on the South side; sea *makai;* and the land has fishing rights. The boundary at shore is Ohiki, a pile of stones on the South side of Paaniau. . . (Volume A No. 1:322)

Kahului 2nd

Niniha, sworn: . . . I pointed out the boundaries of Kahului 1st when it was surveyed; thence along the land sold, to Kalalii, a *pulu lepo* at seashore. Ancient fishing rights extending out to sea. . . (Volume A No. 1:328)

Makuakane, sworn: . . . Thence the boundary runs along land sold, to the sea, and the land has ancient fishing rights extending out to sea. . . (Volume A No. 1:329)

Kaloko

Nahuina, sworn: . . . thence *makai* to Keawewai, an *awaawa,* with water near the shore road thence to Okuhi, an *awaawa* in the sea with a point on each side of it. On the *makai* side Kaloko is bounded by the sea; and the land had ancient fishing rights extending out to sea. The *koa* is on Kaloko and the *olona* on Honokohaunui. . . (Volume A No. 1:371)

Kaumalumalu, Pāhoehoe

Kamakahoohia, sworn: . . . Kaleiahana (now dead) pointed out the boundaries to me; they used to go into the mountain after *uwau.* I went with them after sandalwood. The sea bounds this land *makai* and it has ancient fishing rights extending out to sea. Pahoehoe 1st is on the South side; the boundary at shore between these two lands is Manawai, a water hole on the North side of the landing. . . thence to Kui, a *pali* in the woods where canoe makers used to worship; here the boundary strikes the Judd road. . . (Volume A No. 1:324-325)

Palauolelo, sworn: . . . (The boundary at seashore between Holualoa and Kaumalumalu is at Kuula opelu, a *heiau* [an *ʻōpelu* fisherman's temple] The *Kaheka* [near shore pond—anchialine pond] is on Kaumalumalu . . . (Volume A No. 1:325)

Kaʻūpūlehu

Keliihanapule, sworn: . . . Bounded on the South side by Kukio owned by Pupule, the boundary at shore is in the middle of a place called Keawaiki. The land had ancient fishing rights extending out to sea from Keawaiki to Popoomino, a pile of stones at the corner of Pupule's land. . . The place where they make salt at the seashore is on the Puna side of the lava flow. . . (Volume B:247-248)

Kahueai, sworn: . . . The boundary on Kohala side at shore is a spot of sand called Kolomuo on the south side of Kalaemano. . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:249-250)

Keahuolū

J.Z. Waiau, sworn: . . . thence to Puunahaha, a large red hill on the *mauka* side of the *makai* Government road, thence to Puuokaloa, an *oioina* or small hill; thence to Kaiwi, a *lae pohaku* on the middle of point. Ancient fishing rights extending out to sea. . . (Volume A No. 1:354-355)

Kealakai, sworn: . . . thence to Puunahaha; the boundary passing on the North side; from thence to Puuokaloa; thence *makai* to Kaiwi, the *kula* in middle of point and *lae pohaku* on the point at sea shore. Ancient fishing rights extending out to sea and claiming the *opelu*. . . (Volume A No. 1:356)

Keauhou 1st

Lono, sworn: . . . The boundary at the shore between Keauhou1st and Keauhou 2nd is at Kamauae, a heiau for fishermen situated above the beach, on the hill where the houses stand; thence *mauka* to a breadfruit tree; thence to the head of Holua. . . Keauhou is bounded by the sea and the land has ancient fishing rights extending out to sea. . . (Volume A No. 1:319)

Keauhou 2nd

Kakio, sworn: . . . The boundary at shore between the two Keauhous is at a place called Kamauae at the beach; Thence it runs *mauka* to the head of *Holua* (an old sliding place). . . They say in the days of Keeaumoku the *Akule* used to belong to Keauhou 2d and the birds to Keauhou 1st, but the Chief of Keauhou 2 married a chief of Keauhou 1st and after that all the fish were given to Keauhou 1st and the birds and land *mauka* to Keauhou 2nd. . . (Volume A No. 1:267)

Keōpū 3rd

Kaleiheana, sworn: . . . John Ii (now dead) pointed out the *makai* boundaries to me. The land has very small fishing rights, which are cut off by Honuaula. The sand in the sea is on Honuaula, and the *aa* is on Keopu. The boundary at shore between these two lands is at Puukoa, a noted place for surf riding. There is a wall here called Papaula, and the boundary comes to the middle of said wall. . . Bounded *makai* by the sea. . . Commencing on the other side at seashore at a large stone called Okolepohupohu *makai* of the Governor's stone house Hulihee. . . (Volume A No. 1: 302)

Kauakahi, sworn: . . . Papaula is the boundary at the shore between Keopu and Honuaula; The land had ancient fishing rights at Okolepohopohu, and from there the boundary runs *mauka to* Makakauahi, an *oioina*. . . (Volume A No. 1: 303)

La'aloa 1st

Nahina, sworn: . . . Ancient fishing rights extending out to sea. . . (Volume A No. 1: 331)

Lanihau Nui (2nd)

J.Z. Waiau, sworn: . . . It is bounded on the North side by Keahuolu and on the South side by Lanihauiki, the land has ancient fishing rights extending out to sea. The boundary at shore between Lanihaunui and Lanihauiki is Kukanapaio, an *awaawa kai* in the rocks; thence *mauka* to Kuaaona between the fish ponds, outside of the fort [at Ahuena]. I think one good sized fish pond is on Lanihauiki, called Waikauila; Waihonu is on Lanihaunui ; thence to a cocoanut tree on the inside of the old fort; thence to a long stone above the fort, buried in sand, some of the *kamaaina* say it used to reach wet sand. . . (Volume A No. 1:305-306)

Lehuula Nui

Hapuku, sworn: . . . I only know the boundaries of Lehuulanui below the great walled lot. Sea bounds this land on the *makai* and it has ancient fishing rights extending out to sea. . . Paaaoao is the boundary at sea shore between Kawanui and Lehuulanui; there is a wall and landing there. . . (Volume A No. 1:315)

Mā'ihi 1st

Ehu, sworn: . . . Honalo bounds it on the north side. Maihi 2nd on the south side. Leinakaloa is the boundary at shore between Maihi I and Maihi 2nd. Ancient fishing rights extending out to sea. The *Opelu* belonged to Maihi and the *Ahi to* Keauhou; bounded *makai* by the sea. . . (Volume A No. 1:311)

Kailikini, sworn: . . . Leinakaloa, a canoe landing is the boundary between Maihi 1st and Maihi 2nd. A *pali* between Koa Opelu [a *heiau]* belongs to Maihi 1st. The sea bounds it *makai.* The boundary at shore between Maihi 1st and Honalo is at Keawakui running along the south side of it. . . (Volume A No. 1:312)

Makalawena

Kahailii, sworn: . . . Commencing at the seashore, the boundary between the land of Makalawena and Mahaiula is a *kaheka* [tidal pool], called Kaelemiha. . . thence to Mokupohaku, or Kaiwikohola, a large rock in the surf. Makalawena is bounded *makai* by the sea, and the land has ancient fishing rights, extending out to sea. . . (Volume A No. 1:373-374)

Mamae, sworn: . . . The boundary at shore between Makalawena and Mahaiula is Nahaleoahumakaike, a *kaheka;* thence to an *ahu* called Kaelemiiha. . . Thence to Pohakuanaeapoapu, a large rock at the seashore, and from thence to a large rock in the surf called Kaiwi Kohola. . . (Volume A No. 1:374-375)

Pua'a 1st

Kauwa w., sworn: . . . Puaa is bounded *makai* by the sea and the land has ancient fishing rights near the shore, but not extending out to sea. Thence commencing at a *punawai* by the seashore called Holoke, between the lands of Puaa and Auhaukeae and running *mauka* to Poholua, a *huli pali* near the shore and just above a house. . . *makai* to Hiilia, a punawai; thence to Kekawa, at the seashore.

Hiilia is *mauka* of Governor Adam's wall, and Kekawa is the *awaawa kai* [an ocean inlet], with points each side. The boundary is between the two. Puaa has ancient fishing rights extending to the squid grounds. . . (Volume A No. 1:376-378)

Kahueai, sworn: . . . The boundary at shore on the Kau side is Nakakai, owned by Pupule, the *mauka* corner of Pupule's land on Puaa 2nd is at Kaopapa. . . thence *makai* along Hauanio's land and thence along Ukumea's land and then along Kole to the sea shore. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:244-245)

Puapua'a Nui

Ukumea, sworn: . . . Bounded on the North side by Piki, the boundary at shore between these two lands is Keawapuapua on the south side of the *awa* [landing]. . . thence to Huloa, a resting place above Governor Adams wall; thence to seashore. I do not know the name of this *makai* point. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:260-261)

Mahalo, sworn: . . . Commencing at the seashore on the Kau side of the Awaawa Puhiuhiu, the *awaawa* being on the Kau side of the canoe landing; thence to Pakuhano, *aa mauka* of the wall. . . thence *makai* to Ahuloa; thence to Puuopelu; thence to Kuapae at the seashore. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:261)

Pu'u Wa'awa'a

Aea, sworn: . . . Ono, an older cousin of mine, now dead, pointed out the boundaries to me; as the different lands had different *Konohiki* and different *koele* [planting areas worked for the chiefs] &c. The land of Puawaa is bounded on the South side by Kaupulehu and *mauka* by the same. On the North by the land of Puanahulu, and *makai* by the sea. The ancient fishing rights of the land extend out to sea.

The boundary at sea shore between this land and Kaupulehu, is at Pohakuokahai, a rocky point in the *aa* on the lava flow of 1801, the flow from Hualalai to sea. I think it is the third point from Kiholo, in the flow, as you go toward Kona; thence the boundary between these lands runs *mauka* on *aa* to Keahupuaa. . . (Volume A No. 1:253)

Wai'aha 2nd

Peahi, sworn: . . . A water hole called Waialipi is on the boundary between the two Waiahas. Waiaha 2d is bounded by Waiaha 1st to a banana grove at the edge of the woods. . . Waiaha 2d is bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:269)

South Kona District

There were twenty-nine *ahupua'a* in South Kona whose boundaries were surveyed (Table 7 and Figure 28). Of these, twenty had boundaries that extended out into the sea, and nineteen of those were identified as having ancient fishing rights. Boundary Commission testimony that included detailed accounts regarding these fishing rights were provided only for seven of these *ahupua'a* (Ka'apuna, Kahauloa 2nd, Kalamakowali, Kalamakumu, Ke'ei 1st, Ki'ilae, and Pāpā 2nd),while the testimony for 'Ōlelomoana Nui related that fishing rights and resources belonged to the *konohiki*. With respect to Ki'ilae and Pāpā 2nd, fishing rights only extended out to where the bottom of the sea was no longer visible. Several other *ahupua'a*, including Kahauloa 2nd, Kalamakumu, and Ke'ei 1st, likely held rights only in shallow water, with Kalamakumu being cut off by the fishing grounds of Kealakekua. Similarly, the fishing grounds of Ka'apuna, although they extended out further out into the deep sea, were truncated by Honomalino. The rights of Kalamakowali were geographically restricted to a fishing place known as Mokunui. Excerpts of Boundary Commission testimonies for the *ahupua'a* of South Kona that discussed ancient fishing rights and boundaries are presented below (underlining and italicization added for emphasis and clarity).

'Alikā

Kahinalua, sworn: . . . Bounded *makai* by the sea. *Pali* called Kahoolewlewa is the boundary at shore between Alika and Kipahoehoe. There is a rock marked K. I think by land surveyed by Wiltse. (Volume B:322)

Makia, sworn: . . . Bounded *makai* by sea. Kipahoehoe bounds it on Kona side from shore to *mauka* end. Boundary at shore is at Kahoolewalea a *pali* at shore. The rock is marked. (Volume B:322)

Table 7. Oceanic boundaries and fishing rights in the South Kona District.

Ahupuaʻa	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Alaʻē 1st	Yes	Not specified	Not specified	-
Alaʻē 2nd	Yes	Not specified	Not specified	-
ʻAlikā	Yes	Yes	Not specified	-
Anapuka, Hoʻopūloa	No	-	-	-
Haleili	No	-	-	-
Haukālua 1st	No	-	-	-
Haukālua 2nd	Yes	Yes	Yes	-
Hōnaunau	Yes	Yes	Yes	-
Honokua	Yes	Yes	Yes	-
Honomalino	Yes	Yes	Yes	-
Hoʻokena	Yes	Yes	Yes	-
Hoʻopūloa	No	-	-	-
Ilikahi	No	-	-	-
Kaʻapuna	Yes	Yes	Yes	Extending into deep sea until it became jurisdiction of Honomalino
Kahauloa 2nd	Yes	Yes	Yes	Only shallow water
Kalāhiki	Yes	Yes	Yes	-
Kalamakowali	Yes	Yes	Yes	Only at Mokunui
Kalamaililoa	Yes	Not specified	Not specified	-
Kalamakāpala	No	-	-	-
Kalamakumu	Yes	Yes	Yes	Only to short distance out, truncated by Kealakekua's fishing rights
Kalamaumi	No	-	-	-
Kalamawaiawaawa	No	-	-	-
Kalihi	No	-	-	-
Kalukalu, Hokukano	Yes	Not specified	Not specified	No testimony given
Kamakaolohe	No	-	-	-
Kanakau	No	-	-	-
Kaʻohe 1-3	No	-	-	-
Kaʻohe 4th	Yes	Yes	Yes	-
Kaʻohe 5th	No	-	-	-
Kapuʻa	Yes	Yes	Yes	-
Kapuai	No	-	-	-
Kauahia	No	-	-	-
Kauhakō	No	-	-	-
Kaulanamauna	No	-	-	-
Kauleolī 1st and 2nd	No	-	-	-
Kealakekua, Kaʻawaloa	Yes	Not specified	Not specified	No testimony given
Keālia 1st	Yes	Yes	Yes	-
Keālia 2nd	Yes	Not specified	Not specified	No testimony given
Keʻei 1st	Yes	Yes	Yes	Possibly only in shallow water

Table 7 continued on next page.

Table 7. continued.

Ahupua‘a	*Boundary Testimony*	*Boundary Extends to Sea*	*Fishing Rights*	*Notes*
Ke‘ei 2nd	Yes	Not specified	Not specified	-
Ke‘eke‘e 1st2nd, Kanakau	No	-	-	-
Keōkea	Yes	Not specified	Not specified	-
Keopuka	No	-	-	-
Ki‘ilae	Yes	Yes	Yes	Only as far as can see bottom of sea
Kiloa	No	-	-	-
Kīpāhoehoe	No	-	-	-
Kipu	No	-	-	-
Kolo	No	-	-	-
Kukuiopa‘e 1-2	No	-	-	-
Maku‘u	No	-	-	-
Maunaoni 1-6	No	-	-	-
Miloli‘i	No	-	-	-
Okoe 1-2	No	-	-	-
‘Ōlelomoana Iki	Yes	Yes	Yes	-
‘Ōlelomoana Nui	Yes	Yes	Yes	Fishing rights belonged to *konohiki*
Omoka‘a	No	-	-	-
‘Ōpihihale	No	-	-	-
Pāhoehoe 1st	No	-	-	-
Pāhoehoe 2nd	Yes	Yes	Yes	-
Pāpā 1st	No	-	-	-
Pāpā 2nd	Yes	Yes	Yes	Fishing rights extend out to where bottom is no longer visible
Waiea	No	-	-	-
Waipunaula	No	-	-	-
Waikāku‘u	No	-	-	-

End of Table 7.

Haukalua 2nd

Hoolau, sworn: . . .Bounded on the *makai* side by the sea. Ancient fishing rights extending out to sea. . . (Volume B:214)

Hōnaunau

Kila, sworn: . . . Ancient fishing rights extending out to sea. . . (Volume A No. 1:282)

Kuiline, sworn: . . . Know a place called Anapuka; it is way on Honaunau. The boundary as it was told to me runs from Anapukalua to Puulehu, and then to Mahana. Bounded makai by the sea. Ancient fishing rights extending out to sea. . . (Volume B:223)

Honokua

Kaleikoa, sworn: . . . The sea bounds it *makai.* Ancient fishing rights extending out to sea. . . (Volume B:211)

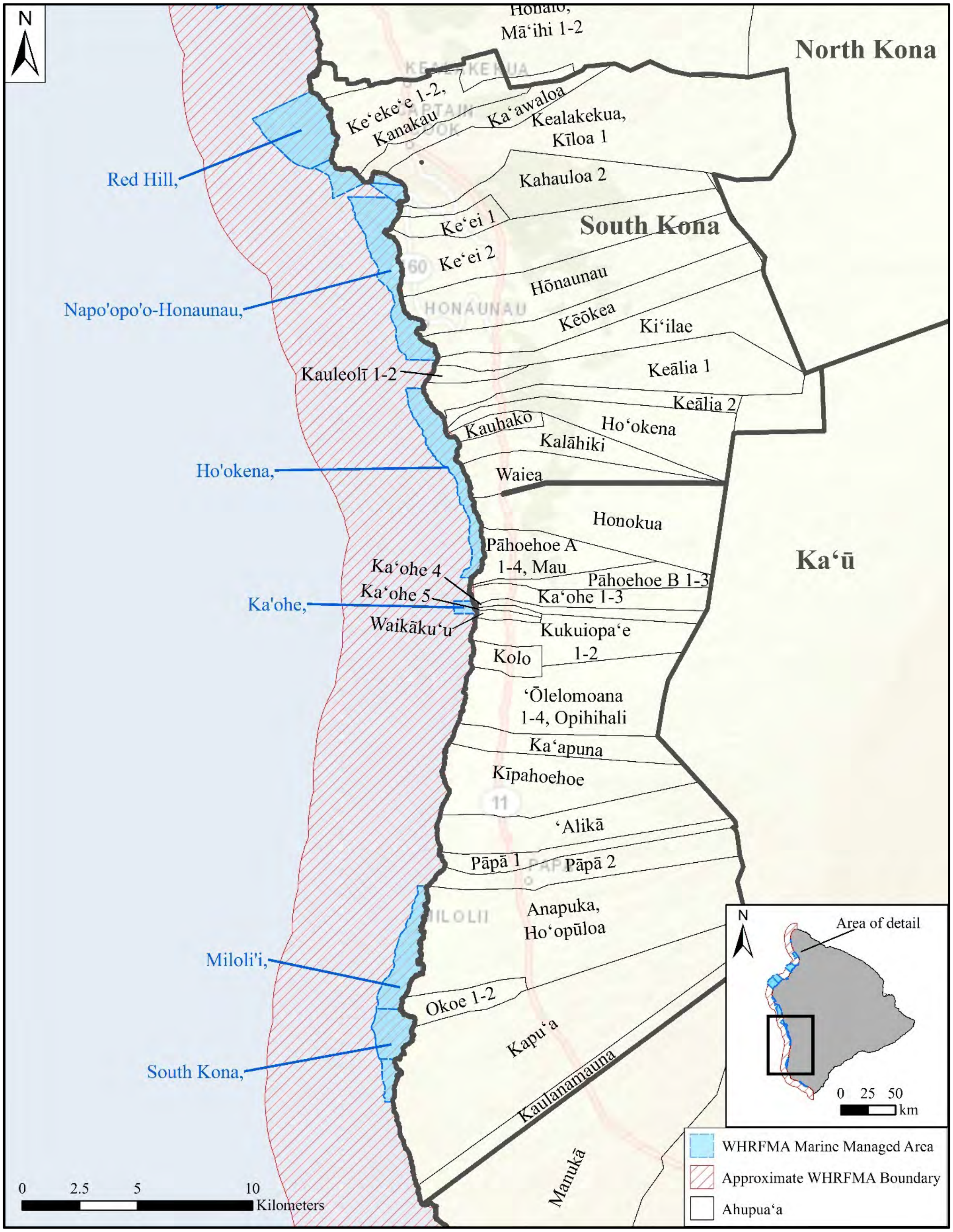

Figure 28. *Ahupua'a* of the South Kona District.

Honomalino

Kuakahela, sworn: . . . Bounded *makai* by the sea, ancient fishing rights extending out to sea. Kalipo is the boundary at shore between this land and Kalihi. Kalihi has been sold by Government from shore to the Government road. . . (Volume B:190)

Ho'okena

Kekuhaulua, sworn: . . . Hookena had ancient fishing rights extending out to sea. . . (Volume A No. 1:275)

Kamaka, sworn: . . . Hookena had ancient fishing rights extending out to sea. . . (Volume A No. 1:277)

Ka'apuna

Kama, sworn: …Commencing at *ahupuaa* on the South side of Kipahoehoe bounded at the shore by Kaleokane, a point extending into the sea, boundary in the middle of the point… running *mauka*, then returning on southern boundary to *makai*. . . Thence along land sold to Kapunanaka, a *puu pahoehoe* all cracked up, at the shore, bounded *makai* by the sea. Ancient fishing rights extending out to the sea. . . (Volume B: 198-200)

Kahauloa 2nd

Kahula, sworn: . . . From Kaneaa the boundary runs *makai* along an *iwi aina* to Kahuamoa, a pile of stones; thence *makai* to Mahana, a pile of stones; thence to Kaneahuea, the *pahoehoe* at the foot of the *pali* being on Keei and the *pali* on Kahauloa. Fishing rights in shallow water only. . . (Volume A No. 1:297)

Kalāhiki

Palea, sworn: . . . Pohokinikini is the name of two water holes on Waiea, where Cummings' land ends and my lands bound Kalahiki from there to the seashore. The sea bounds it on the *makai* side and the land has Ancient fishing rights extending out to sea. . . (Volume A No. 1:291)

Kalamakowali

Naili, sworn: . . . Kaaemoku's land on Kalama 4th bounds Kalama 3rd at seashore on the South side; and the place called Mokunui is said to be the only fishing place belonging to Kalama 3rd [Kalamakowali] From the seashore the boundary runs *mauka,* along *kuleanas*, and lands sold, and along remnants, belonging to Government. . . (Volume A No. 1:310)

Kalamakumu

Kamauoha, sworn: . . . Kalamakumu is bounded *makai* by the sea and it has ancient fishing rights extending out a short distance; the outside sea belonging to Kealakekua. My father-in-law, who was *Konohiki*, pointed out the boundaries to me. I am *Konohiki* now. The boundary at sea shore between this land and Kalama Ililoa is at a landing on Kalama Ililoa, at the south side of Kaiwikahua; Kapahukula's *kuleana*; thence the boundary runs *mauka* along a stone wall. . . (Volume A No. 1:300)

Ka'ohe 4th

Palea, sworn: . . . Pohokinikini is the name of two water holes on Waiea, where Cummings' land ends and my lands bound Kalahiki from there to the seashore. The sea bounds it on the *makai* side and the land has Ancient fishing rights extending out to the sea. . . (Volume B:219)

Huakano, sworn: . . . Bounded *makai* by the sea. Ancient fishing rights extending out to the sea. . . (Volume B: 219)

Kapu'a

Nakai w., sworn: . . . In old times they were very particular about the boundaries of lands. Kaulanamauna bounds it on the Kau side, Okoe on the Kona side, I do not know the *mauka* boundary. The boundary at the sea shore on the Kau side is at a fishing place called Ahuloa, there is a large rock there called by that name; thence *mauka* to Kaanamalu, a cave. . . (Volume B:185)

Makea, sworn: . . . I lived at Manuka for a while. The last witness is my wife and she was the cause of my going there. I know the boundary of Kapua at the shore. Keau, my father (now dead) told me that Ahuloa was the boundary between Kapua and Kaulanamauna . . . From the shore to the Government road I do not know the boundaries, the boundary there is the *pa heiau* [temple wall] *makai* of the road. . . (Volume B:186)

Kuakahela, sworn: . . . Ahuloa is at the sea shore, the sand is on Kaulanamauna ; thence along the *aa* to Kahepapa where the boundary leaves the *aa* and runs up a short distance...across the *aa* to *koa* woods, to a place called Kawiliwahine where they make canoes for both lands, thence to Koolau where Kapua ends, it is here cut off by Kaulanamauna and Honomalino, this is where *Kokoolau* grows, in the *koa*. . . thence along Okoe along the *awaawa* to Makalei, at the sea shore. I can go and point out all the places I have been to and I can tell the marks the *kamaaina* showed me. Bounded *makai* by the sea, ancient fishing rights extending out to sea. . . (Volume B:189)

Keālia 1st

Kekuhaulua, sworn: . . . the boundary turns toward Kona, to Keawe o Kini the *makai* boundary at seashore. Ancient fishing rights extending out to sea . . . (Volume A No. 1:274)

Ke'ei 1st

Kaluna, sworn: . . . Mokuape, a rock in the sea, is the boundary at shore between Keei 1st iki and Kahauloa it is on the North side of a place called Kaneahuea. . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea . . . (Volume B:225)

Kahula, sworn: . . . Fishing rights in shallow water only. . . (Volume B:226)

Ki'ilae

Kila, sworn: . . . Kuwaia, a water spring, under the *pali,* at the seashore, is the boundary between Kiilae and Keokea; the land has ancient fishing rights extending out, as far as you can see bottom; Commencing at the spring at the sea shore, the boundary runs *mauka* along Keokea to a *kahawai* (gulch) called Keokea. . . (Volume A No. 1:292)

'Ōlelomoana-Iki (1st)

Kimo, sworn: . . . Commencing at a large rock in the sea called Kaluahee; thence *mauka* to Kapulehu. . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea. The boundary at shore between Kolo and Olelomoana 1st iki is a large hill, as large as this house, called Kaluaolapauila… (Volume B:206-207)

Kapule w., sworn: . . . Commencing at the seashore, the boundary between Olelomaoana 2d nui and Olelomoana 1st iki is at Kaluahee; the boundary line running in an *awaawa* to the right of it… The boundary I have testified to is the boundary of Olelomoana 1st iki from the shore to Papai. . . Bounded on the North by Kolo Kapuaau, or Kaleiulala is the boundary at shore. . . Puaau is a *moku* in the sea. Bounded on the *makai* side by the sea. Ancient fishing rights extending out to sea. . . (Volume B:208)

'Ōlelomoana Nui (2nd)

Kamaka, sworn: . . . The boundary at the shore is in an *awaawa* on the North side of Kaluahee; thence *mauka* up the *pali* to the North side Kauhiuli, a *kauhale*. . . Bounded *makai* by the sea. Fishing rights belonging to Konohiki; bounded on the South side by Opihale… (Volume B:204)

Kapule w., sworn: …Opihale 1st bounds it on the South side. The boundary at shore between Olelomoana 2d nui and Olelomana 1st iki is Kaluahee; there is an *awaawa* at the right side of it; thence up the *awaawa* to Kauhiuhi. . . The boundary at shore between Opihale and Olelomoana 2d nui is at Kukulu; thence *mauka* to Kapakoholua. . . I can point out the boundaries from woods to shore. Bounded *makai* by the sea. Ancient fishing rights extending out to sea. (Volume B:205)

Pāhoehoe 2nd

Kuaimoku, sworn: …Bounded *makai* by the sea and I have always been told that the land has ancient fishing rights extending out to sea. I was born here. . . (Volume B:196)

Papa 2nd

Kuakahela, sworn: The boundary at shore between the two Papas is at Keawemoku. . . There is *koa* on this land fit to make canoes, but the most of the *koa* is on Honomalino. Anapuka bounds it on the South side of a point called Namakahiki. . . Bounded *makai* by the sea. Ancient fishing rights extending out to sea. . . (Volume B:193-194)

Makia, sworn: . . . Anapuka bounds it on the South side at a large *puka* on the South side of Namakahiki; thence *mauka* along a line of craters or holes, to the woods. . . Sea bounds it on the *makai* side. Ancient fishing rights as far out as you can see bottom. . . [Volume B:194]

Kaʻū District

Of the six *ahupuaʻa* in Kaʻū that extend southward from Kaulanamauna in South Kona to Ka Lae, Puʻuʻeo within the study area (Table 8 and Figure 29), one (Kīʻao) is landlocked, and five extended from *mauka* to *makai*. The significance of landlocked *ahupuaʻa* such as Kīʻao, represented "a very significant anomaly, since this means inhabitants of these ahupuaʻa were either not using any marine resources, which seems unlikely, or they needed to trade them from outside communities" (Gonschor and Beamer 2014:69). The boundaries of three of the five remaining *ahupuaʻa* (Kahuku, Pākini-iki, and Pākini-nui/Puʻu Lena) were brought before the Boundary Commission in 1873. With respect to these *ahupuaʻa*, the testimonies collectively relate that all three extended out to sea and retained fishing rights. However, in the case of Kahuku, it appears that although the *ahupuaʻa* indeed had ancient fishing rights, it was said in the testimony the inhabitants preferred hunting birds to fishing. Excerpts of Boundary Commission testimonies for the *ahupuaʻa* of Kaʻū that discussed ancient fishing rights and boundaries, are presented below (underlining and italicization added for emphasis and clarity).

Table 8. Oceanic boundaries and fishing rights in the Kaʻū District.

Ahupuaʻa	***BoundaryTestimony***	***Boundary Extends to Sea***	***Fishing Rights***	***Notes***
Kahuku	Yes	Yes	Yes	Natives did not fish, they hunted birds
Kamāʻoa, Puʻuʻeo, Ke	No	-	-	-
Kīʻao	No	-	-	Landlocked
Manukā	No	-	-	-
Pākini-iki	Yes	Yes	Yes	-
Pākini-nui, Puʻu Lena	Yes	Yes	Yes	-

Kahuku, Kau District

Kumauna, sworn: The sea bounds Kahuku on the *makai* side and the land had ancient fishing rights. The cave Kanupa is between Puulonolono, Puukeokeo and Pohaha on the *aa*; a hill called Hapaimamo is on Kahuku and the boundary between kapuhonu and Puuohia runs *makai* of this hill. I am an old canoe maker. . . In ancient days the people of Kahuku did not go fishing, but were after birds of all kinds to eat and this is the reason all the land on the mountain belonged to Kahuku. My *makuahonowai* and others always took their weapons with them as they used to have fights when they found people from other lands catching birds. . . (Volume A No. 1:141-142)

Pākini-iki

Puhi, sworn: . . . I was born at Kawela, Kau three months before the Okuu and have always lived at same place near there. I am a *kamaaina* and know the boundaries of Pakiniiki. I used to go with my parents, cultivating and fishing and they showed me boundaries of the lands. . . (Volume A No. 1:391)

Kuehu, sworn: . . . thence to Pohakukulua, two rocks in the sea on the boundary between Pakini iki and Kamaoa; thence along shore to Pakini nui. Ancient fishing rights extending out to sea. . . (Volume A No. 1:392)

Pākini-nui, Pu'u Lena

Puhi, sworn: . . . thence to Kanikaula a *heiau*; thence to Pouli, a kauhale and canoe landing; thence to Mokuhonu, a rock in the sea. The sea bounds it on the *makai* side, and the land has ancient fishing rights extending out to sea. . . (Volume A No. 1:395)

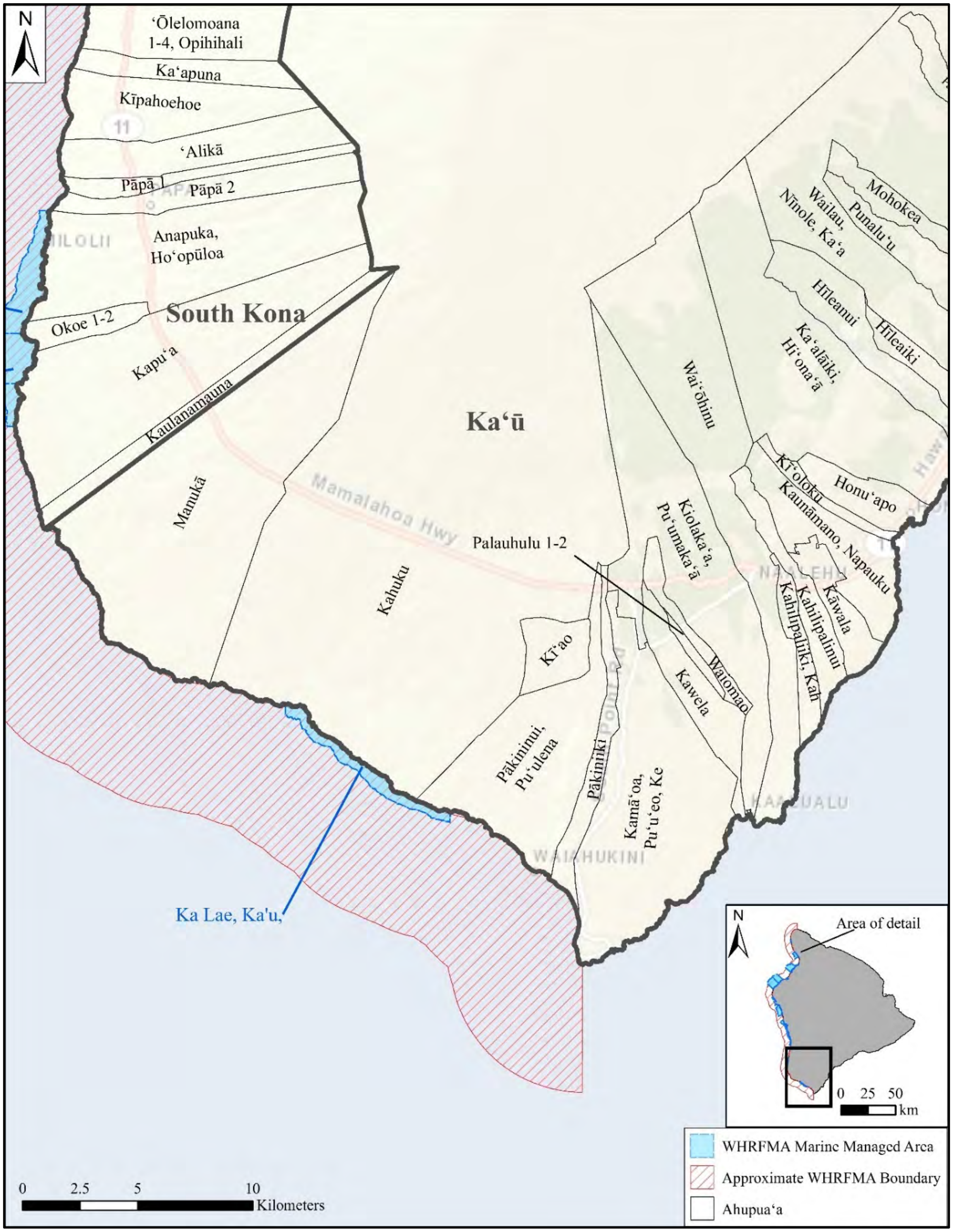

Figure 29. *Ahupua'a* of the Ka'ū District.

POST-*MĀHELE* TO EARLY TWENTIETH CENTURY COMMERCIAL FISHING

In the decades following the *Māhele ʻĀina*, Kānaka Maoli sought to navigate their way through a major land and political transitions, moving from a time when fisheries were strictly managed by appointed *aliʻi* and *konohiki*, to one where fee-simple interest and broader public rights existed (Maly and Maly 2003). While the *Māhele ʻĀina* enabled foreigners to own property in fee-simple, it simultaneously resulted in the displacement of many Kānaka Maoli from their ancestral lands, which severely disrupted the ancient system of land management (Kameʻeleihiwa 1992). Galzier (2007:66) suggests that during these challenging times, subsistence fishing remained an important part of the Kānaka Maoli lifestyle. He points out that during this time "certain beliefs and ways of living were not abandoned in full, but rather subverted" (ibid.). The years following the *Māhele* of 1848 were filled with difficulties for Kānaka Maoli fishers, as fishing laws continued to be redefined as a means to address a wide range of fishery-related issues including access rights, *konohiki* rights, and taxation. Maly and Maly (2003:312) report that by 1850, the traditional method of using plant-based poisons, specifically *ʻauhuhu* "or other substance deleterious to fish" was made illegal. Regardless of these changes, for close to 100 years— through the whaling era (1820-1865) and well into the 20th century—Kānaka Maoli continued to play the leading role in Hawaiʻi's commercial fishing industry (Cobb 1905; Glazier 2007; Schug 2001). Despite the vast socio-political and economic changes that occurred in the islands during this time period, Kānaka Maoli managed to adapt their subsistence lifestyle and culture to meet the demands brought about by a market economy.

The shift to fee-simple ownership of land ultimately paved the way for large scale commercial agriculture, which led to successive waves of migrant contract laborers, including those of American, Chinese, Portuguese, Filipino, and Japanese descent. Schug (2001:17), who conducted historical research on Hawaiʻi's commercial fishing industry, reports that in 1872 "Hawaiʻi's non-indigenous population" numbered around 5,366, but that by the turn of the 20th century, that number had increased to some 114,345 individuals of foreign descent. Of all of the ethnic groups to arrive in Hawaiʻi to support the burgeoning sugar industry, the Japanese had become the most heavily involved in Hawaiʻi's commercial fishing industry. Schug explains:

> When their plantation contracts expired many Japanese who had previously been skilled commercial fishermen in the coastal areas of Wakayama, Shizuoka, and Yamaguchi Perfectures remained in Hawaiʻi and turned to the sea for a living. The earnings of these fishermen were on average higher than those of plantation workers. (ibid.:17)

Many of the *issei* (first generation Japanese migrant laborers) become deeply invested in Hawaiʻi's commercial fishing sector. Gradually, these Japanese fishers introduced fishing gear and methods that were well suited for deep-sea and some nearshore fishing. Some of the more popular technological introductions included long line fishing and the sampan fishing vessel, originally propelled by oar or sail (Glazier 2007; Schug 2001). Sampan fishing vessels were later outfitted with an engine which gave access to previously unexploited deep-sea fisheries (ibid.). Additionally, the introduction of the Japanese cast net sometime around 1890, which was well-suited for near-shore fishing, was quickly adopted by Kānaka Maoli fishers, who then later dubbed it the *ʻupena hoʻolei*, or throw net (Figure 30) (Mitchell 2001; Pukui and Elbert 1986). During the late 19th century, Hawaiʻi's political system underwent a series of monumental changes as the Island Kingdom shifted to an American Territory. In summarizing the political climate of the islands during this time, and its impact on local fisheries, Maly and Maly (2003:viii) write:

> This system was radically altered in 1893, when the Hawaiian Monarchy was overthrown by foreign residents and American forces. Subsequently, the leaders of the parties responsible for the overthrow, made a steady move towards annexation of the Hawaiian Islands by the United States, which occurred in 1898. Then in 1900, the Hawaiian Islands became a "Territory" of the United States, and the resulting "Organic Act" set in place the legal parameters for freeing up the fisheries of Hawaiʻi.

In 1901, John N. Cobb, Agent of the United State Fish Commission visited the islands to investigate the condition of the islands' commercial fisheries. Cobb (1905) compiled his findings in his 1903 report titled, *The Commercial Fisheries of the Hawaiian Islands*, which provided details about fishing practices of this time, as well as the changing cultural tapestry of the islands. In relating what he observed during his visit, Cobb (ibid.:718) wrote:

> In numbers the native Hawaiian fishermen surpass all others combined, but this is partly because so many women and children engage in the hand fishery for octopus, algae, etc., and these have been counted in total. Some of the natives are at the head of quite important fisheries, and for many years held a monopoly of the industry, but more recently the Japanese have been engaging in it in large numbers and now occupy second place. The native fish spasmodically, as a rule, while the Japanese give to it their whole time and attention, and as a result are profiting much more. They are especially

> numerous on Oahu and Hawaii, most of them being engaged in deep-sea line fishing, which they virtually monopolize. They have several companies at Honolulu, Lahaina, and Hilo, and in this way control certain features of the fishing industry, thus enhancing the cost of the products to the general public.

Furthermore, Cobb (ibid.) reported that much of the same fishing methods and apparatuses used in early times were still being employed by Kānaka Maoli fishers. These technologies included fishing from canoes and from the shore using nets of various types, spears, basket traps, lures, hand lines, snares, and poles, all of which have been previously described in this study (see Traditional Hawaiian Nearshore Fishing Techniques section). While Cobb provides a variety of statistical information on Hawaiian fisheries during the turn of the 20th century, most interesting is perhaps his detailed list of catch yields sorted by island. His detailed list indicates that near-shore reef species, particularly on Hawai‘i Island, constituted a significant portion of the catch yields during 1900. Throughout the early part of the 20th century, the participation of Japanese in Hawai‘i's commercial fishing continued to increase, while Kānaka Maoli participation gradually waned (Glazier 2007). As the commercial fishing industry continually expanded to meet the demands of the growing consumer population in the islands, the fish and other marine resources became more scarce. With the shift to a market economy and a commercial fishery these marine resources were valued mostly for their economic potential, and little to no regard was paid to the myriad of traditional values and more that emphasized the spiritual, cultural, familial, and ecological importance of the fish and other marine species. Maly and Maly (2003:ix) contend that "this trend has continued through the present-day and fostered the decline in health and well-being of the broad range and diversity of Hawaiian fisheries."

Figure 30. Fisherman using the *‘upena ho‘olei* (throw net) ca. 19th century (Hawai‘i State Archives Call No. PP-22-8-003).

Commercial Aquarium Fishing in Hawai‘i

After the turn of the 20th century, on March 19, 1904, the Honolulu Rapid Transit and Land Company established the first public aquarium in Waikīkī, O‘ahu. Known then as the Honolulu Aquarium, Frederick A. Potter (for whom the Potter's Angelfish; *Centropyge potteri* is named after), who worked as a clerk for the Honolulu Rapid Transit Company became the aquarium's first Director. During its early years, the Honolulu Aquarium showcased various marine animals that were collected by local fishermen (University of Hawai‘i n.d.; Wiegel 2008). By the 1940s the collection of reef fish and other marine species to be used in aquariums had developed into a commercial industry. Throughout the mid-20th century, the aquarium fish industry went through a period of expansion, moving from O‘ahu to the outer islands. In 1953, the territorial government of Hawai‘i enacted Act 154, which authorized the Board of Agriculture and Forestry to establish a permit system for the use of fine-mesh nets and traps for the taking of aquarium fish (Walsh 2000).

The history of the aquarium fishery in West Hawai‘i has been detailed by Dr. William J. Walsh, of the Division of Aquatic Resources. The following section presents a brief history of aquarium fishing leading up to the creation of the WHRFMA, as described in Walsh's (2000) report, *Aquarium Collecting in West Hawaii: A Historical Overview.* By the early 1970s, growing public concern over the take of fish in West Hawai‘i prompted the Division of Fish and Game to temporarily suspend the issuance of additional aquarium fish permits. A week later, the Division of Fish and Game resumed issuing aquarium fish permits, but stipulated that permittees submit monthly catch reports—a process that by 1983, was called into question by Fish and Game biologist. Throughout the latter half of the 20th century, as the number of permits continued to increase so did the conflict between different marine user groups, but most notably, dive tour operators. In July of 1987, as a means to deescalate the mounting conflict, DAR (formerly the Division of Fish and Game) in conjunction with Sea Grant helped to establish a "Gentleperson's Agreement" between the two groups "whereby aquarium collectors agreed to refrain from collecting in certain areas," and in return, dive tour operators "agreed to not initiate legislative-opposition collecting and to cease harassment" (ibid.:1). This agreement had only short-lived success, however, as conflict continued to mount following the expiration of the agreement a year later, when it was reported that aquarium collectors had resumed operations is the previously closed areas.

Over the next decade, a series of legislative actions were undertaken to establish areas that would prohibit the removal of fish for aquarium purposes. In 1991, the areas previously defined under the "Gentleperson's Agreement," were incorporated into the Kona Coast Fisheries Management Areas (FMA), and a year later the Old Kona Airport Marine Life Conservation District was established. In May of 1996, House Resolution (HCR 184) established rules that required DLNR to work in conjunction with a task force in order to develop a comprehensive management plan that would regulate the collection of aquarium fish. In May of 1993, the task force was formed and duly named the West Hawai‘i Reef Fish Working Group (WHRFWG). The roughly seventy member working group met over a period of fifteen months to gather the information that would assist in the management efforts. The working group helped to identify areas where user conflict was most intense, and proposed various management recommendations, which were later included in DAR's 1997, legislative package.

During this time, DAR staff worked with groups from Ho‘okena and Miloli‘i, Kūki‘o, and Ka‘ūpūlehu—where there was a native Hawaiian presence and participation in fisheries management, and also strong opposition to the take of reef fish for the aquarium industry (Brandt personal communication 2019)—to develop FMA rules for these communities. To improve understanding of the biological impact of aquarium collecting, DAR also established a joint research project with the University of Hawaii at Hilo. These efforts, however, did not come to fruition during the following legislative session. In response to this outcome, several members from the WHRFWG branched out and created the Lost Fish Coalition, who pushed for a complete ban on aquarium collecting in West Hawai‘i. House Bill 3349 was introduced in January 1997 by Republican Paul Whalen, a Representative for the Kona and Ka‘ū Districts. This bill sought to ban aquarium collecting between Kawaihae and Miloli‘i. House Bill 3349 was killed in the following legislative session. House Bill 3457, which eventually established the WHRFMA, and included a provision to set aside 50% of the FMA as FRAs where aquarium collecting would be prohibited, was also introduced in 1997 by Democratic Representative, David Tarnas (North Kona and South Kohala). Following the committee hearings on House Bill 3457, the 50% provision was reduced to 30%, but the bill was ultimately approved by the Hawai‘i State Legislature, where it became Act 306, and thereby established the WHRFMA extending from ‘Upolu Point in Kohala to Ka Lae in Ka‘ū.

4. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Community members often possess traditional knowledge and in-depth understandings that are unavailable elsewhere in the culture-historical record of a place. As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify information "relating to the practices and beliefs of a particular cultural or ethnic group or groups" (State of Hawai'i, Office of Environmental Quality Control 2012:11). It is our contention that, in addition to assessing the significance of any identified traditional cultural properties, oral interviews should also be used to augment the process of identifying traditional cultural properties. Thus, it is the researcher's responsibility to utilize the gathered cultural-historical background information, as well as the information collected through the consultation process, to identify and describe potential cultural impacts to resources, practices, and beliefs, and to propose appropriate mitigative measures for those impacts as necessary.

In an effort to identify individuals knowledgeable about traditional cultural properties, practices, beliefs, and/or uses associated with the entire WHRFMA, a public notice was submitted to the Office of Hawaiian Affairs (OHA) for publication in their monthly newspaper, *Ka Wai Ola*. The notice was submitted via email on February 14, 2019, and was subsequently published in the March 2019 issue. A copy of the public notice is included as Appendix A of this report. As of the date of this publication, one individual, Diane Maka'ala Kaneali'i responded to the public notice. Mrs. Kaneali'i invited ASM staff to the Kailapa Hawaiian Homestead Community located in Kawaihae 1st Ahupua'a, as well as to the April 2019 Kai Kuleana Network quarterly meeting held at Manini Beach in Nāpo'opo'o. The summaries from these consultation efforts are detailed below. Sixteen individuals participated in the Kailapa Hawaiian Homestead Community interview all of whom reviewed and approved their interview summaries; another thirteen individuals participated in the Kai Kuleana Network interview, of which ten individuals responded with approval to include their thoughts in this study.

In addition to the responses received from the March *Ka Wai Ola* publication, ASM staff contacted an additional thirty-eight individuals (via email and/or telephone) with requests for consultation. Table 9 (presented below) lists all the individuals and/or organizations contacted for consultation and presents brief comments concerning the outcome of the consultation effort. In addition to the thirty-eight individuals contacted by ASM directly, another twenty-five individuals also participated in the consultation process (either through recommendation or invitation of those contacted). In all, a total of fifty-five individuals, representing various communities within the WHRFMA and various user groups (including cultural practitioners, aquarium collectors, subsistence and commercial fishers, dive tour operators, and researchers), participated in the consultation process. The consultation process commenced in March of 2019, and the interviews were conducted between April and September of 2019.

Table 9. Persons/organization contacted for consultation.

Name	*Initial Contact Date*	*Date of Interview*	*Comments*
Bimo Akiona	3/13/2019	4/2/2019	Summary below
Henry Cho III	3/13/2019	n/a	No response
Makani Christensen	6/6/2019	n/a	Makani called on 6/6, spoke with Aoloa. Lokelani called on 6/7, left message with request for interview. Aoloa called 6/10 with request for interview. Did not receive a call back.
Kevin Awa	5/21/2019	9/7/2019	Summary below
Chelsea Faavesi	5/21/2019	9/23/2019	Summary below
Elena Waiwaiole	5/20/2019	n/a	No response.
Kela Pule	5/20/2019	n/a	No response.
Adrian Kuauhia	5/20/2019	n/a	Number was disconnected.

Table 9 continued on next page.

Table 9. continued.

Name	*Initial Contact Date*	*Date of Interview*	*Comments*
Nicki Kohia	5/20/2019	n/a	Aoloa spoke with Nicki. Nicki stated she would call back to set up a time to meet. Aoloa followed up but no response was received.
Henani Enos	3/28/2019	5/5/2019	Interview not approved as of 9/26/2019
Kamehameha Schools, Jason Jeremiah	3/28/2019	n/a	No response
Kehau Springer	3/28/2019	4/29/2019	See summary below. Recommended we speak to the *'ohana* at Miloli'i
U'ilani Macabio	3/28/2019	n/a	No response
Pelika Andrade	3/28/2019	4/12/2019	Summary below
Milton "Shorty" Bertlemann	3/28/2019	n/a	No response
Randy Vitousek	3/28/2019	4/2/2019	Summary below
Mele McPherson	3/28/2019	n/a	Responded via email. Declined to comment and recommended ASM staff speak to Pelika Andrade.
Leina'ala Lightner	3/28/2019	n/a	No response
Leivallyn Ka'upu	5/15/2019	n/a	Contacted 5/15 by Kehau Springer. ASM staff followed up on 5/16 to schedule interview. Was interested in participating but was not able to secure a date. Followed up again 6/14. No response
Ka'imi Kaupiko	5/15/2019	6/28/2019	Contacted 5/15 by Kehau Springer. ASM staff followed up with Ka'imi. Summary below.
Laila Ka'upu	5/15/2019	n/a	Contacted 5/15 by Kehau Springer. ASM staff followed up with Laila. No response
Wilfred Kaupiko	5/15/2019	6/28/2019	Contacted 5/15 by Kehau Springer. ASM staff followed up. Summary below.
Bobo Lopez	5/15/2019	n/a	Contacted 5/15 by Kehau Springer. ASM staff followed up. No response.
Limah Lopez	5/15/2019	n/a	Contact 5/15 by Kehau Springer. ASM staff followed up. No response.
Greg Asner	n/a	6/28/2019	Was invited by Ka'imi Kaupiko to the interview. Summary below.
Gail Garoutte	n/a	6/28/2019	Was invited by Ka'imi Kaupiko to the interview. Participated in the interview but did not approve her portion of the summary.
Alan Holokai Brown	3/28/2019	n/a	No response.
Akoni Palacat-Nelson	6/21/2019	6/28/2019	Summary below.
Charles Young	3/28/2019	n/a	No response.
Damien Kenison	6/25/2019	8/1/2019	Summary below.
Joe Balsimo	n/a	8/1/2019	Invited by Damien Kenison to the interview. Summary below
Stanford Cho	n/a	8/1/2019	Invited by Damien Kenison to the interview. Summary below.
Hawila Alani	n/a	8/1/2019	Invited by Damien Kenison to the interview. Interview not approved as of 9/29/2019
Nohea Ka'awa	3/28/2019	6/12/2019	Summary below.
Mel Johansen	n/a	6/12/2019	Invited by Nohea Ka'awa to the interview. Summary below.

Table 9 continued on next page.

Table 9. continued.

Name	*Initial Contact Date*	*Date of Interview*	*Comments*
John Replogle	n/a	6/12/2019	Invited by Nohea Ka‘awa to the interview. Summary below.
Meghan Lamson	n/a	6/12/2019	Invited by Nohea Ka‘awa to the interview. Summary below.
Shaylan Crysdale	n/a	6/12/2019	Invited by Nohea Ka‘awa to the interview. Summary below.
Lester Gebin	n/a	6/12/2019	Invited by Nohea Ka‘awa to the interview. Summary below.
Kala Mossman	3/28/2019	n/a	Recommended ASM staff speak with James Mahona and Luka Mossman.
James Manoha	5/20/2019	5/23/2019	Summary below.
Luka Mossman	3/28/2019	n/a	No response.
Diane Maka‘aka Kaneali‘i	3/14/2019	4/16/2019	Responded to OHA public notice. Requested that ASM staff meet with members of the Hawaiian Homestead community at Kailapa, Kawaihae as well as the Kai Kuleana Network. Summary below.
Cindy Sharp	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Jordan Hollister	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Kaena Peterson	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Justin P. Asing	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Jonah Yardley	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Robin Yardley	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Ted Angelo	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Jimmy Bouncs	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Pualani Lincoln Maielua	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Tani Waipa	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Keali‘i Maielua	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.

Table 9 continued on next page.

Table 9. continued.

Name	*Initial Contact Date*	*Date of Interview*	*Comments*
Mark Keali‘i Freitas	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Roger Kaneali‘i	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Susan Fischer	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Paul Fischer	n/a	4/16/2019	Invited by Diane Maka‘ala Kaneali‘i to Kaipala Hawaiian Homestead Community interview. Summary below.
Chad Wiggins	4/2/2019	4/16/2019	Arranged for ASM staff to meet with the Kai Kuleana Network.
Cecile Walsh	4/12/2019	4/16/2019	Arranged for ASM staff to meet with the Kai Kuleana Network.
Hannah Kihalani Springer	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Kalani Hamm	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Reggie Lee	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
George Fry III	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Pi‘i Laeha	n/a	4/16/2019	Member of the Kai Kuleana Network. See summary below.
Aric Arakaki	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Ku‘ulei Keakealani	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Krista Johnson	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Chuck Leslie	n/a	4/16/2019	Member of the Kai Kuleana Network. Summary below.
Francis Ruddle	n/a	4/16/2019	Member of the Kai Kuleana Network. Did not approve summary.
George Roberson	n/a	4/16/2019	Member of the Kai Kuleana Network. Did not approve summary.
Mike Nakachi	6/21/2019	6/26/2019	Summary below.
Ling Nakachi	n/a	6/26/2019	Invited by Mike Nakachi to interview. Summary below.
Kaiakea Nakachi	n/a	6/26/2019	Invited by Mike Nakachi to interview. Summary below.
KAHEA Hawaiian Environmental Alliance	6/21/2019	n/a	Called on 6/21, left message. Sent interview request to Jon Osorio on 6/25 and to Bianca Isaki on 7/2. Corresponded with Bianca but was not able to secure a date for an interview.
Kealoha Pisciotta	6/25/2019	7/5/2019	Summary below.

Table 9 continued on next page.

Table 9. continued.

Name	*Initial Contact Date*	*Date of Interview*	*Comments*
Department of Hawaiian Homelands (DHHL), William Aila	6/25/2019	n/a	No response.
Office of Hawaiian Affairs (OHA)	n/a	6/29/2019	Request for consultation forwarded from Shane Palacat Nelson, OHA Outreach Coordinator for West Hawai‘i to Kamakana Ferreira, OHA’s Lead Compliance officer.
Joseph “McGee” Akiu, Jr.	9/10/2019	9/10/2019	Summary below

End of Table 9

INTERVIEW METHODOLOGY

ASM staff utilized a combination of informal one-on-one interviews as well as informal group interviews. The locations at which the interviews took place were determined by the individual, or the point of contact for the group interviews. While one-on-one interviews afford the researcher the opportunity to gather more detailed personal history, the group interviews (which ranged from five or six to more than sixteen participants) allowed for more nuanced discussions about the topic, but limited the researcher’s ability to gather detailed personal history. As a result, most of the group interviews focused more on knowledge of past, and/or ongoing cultural practices, general thoughts on the proposed action, and recommendations, rather than personal recollections. All of the interviews were conducted in person with the exception of the interviews conducted with Pelika Andrade, Kevin Awa, Joseph Akiu, Jr., and Chelsey Faavesi, which were conducted by phone.

Prior to the interview, ASM staff provided a written description of the proposed action, its location—which included maps showing all current marine managed areas in the WHRFMA (see Figure 1)—and the “white-list” species that included any known Hawaiian names, scientific name, and common names (see Table 3). The interviewees were asked five primary questions about:

1) their personal background and connection to the study area;
2) their knowledge of any past and or ongoing customary cultural uses, beliefs, traditions, and practices within the proposed project area;
3) any traditional cultural knowledge, beliefs, and uses of the forty “white-list” species;
4) their thoughts on whether the proposed action would result in any impact on traditional cultural practices, beliefs, and uses associated with the study area or the “white-list” species; and
5) their recommendations to mitigate any identified cultural impacts as well as share any additional through about the proposed action.

Some of the interviews, with the consent of the interviewees, were audio recorded for note taking purposes only (audio files are not available). Where audio recordings were not permitted, ASM staff recorded hand-written notes throughout the interview process. Upon completion of the interview, ASM staff prepared an interview summary, which was later emailed to the interviewees for review. To ensure that the summaries prepared by ASM staff accurately reflected the thoughts, feelings, and information shared by the interviewees themselves, ASM staff afforded the interviewees the opportunity to review the summary and revise, edit, or delete any information as they saw fit. Where revisions were requested, ASM staff continued to work with the interviewees, making all requested changes. The approval to publish the summaries was obtained by ASM staff via email or phone. The final interview summaries are presented below, these summaries were all reviewed and approved by the interviewees prior to the publication of this CIA.

BIMO AKIONA

On April 2, 2019, Lokelani Brandt interviewed Mr. Edward “Bimo” Akiona, a retired firefighter for the County of Hawai‘i and a former aquarium fish collector. Born in Hilo, Hawai‘i in 1954, Bimo shared fond memories of spending the entire summer at his uncle’s home in Kahalu‘u, Kona, where he gained his love and respect for the ocean. At the age of eight, Bimo recalled being given a pair of bamboo goggles by his uncle Jimmy, with instruction to peer under the water. Bimo remembered peering under the water and was amazed by the active reef and ocean life below. It was this childhood experience that established his deep connection to the ocean, leading him to become an expert diver and fisherman. Bimo shared that one of the most important traits of being a diver or fisherman is their observation skills, which includes understanding changes in the tide, the moon cycle, the time of day that was most ideal for fishing, fish habits, and conservation practices. From a very young age, fishing and diving was simply a way of life for Bimo.

Bimo's involvement with aquarium collecting began when he returned to Hawai'i Island and later joined the Hawai'i Police Department. Bimo shared that his very first case as a police officer involved a dive shop, which eventually led to his involvement in the aquarium collection industry. In 1985, Bimo started his own aquarium fish collection company, which he operated for eight years. He shared that growing up and learning about the ocean from his family helped to guide much of his business practices. Bimo recalled his primary collection areas extending from Kulaimano to Hōnaunau as well as from Kawaihae Harbor to 'Anaeho'omalu as well as Ka Lae. His experience in diving and fishing in these areas and observing fish behavior and cycles had led him to believe that certain areas should be restricted from all forms of commercial activities, namely Puakō, Kaiwi Point (from Honokōhau to Kailua Bay) as well as Ka Lae. Bimo stated that the aforementioned areas are where breeding groups congregate and for this reason, should be protected. He also stated that at Ka Lae in the district of Ka'ū, the ocean conditions in this area can be treacherous to novice fishers and divers.

When asked if he knew of any traditional practices within the region, he shared that he would see people gathering *'ōpihi* or laying net but believes the lack and difficulty in coastal access have limited the number of practitioners. Bimo believes that over time these families that no longer have access to these areas have lost their connection and as a result no longer possess the traditional knowledge and practice of these places. He believes it is important for families and people with ties to the area to be given access. However, although Bimo is in favor of giving access to families and communities he recommends that certain areas should be restricted from commercial use in order to improve and restore the ocean resources.

When asked if the proposed project could result in any potential cultural impacts, Bimo did mention that aquarium collecting methods can have a damaging effect on the reef, which in itself, is considered a valued cultural resource. He spoke specifically about the method used to capture and remove Potter's Angelfish (*Centropyge potteri*), Hawaiian Flame Angel (*Cirrhilabrus jordani*), Hawaiian Saddleback Butterfly (*Chaetodon ephippium*), and Angler fish (*Antennarius sp*.) and all eels. Bimo explained that these species often conceal themselves deep within the coral reefs and that removing them requires significant damage to the reefs. He believes that the economic value of these fish does not justify the environmental damaged required to catch them. Because of the damaging effects, he strongly recommends that these fish not be caught and removed from Hawai'i. However, Bimo shared that the collection and removal of invasive species would yield long-term benefits to Hawai'i's reef systems. He has witnessed firsthand the dramatic impacts of introduced species such as the Bluestripe Snapper (*Lutjanus kasmira*), also known as Ta'ape, that has contributed to a decline in reef fish population. Bimo noted additional impacts to Hawai'i's reef system which includes runoff and pollution. Following major storms, he has witnessed drastic changes that have completely devastated ocean wildlife and reef systems, which has adversely impacted many subsistence fishers.

Mr. Akiona shared that the business of fish collection requires a great deal of "self-management" and should always include conservation practices. He further explained that policies and restrictions did not exist when he was involved in the industry, but managed to heed the teachings of his elders to "*mālama* your resources." He strongly feels that these businesses should have a "connection to place" and be respectful of the resources, particularly in Hawai'i, where cultural values and traditions continue to thrive. In his experience, Bimo was involved and witnessed many disputes between "shop divers" and "dive operators." Dive operators have argued that aquarium collectors were "raping the ocean," implying that they were taking all the fish from certain areas. Disturbed by the untrue statements, Bimo began attending public meetings to stay informed and remain involved in the process when policies and restrictions were being written. Bimo also spoke about the safety issues of the business, having been put in a hyperbaric chamber several times due to having the bends, or decompression sickness. The demand of the business may affect "self-management" practices and suggests that divers take caution not just from a cultural standpoint but also for a person's health as the industry require divers to spend a substantial amount of time in the ocean.

RANDY VITOUSEK

On April 2, 2019, Lokelani Brandt interviewed Randy Vitousek, a third-generation fisherman and long-time resident of Waimea on Hawai'i Island. Randy frequents the coastal fisheries in West Hawai'i, primarily in the areas between Kīholo in North Kona and 'Upolu in Kohala. He is experienced in shoreline fishing and diving but now prefers deep-sea vessel fishing. He has held a commercial fishing license for the past twenty-five years. Randy shared that he comes from a family of fishermen and learned how to fish from his father at a very young age. His grandfather owned a boat and his grandfather and father would bring the boat from Kewalo to Kailua-Kona or Kawaihae to fish. Randy stated that he learned about the ocean from his father and from other men and women of his father's generation, and this accumulation of knowledge is something he has passed on to his children and grandchildren.

When asked if he was aware of any ongoing traditional cultural practices along the West Hawaiʻi coastline, Randy stated that "modern fishing is a continuation of cultural practices, but with more durable gear." He describes that fishing practices are based upon a person's awareness of the ocean and marine life patterns, such as understanding what areas are abundant with a certain species of fish and the reasons they are so abundant in these specific areas. Randy added that these basic observations are considered traditional knowledge, the difference being that *kupuna* (ancestors) depended on this intimate knowledge much more than we do today. He noted that the advancement of fishing technology and equipment has altered our dependency on the ocean and our understanding of marine life patterns. Randy, however, emphasized that the activity is the same, more so for those fishing for subsistence purposes. He noted that subsistence fishing and even some commercial fishers help to provide food for family and friends, which continues the practice of connecting with the ocean environment.

Randy believes that living on an island is a remarkable experience as it forces people to take care of their resources and each other. Randy noted that this same kind of behavior that is seen in other island communities around the world who depend on the ocean. This involves developing common practices and beliefs based on environmental conditions and understanding the limitations of the land, which necessitates harvesting resources from the ocean. Randy opined that there is something important to be said for people who make a living on the ocean. He went on to explain that when we lose the ability to make a living on the ocean or from the ocean resources, we also lose important knowledge about the ocean. He believes that having vibrant marine employment is this is an important part of living on an island and that all people have a unique place in our communities. He emphasized that markets are ever-changing and noted some of the historical changes in Hawaiʻi's fishing industries. Randy pointed out that at one time there was a big market for *aku* (*Katsuwonus pelamis*) and now economically the aquarium fishing is or can be a big component of this ever-changing market.

When asked if there were any potential cultural impacts associated with the proposed action, Randy stated that he has witnessed many changes in fishing in Hawaiʻi, particularly along the West Hawaiʻi region. Although Randy is not against aquarium fishing, he stated that easily accessible areas like Puakō, NELHA, and Kawaihae Harbor should be temporarily closed, have restrictions, or have bag limits, as he has seen a major decline in reef population in these areas, which he believes is associated with "catch and kill" fishing. Although seasonal changes pose some difficulty in determining an overall trend and knowing the catch statistics, he has personally not seen any significant changes in off-shore and in deeper waters. He recommends and advocates for easily accessible areas to be a preserve as a "no-take, catch and release" or limit fishing to families and children so they can stay connected or reconnect to the ocean. Randy emphasized that these simple fishing practices teach basic skills and knowledge in fishing and the practice of observation, which are vital for our future generations. Despite this, he believes that there should be an appropriate and regulated amount collected for all fishing, commercial and non-commercial that is based on reliable scientific evidence. He explained that there should be "controls based on sustainable yields of different species" as well as having certain areas restricted and catch areas rotated. He believes aquarium fishing is a good thing for the communities because it allows for the "continuation of the tradition to harvest the sea" and further added that aquarium collection "is not culturally inappropriate as long as the practice is done with respect for the ocean and its resources."

Randy also spoke about *koʻa* (traditional fishing grounds) and when asked if the tradition of fishing at the *koʻa* in West Hawaiʻi would be impacted by the proposed action, Randy spoke specifically of *ʻōpelu* (*Decapterus pinnulatus* and *D. maruadsi*). He has seen about four or five *ʻōpelu koʻa* situated between Kawaihae and ʻUpolu and added that it tends to be associated with a *hale waʻa* (canoe house) on land. These highly concentrated areas of *ʻōpelu* have a thriving ecosystem that builds up around them. He mentioned that off-shore fishing *koʻa* is not fixed to a particular spot rather it shifts in a known area and its location is determined by where the fish congregate. Randy expressed that aquarium fishers will not likely affect these traditional fishing *koʻa* because aquarium fishers often fish close to the shore. Randy believes that Native Hawaiians should be allowed to continue their practice and hopes that the proposed action does not adversely affect Native Hawaiians communities who rely on the ocean.

Randy's understanding of the aquarium industry is that they try to limit the destruction to the reef and to the fish. He explained that using a finer mesh net instead of a gill net would allow for the proper handling of the fish and limit any damage to the fish. Based on his knowledge of the industry and if the proper measures based on valid science are taken to ensure sustainable harvesting of aquarium fish, Randy does not anticipate any major cultural or environmental impacts.

Randy believes that regulatory efforts should focus on enforcing existing fishing laws, developing science-based quotas, size limits and fishing areas, and improving parks, harbors and public marine and coastal facilities to encourage residents and visitors to have easy, authentic connection to the ocean around us.

PELIKA ANDRADE

Pelika Andrade, an Extension Agent for the Hawai‘i Sea Grant was interviewed via phone by Lokelani Brandt on April 12, 2019. Born on the island of Kaua‘i, to a family adept at the cultural and physical aspects of the ocean, Pelika recalled spending most of her childhood on and in the ocean. Her upbringing and later experiences led her to the field of marine resource management, where she has earned a degree in Hawaiian Studies and certificates in Marine Science and Pacific Island Studies. Currently residing in Waimea on Hawai‘i Island, Pelika continues to develop educational programs that integrate traditional knowledge and science to address issues facing marine resource management in Hawai‘i.

When asked if she knew or witnessed any traditional fishing practices occurring within the West Hawai‘i region, Pelika offered an in-depth perspective on the “traditional” practice of *lawai‘a* (fishing). She described the *kai* as inseparable from the *‘āina* (land), literally translated as “the thing that feeds (us),” and just as a farmer would tend to their fields to ensure its productivity, the *lawai‘a* (fisher) did the same. In describing how the Hawaiian fisher tended to the ocean, she explained that the people fed the ocean with food that they grew and noted the *ko‘a* as an example of this feeding practice. She highlighted that the practice of *kilo* (astute observation) played an important role for the fisher that allowed them to understand the nuances of the ocean environment as well as any seasonal correlations. *Kilo* provided the *lawai‘a* with an in-depth understanding of natural fish cycles and its relationship to its ecosystem and the greater ocean. Pelika stated that in some areas, the *lawai‘a* (fishers) role in a community was so valued that the chiefs often relied on the *po‘o lawai‘a* (head fisher) to determine what and when certain practices were to take place—a role that was often delegated to the *konohiki* or headman of an *ahupua‘a*. She explained that the *lawai‘a* (fisher) spent a large majority of their time “tending to the ocean garden,” and that the act of *lawe i‘a* (taking fish from the ocean) constituted a very small component of this tradition. She noted that when large communal fishing was performed, it was done at the order of the *po‘o lawai‘a* or the *konohiki* and the collected resources benefitted the whole community, providing both a short and long-term supply of food. Adding to this, she explained that traditionally, when decisions were made, an individual was held accountable to that community. Pelika edified that fishing is a practice that is found around the world, but in Hawai‘i the traditional practice of fishing encompassed caring for one’s equipment and gear, understanding the natural cycles, seasonality, and productivity; but most importantly, traditional *lawai‘a* in Hawai‘i is fully engaging in the practices of managing marine resources, and being an active contributor to its productivity and its ecosystems. She expressed that *lawai‘a* are acts of sustainability, which in her view is the balance of sustainable marine resources and thriving and productive communities.

When asked if the proposed project would lend to any potential cultural impacts, Pelika compared the practice of *lawai‘a* to aquarium fish collection as it is practiced in Hawai‘i today. She evaluated that *lawai‘a*—the reciprocal relationship between man and the environment—and aquarium collection, which focuses on the act of *lawe i‘a*, removing fish from the ocean does not align with the Hawaiian worldview of caring for the ocean and its resources. She stated that aquarium fishing is not about feeding those at your table, but a business that impacts that larger community. She feels that there is no accountability to the communities that are impacted by this industry, which was a fundamental aspect of traditional fishing practices. Based on this, Pelika believes that the proposed project would lend to adverse impacts to the community and is not aligned with traditional fishing practices. She went on to explain that with aquarium collection, “there’s no tending process, only *lawe i‘a*.” She argued that modern aquarium collection practices negatively impact fisheries and disrupts traditional knowledge systems, because there is no input or contribution to maintaining the very resource that the industry is dependent upon. She emphasized that the practice of *kupuna* (Hawaiian elders) was not based exclusively on *lawe i‘a* (taking fish), rather the act of *lawe i‘a* was carried out after a fisher understood all of the other components that allowed for healthy marine resources. She argued that identifying oneself to the act of *lawe i‘a* (taking fish) with no forms self-management, severely limits the individual from fully embracing the traditional practice of *lawai‘a*, which emphasized caring for the resources. Pelika opined that the act and the sense of entitlement associated with *lawe i‘a* (taking fish) can be applied to other fishing industries, from commercial to subsistence fishing. She explained that this mindset shift from caring for our resources, to entitlement to our resources, is a result of a lifestyle change. For these reasons, Pelika does not support aquarium fishing and other fishing practices or industries that make no effort towards contributing to maintaining the resources or encourages self-management.

While Pelika was not against utilizing our resources to support our families and communities, she strongly advocated for changing the current mindset and practice of *lawe i‘a* (taking fish). She argued that Hawai‘i’s current system of marine management, which is comprised of western concepts and rules, is set up in such a manner that accepts the mindset and practices of *lawe i'a*—a causal element that has led to the decline of our marine resources along with other important factors such as water diversions (affecting estuary and nursery habitat), development (increasing nitrification and affecting water quality), and management rules/regulations that work against productive fisheries. She opined that the contemporary practice of establishing marine preserve areas, rest zones, and conservation areas, have also impacted the traditional practice of *lawai'a*, because it disrupts people's ability to interact with and understand the productivity of the resource in an area. She noted that there are conservation models that are trying to counter western system of marine resource management. Despite these efforts, she explained that these models often fall short, because they do not support caring for the resources nor do they foster developing a relationship to place, both of which were crucial to sustaining traditional *lawai'a* practices. Pelika also questioned the industry's techniques and methods to harvest fish, noting that some methods are known to be destructive to coral heads and general productivity of targeted species. She also questioned the quantity of fish that are being harvested from Hawai'i's reefs for the aquarium industry.

When asked for recommendations on how we can improve the current state of aquarium fish collecting in Hawai'i, Pelika commented that anyone choosing to utilize our marine resources whether for subsistence or commercial use should have a more holistic understanding of the resources. She believes that these individuals and industries should sustainably interact with our marine systems and make more than financial contributions to ensuring Hawai'i's marine resources are thriving and productive. She noted that most people seem to be aware of the industry's failures and drawbacks rather than its benefits. She expressed that all aspects of this industry have remained shrouded in mystery resulting in a poor public perception and understanding. While Pelika felt that she did not know a significant amount about the aquarium industry or how to resolve the contentious relationships, she does know that the conservation proponents are at one end of the spectrum and noted that "rarely is the loudest voice, the one in the middle or the voice of reason." She expressed that many who are screaming "conservation" rarely are attached to the lifestyle that is dependent upon fishing. She opined that this is also true for those proponents advocating for aquarium fishing. She believes that this is not a fair representation and what has resulted is an emphasis on "bad practices" of the industry.

Pelika also explained the importance of having a proper balance of small and large fish in Hawai'i's reefs to ensure minimal disruption to natural fish cycles. She believes that the aquarium industry as well as others that remove fish from the ocean should have export limits that are reasonable and are based on the percentage of local fish stocks. Hypothetically, Pelika explained that if the amount allowed to be collected is based on the percentage of local fish stocks, when the number reaches below a certain percent, then the industry needs to advocate for management and better fishing practices and only then will we all benefit. She believes that as a part of their responsibilities to their industry and to Hawai'i's fisheries, the aquarium industry should invest in aquaculture, which would teach them how to grow and spawn their own supply and make contributions to replenishing the fish removed from our waters. Pelika believes that if the aquarium industry and fishers want to continue to reap the benefits of removing fish from the sea, it needs to be a shared initiative and there must be a shift towards a more reciprocal relationship.

KAI KULEANA NETWORK: ARIC ARAKAKI, GEORGE FRY III, KALANI HAMM, PI'I LAEHA, REGGIE LEE, MAKA'ALA KANEALI'I, HANNAH KIHALANI SPRINGER, KU'ULEI KEAKEALANI, KRISTA JOHNSON, AND CHUCK LESLIE.

In response to the OHA public notice published in February 2019, Lokelani Brandt was invited to the April 16, 2019, Kai Kuleana Network quarterly meeting held at Manini Beach in Nāpo'opo'o, Kealakekua, Hawai'i. Kai Kuleana Network is comprised of multiple members representing various *ahupua'a* communities from Kohala to South Kona on Hawai'i Island. A total of fifteen individuals were in attendance of which twelve participated in the talk-story, sharing their knowledge of traditional cultural practices associated with their respective areas throughout West Hawai'i as well as their knowledge of some of the fish species listed on the "white-list." Participants included, Aric Arakaki of Ala Kahakai National Historic Trail, George Fry III of Puakō, Kalani Ham of Keauhou-Kahalu'u and La'aloa, Pi'i Laeha of Kalāhuipua'a, Reggie Lee of Kaloko-Kohanaiki, Maka'ala Kaneali'i of Kawaihae, Hannah Kihalani Springer and Ku'ulei Keakealani of Ka'ūpūlehu, and Krista Johnson and Chuck Leslie of Nāpo'opo'o. While the individuals spoke at various points throughout the interview, for readability, their individual thoughts and insights have been compiled into paragraph form and are presented below.

Kalani Hamm: Kalani noted that her family often used the beach as part of their cleansing ceremonies. She also recalled one of the last *hukilau* taking place in Kailua-Kona in 1948. She described that in the past, these large communal fishing efforts provided food for multiple communities. Kalani recalled going to *kū'ula* to *pule* (pray). She remembered going to the ocean while the fish were sleeping to catch them and using them as offerings.

Reggie Lee: Reggie spoke about the importance of *mālama*, caring for our resources, a practice that was handed down to him by his mother tūtū Malu‘ihi. He shared that knowledge of different fishing spots was handed down in families. He added that the aquarium industry should consider raising their own fish to supply its industry. And if fish are to be taken out of the ocean, the industry should assist with supplementing the fish stock by investing in hatcheries. Reggie also emphasized the importance of having adequate enforcement, noting that there are very few DOCARE officers that patrol this region. With the aquarium industry potentially adding to the workload, he recommended that the aquarium industry should help to supplement DOCARE’s efforts so they can be productive in enforcing the rules and regulations.

Hannah Kihalani Springer: Hannah explained that in the past, people delighted in eating a wide variety of reef fish, but today, peoples preferences are more limited and fewer varieties of fish are eaten. She spoke of encouraging each other to develop an *‘ono* for different kinds of fish. She also emphasized the importance of restoring our food producing capability and capacity. In reviewing the “white-list” species, Hannah remarked that the wrasse, the *hīnālea* fish, is a *kinolau* or physical embodiment of the god Kanaloa. She described another wrasse, the *hilu*, as being representative of positive attributes and that in traditional times it was venerated and that its importance is recorded in several traditional accounts. Hannah stressed the ecological importance of reef fish, describing them as cleaners and rehabilitators of reef ecosystems. She questioned what the aquarium fish industry’s contribution to the public trust, that includes the aquatic resources of Hawai‘i is. She questioned the sustainable yield quotas for the aquarium fish industry and stressed the importance of them.

Maka‘aka Kaneali‘i: Maka‘ala highlighted the extent of the traditional *ahupua‘a* boundaries. In her community in Kawaihae, she explained that the traditional *ahupua‘a* rights extended three miles out into the ocean. She explained that in her community, they are working towards restoring their traditional fishing rights and practices so that families can once again utilize the ocean for sustenance. She strongly opposed the proposed issuance of commercial aquarium collection permits because this action is not aligned with the current efforts to restore physical and cultural aspects of the fisheries in West Hawai‘i. She commented that aquarium collection is disrespectful to the fish and that when we capture fish without having the intent to consume them, then we lose the function of the fish. Maka‘ala added that what are the fines and repercussions for aquarium collectors that do not comply with the laws. She hopes that DLNR considers having more rigid fines and serious repercussions to those who violate the law.

George Fry III: George spoke of many subsistence fishermen who access the Puakō area to gather fish and *‘opihi*. He described this area as once having an abundance of fish but noted that today the fish stock has been seriously depleted, which he attributes to overfishing, warming waters, and poor water quality.

Pi‘i Laeha: Pi‘i opposed the proposed action and stated that there should absolutely no collection of fish for the aquarium industry outside of Hawai’i, especially any endemic fish that is listed on the “white-list.” Pi‘i emphasized that having fish in the ocean is important for educational purposes but also with the education and awareness process, it should allow established institutions in Hawai’i, those that show a perpetual responsibility for fish sustainability, the opportunity to responsibly collect fish under a Special Activity Permit. Pi‘i described the near-shore zones as the place where it is the safest for *keiki* (children) to learn about marine life and added that... *‘a‘ohe pau ka ‘ike i ka hālau ho‘okahi* (all knowledge is not taught in a single school).

Aric Arakaki: Aric spoke about coral bleaching in West Hawai‘i and asked if coral bleaching is being accounted for in the scientific studies that are being done for the EIS?

Ku‘ulei Keakealani: Ku‘ulei emphasized that culturally fish are connected to humans and that this connection is well recorded in the Hawaiian cosmogony chant, *Kumulipo*. In referencing the *Kumulipo*, Ku‘ulei further explained that certain fish was paired with a land/forest counterpart. In Hawai‘i, certain fish often shared familial bonds with particular individuals and families who cared for them. In turn, these fish aided the fisher in their endeavor. She noted that within one generation in her family, their reliance on fish and some of the associated cultural practices such as praying to *kū‘ula*, a Hawaiian fishing deity, has changed significantly. Despite these changes, she stood firm in her belief that Hawaiian today must continue to maintain our traditions. She stressed that familial bonds to our oceans must be considered as an important cultural tradition. Ku‘ulei also spoke of the ceremonial aspects of fish, noting that some fish were desirable for certain cultural practices. She stated that these aspects of Hawaiian culture are still being practiced. Adding to this Ku‘ulei stated that “the *kai* is medicine for us, truly something or place that is sought for healing, a sense of well-being, a familiar part of the *kanaka* being. *I‘a* (fish) therefore, is looked at as *lā‘au* as well.” She expressed that she has family stories of *kupuna* (*elders*) requesting certain species of fish to treat particular ailments. Ku‘ulei explained that whether it’s the fish name and or color, healing properties are held in fish species and this knowledge and practices are still in the living memory of folks and further applied in our lives. She added that the lack of fish necessary for these facets of our cultural ways has a direct impact on the health of our *kanaka*. In her closing remarks, Ku‘ulei stated, “truly, healthy land and sea, healthy people!”

Krista Johnson: Krista commented that there is so much death with aquarium collection and spoke of instances when bags of dead fish were found in Kona. She questioned whether the industry is going to self-regulate? She worried that the current enforcement is not adequate and hope that more enforcement officers will be added.

Chuck Leslie: Check asked, “why should people take our fish just for pleasure?” He emphasized that we should be encouraging people to come to the ocean and view our marine life first hand. Chuck, who has fished at *ko‘a* was asked specifically whether the proposed action would impact the tradition of *ko‘a* fishing. He explained that *ko‘a* are typically located offshore and in deeper waters and that aquarium collectors fish closer to shore and are targeting different fish species. For these reasons, he didn’t anticipate the proposed action to have an impact on the traditional fishing *ko‘a.* He did, however, recall the tradition of *imu*, which involved the construction of stone houses on the reefs. He explained that stones were often stacked in the water on the reefs and that these houses would attract fish. After the fish had become accustomed to living in the *imu*, people would throw their net over the house and catch the fish. Ku‘ulei added that the *imu* was typically built so that *kupuna* (elders) and *wahine* (women) could fish easily and safely. Hannah noted that fish *imu* was known to exist at Ka‘awaloa and Kīholo. Chuck expressed that the *imu* fishing method is a dying art.

KAILAPA HAWAIIAN HOMESTEAD COMMUNITY: CINDY SHARP, JORDAN HOLLISTER, KAENA PETERSON, JUSTIN P. ASING, JONAH YARDLEY, ROBIN YARDLEY, TED ANGELO, JIMMY BOUNCS, PUALANI LINCOLN MAIELUA, KEALII MAIELUA, TANI WAIPA, MARK KEALII FREITAS, MAKA‘ALA AND ROGER KANEALI‘I, AND SUSAN AND PAUL FISCHER

In response to the OHA public notice published in February 2019, Lokelani Brandt was invited by Maka‘aka Kaneali‘i, (the President of the Kailapa Community Association) to the Kailapa Hawaiian Homestead Community in Kawaihae Ahupua‘a, Kohala. Maka‘ala Kaneali‘i organized a community meeting, which was held at the Kailapa Community Center and a total of sixteen individual representing two distinct communities (Kailapa Hawaiian Homestead community and the nearby Kohala Estates), were in attendance all of whom participated in the talk-story. The names of the participants from Kailapa are Cindy Sharp, Jordan Hollister, Kaena Peterson, Justin P. Asing, Jonah Yardley, Robin Yardley, Ted Angelo, Jimmy Bouncs, Pualani Lincoln Maielua, Kealii Maielua, Tani Waipa, Mark Kealii Freitas, Diane Maka‘ala Kaneali‘i and Roger Kaneali‘i. Representing Kohala Estates, were Susan and Paul Fischer. The community members expressed that they would like their *mana‘o* and concerns to be expressed as a unified voice instead of individually.

When asked if they were aware of any ongoing traditional cultural practices, the community expressed that fishing from the reef is an ongoing traditional cultural practice. They emphasized the traditional practice of taking only what is needed is a practice that has been taught to them and is something they are passing down to their children. They stressed that culturally, fish that was caught was for eating and that the Hawaiian saying, “*ka ‘ai a me ka i‘a*” literally translated as “the vegetable and the fish” constituted a complete meal. In looking at the “white-list”, some individuals added that *i‘a* (fish) was and will always be an important part of the Hawaiian diet. They noted that many of the fish on the “white-list” are still caught for subsistence purposes and stressed that fishing is part of Hawai‘i’s subsistence economy. They also spoke about the Hawaiian cosmogony chant *Kumulipo*, and urged for the need to maintain balance in our marine ecosystems. Some members shared that *pule* (prayer) was integral to maintaining balance and to traditional fishing practices.

Several community members spoke about the fishing *ko‘a* in their area and noted that some fishers continue to *hānai* (feed, care for) these *ko‘a*. They described that every family in an *ahupua‘a* had and maintained a *ko‘a*. They stated that everything in the ocean is a part of Hawaiian culture and that every species has a role in maintaining a healthy marine ecosystem.

One community member noted that the Kohala shoreline was once considered a spawning ground and that the historical changes that have occurred on land have severely impacted the coral reefs in some areas. One community member recalled seeking a lot of black coral in the area and that today, it is almost impossible to find any. They noted that during episodic rain events, the runoff from land clouds the ocean for weeks at a time, leaving the coral reef severely depleted.

In their collective efforts to better steward their marine resources and the entire Kawaihae *ahupuaʻa*, the Kailapa community has been active in maintaining the traditional practice of *kilo* or astute observation. One community member emphasized that *kilo* is one way they are improving their understanding of their resources so that they can properly manage these resources. This community member also emphasized that proper stewardship is "always about management" and "never about taking." It was also stressed that Hawaiians continue to maintain and revive their traditions, practices, and beliefs. Also, highlighted was that the idea that society today requires the culture to evolve and naturally the practices, traditions, and beliefs coevolve with it.

The Kailapa Community members and those from the Kohala Estates spoke openly against the collection of reef fish to supply the aquarium industry. Many stated that the practice of catching fish without intending to consume it goes against traditional belief and that this act is not *pono* (proper, morally fitting, beneficial). They expressed that all fish are part of the public trust and that removing fish to supply a "lucrative" industry undermines traditional practices and beliefs associated with the ocean. They urged people to view fish in their natural environment where their colors are bright and brilliant. Several community members expressed concern for the high mortality rates of aquarium fish. They believe that removing any part of the ecosystem alters the natural balance and that removing small fish disrupts the natural food chain. The members from Kohala Estates believe that the aquarium industry is unsustainable.

They urged for more fish studies, and for establishing open and closed seasons that are based on fish stocks. They believe that if the permitting is approved then there should be more DOCARE officers and that the aquarium industry should help to offset the additional operating costs. The community did support the removal of those invasive species noted on the "white-list" and saw this as a benefit to restoring balance to the reef system in West Hawaiʻi.

JAMES MANOHA

On May 23, 2019, Aoloa Santos conducted an interview with James Manoha, a *kamaʻāina* of Naʻalehu and retired fireman. James is also a recreational and commercial fisherman, which he has done for over thirty years. James frequents the coastal fisheries in West Hawaiʻi, primarily in the Ka Lae or South Point region in the Kaʻū District. He is experienced in a range of fishing activities such as spearfishing, diving, pole fishing, throwing net, and boat fishing, and utilizes the ocean resources primarily for subsistence purposes.

When asked if he was aware of any ongoing traditional cultural practices along the West Hawaiʻi coastline, James stated that traditional cultural practices have definitely evolved and fishing practices have changed, though the need to survive has remained. James shared that he has witnessed many native Hawaiians fishing, using various methods, for subsistence purposes. He identified species on the white-list that were traditionally and are still utilized as an important source of food. James noted that within his *ʻohana* (family) the *pākuʻikuʻi*, *lāʻī pala*, and *kole* are amongst some of their favorite eating fish.

When asked if there were any potential cultural impacts associated with the proposed action, he stated that the fish on the white-list are numerous and therefore feels aquarium collection of these species would not negatively impact fish population and subsistence practices. However, he strongly advocated, with respect to the general harvesting of resources for subsistence or commercial purposes, that any permitting process give preference to those of "Native Hawaiian blood." James believes that the ocean is a resource that should be utilized to support families, whether for subsistence or financial and therefore, supports recreational or commercial fishing practices as long as it is done sustainably and responsibly. He further emphasized that "it is our responsibility to take care of our resources" and does not support the "abuse of resources," or overfishing practices.

James also spoke extensively about the implementation of "restricted areas" and explained that over the years, he has witnessed significant growth in fish populations which he credits to the implementation of "restricted areas." He also added that the literature and research he has reviewed supports many of his observations. Argumentatively, James added that although "restricted area" designations have produced positive results for heavily impacted coastal fisheries, he, in turn, has witnessed unnecessary designations that negatively impact subsistence fishing practices. He stated that he is concerned about a recent "restricted area" designation from Kaʻaluʻalu to Kahuku, an area that is renowned for its "bottom-fishing" grounds. He argued that this new restricted area is "self-regulated" due to rough seas and numerous predators. He added that there is no scientific basis that supports the creation of this "restricted area" which has led him to believe that it was created due to federal demands and pressures to establish conservation areas. Additionally, he stated that with a small number of fishermen that frequent this region, implementation of this restricted area would be met with less resistance in comparison to other areas. As a result, the local fishermen have reverted to unsafe and expensive practices in order to continue fishing near these fishing grounds. James recommended that these designations should only be considered if backed by extensive scientific data. He also stated that such studies should be conducted by a neutral third-party to ensure an unbiased representation of those fisheries so that rules and regulations can be formed that would benefit all parties and establish a "common ground." James also added that areas have different resources and disapprove of the "blanket approach" for an entire region. He recommended that extensive research should be conducted to identify areas, its resources, and impacts in order to develop specific management practices.

James concluded that from his experience and observations in fishing within the WHFMA, the designation of "restricted areas" has positively impacted these areas resulting in increased fish populations. However, in order to safeguard these outcomes, he recommended that substantial scientific data must be included when identifying areas proposed regulated areas. In addition to "restricted areas," he also supports the idea of "residential only" areas, as demonstrated by the community of Kaimū, in which only the residents of the area are allowed to fish. He strongly believes this designation will encourage fishing communities to develop and implement sustainable management practices resulting in improved resources. Based on scientific data and from his personal observations, he firmly stated that he does not anticipate any major cultural impacts as a result of aquarium fish collection as long as collectors conduct sustainable and responsible practices.

KEHAU SPRINGER

On April 29, 2019, Aoloa Santos met with Kehau Springer of Volcano, Hawaiʻi. Born and raised on Oʻahu, Kehau always had a "love of the *kai*, growing up." Her deep love of the ocean coupled with her academic career inevitably led her to the field of marine resource management, where she has earned degrees in both Marine Science and Hawaiian Studies and a master's degree in Tropical Conservation Biology. As the Coastal Community Capacity Development Advisor for Conservation International Hawaiʻi, Kehau shared her knowledge and extensive experience in working within the West Hawaiʻi region but has declined to provide any recommendations.

When asked if she is aware or has witnessed any ongoing traditional cultural practices along the West Hawaiʻi coastline, Kehau provided a candid perspective on some of the traditional and customary practices. She stated that traditional fishing is contingent upon access of *kanaka* (man) to places in order to maintain sustainable and "*pono*" relationships with the resources which then ensures the perpetuation of traditional harvesting practices. She also added that traditional customary practice is not one singular or specific practice, such as "paddling a canoe or using a specific type of net to catch a specific type of fish," but in the actions of caring for and acknowledging the communities, we harvest from. Kehau provided examples of this which includes traditional practices such as offering an *oli* (chants) or *hoʻokupu* (offering) or *mālama ʻāina*, the acts of caring for the land.

Through her work, Kehau has witnessed different communities along the West Hawaiʻi region that maintain specific cultural practices. In North and South Kohala, particularly in the Kawaihae area, she observed the use of *waʻa* (canoe) which are used to access adjacent fisheries. At Puakō, she has witnessed "*lawaiʻa*" (fishermen) catching *heʻe* or using a three-pronged spear for diving. At Kīholo, a place known for its freshwater and groundwater input, the community is knowledgeable in managing *loko iʻa* (fishponds). She has also seen salt gathering, diving, "throw net" and active use of *ʻōpelu koʻa,* areas that mackerel scad (*Decapterus pinnulatus and D. maruadsi*) gather. Through her collaborations with the community, Kehau has seen the active use of the *koʻa* in various ways including education by teaching children to clean and prepare fish for consumption.

In North Kona, Kehau observed a large number of anchialine pools, that are very healthy and continue to maintain *ʻōpae ʻula* (*Halocaridina rubra*), an endemic shrimp species known to be ideal *ʻōpelu* bait. Kehau has seen people still use *ʻōpae ʻula* as bait but due to the difficulty in collecting this shrimp the practice is not as common. However, she has seen these communities take on the initiative to maintain these anchialine pools with the intent to revive the practice of using *ʻōpae ʻula*. Additional practices she has observed in this district is salt gathering, diving, and pole fishing.

In areas of South Kona, particularly at Nāpoʻopoʻo, Hōnaunau, Hoʻokena, Miloliʻi, the tradition of *hānai koʻa* continues. Kehau explained that *hānai koʻa* is the traditional practice of feeding and caring for a *koʻa*, which she described as "natural areas within the ocean where fish gather." Kehau stated that this phenomenon is influenced by the mixing of currents and natural formations underwater that attract the fish to these areas. The tradition of *hānai koʻa*, is a method to gather the fish to eat. A bag or handkerchief is filled with cooked vegetables such as pumpkin, avocado, papaya, *kalo* (taro), or *ʻuala* (sweet potato) and with an attached lead weight, the bag is lowered down onto the *koʻa*. She explained that the use of pumpkin is popular because as it disperses into the water and that the color of the pumpkin resembles that of *ʻōpae ʻula*. The practice of *hānai koʻa* ran throughout the year but *kapu* (restrictions, prohibitions), are enacted to restrict harvesting during the months of April through August, which coincides with the *ʻōpelu* spawning period.

Through her interactions with various communities in West Hawaiʻi, and in speaking with *kamaʻāina* of the areas, certain harvesting and fishing practices have changed due to a decrease in fish population and environmental changes as exemplified by the *pākuikui* (*Achilles tang*). Kehau shared that this is a favorite delicacy in South Kona. Elders of the area shared that this fish was highly favored for parties and gatherings. However, according to oral interviews with various community members, in the last decade, there has been a major population decline. As a researcher, she confirmed that she has observed a very small population of *pākuikui* in these areas and in comparing scientific monitoring data, statistics, and literature reviews, their numbers have decreased significantly over the years. She does contend that there are other factors that may affect the population, such as their monogamous behavior, urbanization, pollution, and overharvesting.

Kehau shared from her experience and observation that the influx of ocean activities, including aquarium fishing, has caused a major disruption to fish behavior. With the increase in boat traffic and people, she has seen a change in fish aggregation patterns and thus has seen the differences in the natural patterns of ocean wildlife. These increased activities have not only affected ocean life behavior but have consequently altered human behavior and as a result, affected traditional and cultural practices.

HENANI ENOS

On May 5, 2019, Lokelani Brandt interviewed life-long fishermen and educator Henani Enos. Born in the Hawaiian Homestead community of Anahola, East Kauaʻi, Henani relocated to Hawaiʻi Island and currently lives in ʻŌlaʻa, Puna District. With his experience and upbringing in Hawaiian fishing practices and beliefs, art, and traditional navigation and wayfinding, Henani has taught ethnozoology, Hawaiian lifestyle, and Hawaiian moon phases courses at Ka Haka ʻUla O Keʻelikōlani College of Hawaiian Language at the University of Hawaiʻi at Hilo since 2001. He is also a high school math, science, and navigation teacher at Ke Kula ʻO Nāwahīokalaniʻōpuʻu, a Hawaiian immersion school. Early in the email correspondences, Henani explained that he was aware of how different Hawaiian fishes were used by *kūpuna* (ancestors) but added that he did not have much knowledge about any ongoing cultural practices in West Hawaiʻi. Henani, however, provided a wealth of knowledge concerning the traditional aspects of certain fish including those listed on the "white-list." The interview was conducted in ʻŌlelo Hawaiʻi (Hawaiian language) and what appears below is a translated summary.

Henani stated that nearly all of the fish listed on the "white-list" are considered *ʻai* (food). With the exception of butterfly fishes, puffers, and boxfishes, which were not considered safe to eat, Henani explained that traditionally any fish that could be consumed safely was eaten. He opined that today people are *pailani* (spoiled) and favor certain fish over others, which he believes is one of the reasons for the decline in the more popular fish species.

With respect to traditional fish naming practices, Henani shared that sometimes fish were named based on their characteristics, body shape, behavior, or where they live, which differs from the classical scientific taxonomy. He shared that while some of the general names have been retained, many people today do not know the specific Hawaiian names that were given to distinct fish species. He also added that certain fish names changed based on their growth stages and including such names in the cultural impact study are important to understanding the Hawaiian cultural value of those fish. He believes that the names given during each growth stage attest to the cultural value of that fish and indicates that its life cycle was carefully observed by *kūpuna*.

Henani described in detail the importance of certain fish in traditional house blessing ceremonies and described several occasions when friends have asked his help in obtaining certain fish for such ceremonies. He noted that the yellow ring around the eye of the *kole* was considered a sign of luck and that this fish was planted under the wall on the eastern side of the house where the sun rises. Henani noted that when the sun rises in the east, the belief is that it raises the luck for the occupants of the home. He expressed that there were other fish that were used in these types of ceremonies including *āholehole*, which is believed to *hole* (strip) a house of unwanted spiritual energy and therefore kept the occupants safe from harm. The *weke* was placed at the entrance of a new home when being blessed as a way to *weke* (open) the home. The *ʻamaʻama*, which is associated with enlightenment and knowledge was also placed inside of a new house during the blessing so that the house would have light and the occupants will receive constant enlightenment and knowledge. The *kūmū* fish was used during *ʻūniki* (graduation ceremonies) as its name means "master". Henani emphasized that from a *kuanaʻike* Hawaiʻi (Hawaiian perspective), fishes carry cultural connotations that are often articulated in their name and sometimes their behavior. If certain energies or beliefs were desired for a home, then the homeowner tried to obtain a fish that possessed those qualities. He added that while there were prescribed fishes for certain ceremonies, there was flexibility and other fishes that shared similar qualities, whether behavioral, physical characteristics, or in name, could be substituted.

With respect to the *kīkākapu* (butterfly fishes), Henani explained that these fish were considered extremely *kapu* (restricted) and were not caught because they were associated with *kauwā*, a menial class of people that lived apart from the general populace and were drawn upon for human sacrifices. Henani specified that the black band of color that marks the forehead of the fish was similar to the tattooed marking of the *kauwā*. Henani added that while growing up, *kūpuna* enforced the practice of releasing this type of fish back into the ocean because of its association with *kauwā*. He explained that if this fish was accidentally caught in a net, it was immediately released and as a child, he was not allowed to take this fish home.

Henani described that traditionally each family had their respective fishing areas at the ocean and that growing up, they were not allowed to roam or fish in another family's area. He laughingly explained that there were no signs to indicate whose fishing spot it was, rather, that knowledge was held within the families and passed on to the children while they were fishing with elder relatives. Henani stated that these areas were sometimes referred to by elder relatives as a family's "icebox." He believes that this practice followed the traditions associated with the *ahupuaʻa* system and lamented that these traditions are no longer practiced. Henani expounded on this, noting that families tended to their fishing areas just as they did to their gardens. He added that growing up, they would prepare and cook vegetables such as *kalo* (taro) and pumpkin which they took to the ocean to feed the fish. He lightheartedly commented that it was a lot of work to prepare vegetables and to feed the fish. When asked if this practice of feeding the fish was associated with the *koʻa* fishing, Henani clarified that the concept was the same but that feeding was done near the shore where other favored fish lived.

Henani spoke at length about how this type of detailed cultural knowledge was a natural way of life. He stated that while growing up, what the *kupuna* shared was adhered to and that questions were not asked. He stated that these types of practices were "*a mea maʻamau, a hahai wale nō*" (a customary thing, to which we just followed). He explained that people today want to know why certain traditions are followed and for these reasons, Henani stated that he takes the time to learn why certain traditions were practiced and now shares that information with his children and students. He believes that if we don't take the time to understand why certain traditions were practiced, then we cannot convey its importance to the youth and to others who don't understand. He opined that knowing why our *kupuna* did certain things is critical to the perpetuation of Hawaiian cultural practices and traditions.

He emphasized that the detailed cultural knowledge associated with the seasonal changes in the ocean and its lifeforms were carefully developed by *kupuna* because of their ability to *kilo* (astutely observe) the subtle distinctions. He stressed that *kilo* is a skill that needs to be practiced all of the time and that it required a great deal of self-motivation and discipline. He expressed that *kilo* should allow one to observe and be able to convey the subtle distinctions in the natural environment. In describing how *kilo* can be practiced at the ocean, Henani explained that when you continuously observe your environment, you will be able to see things like the gradations of color and that over time, you will be able to observe and distinguish things in nature such as fish types. He emphasized that fishing and preparing and repairing equipment requires a lot of time and energy but if one is able to develop skills in *kilo* they can become more efficient at fishing.

Henani also spoke about changes to the ocean environment that he has observed throughout his lifetime and questioned whether these changes are associated with environmental change or whether it was having a sort of limited understanding of the ocean. He described changes in fish habitat and noted seeing *uhu* (parrot fishes) in rocky areas devoid of coral and has observed *ʻōʻio* (bonefish) in rock filled areas with no sand, which to his understanding are not their preferred habitats. He stated that these observations are unusual and is likely attributed to the changes in the environment and supposes that these are *hōʻailona maikaʻi ʻole* (not good signs). He stated that today, fish habitats seem to be disrupted and recalled knowing where certain fish could be found. Henani added that today, fish seem to be moving into other areas outside of their preferred habitat and noted that this is cause for concern.

When asked about his thoughts on the proposed action, Henani shared that he has always enjoyed observing fish and therefore, has an appreciation for aquariums. However, he explained that when fish are removed from their habitat, it severs the natural life cycle which is of no benefit to the overall health of the ocean. He believes that what is most important is that the proper studies be conducted, and that the aquarium industry and the public remain vigilant and watchful. Henani stated that what is most important is that aquarium collection is not "*ʻae wale ʻia*" (freely allowed) and that too many fish are not taken because what we do not know now, are the long-term effects of taking too much fish from the ocean. Henani added that there is a reason these fish exist in the ocean and that these fish have been there since the beginning of time, so they are, therefore, an important component of the ecosystem. He emphasized that many people don't realize this and added that this idea is not only applicable to the aquarium industry, but to all people that harvest marine resources. Henani spoke about a mindset that causes people to take what they can, even if they don't actually need it and the notion that if they don't take it, someone else will. He stated that this is an unfortunate mindset. In light of these thoughts, Henani believes that aquariums can serve as an important educational tool.

When asked if he had any recommendation, Henani stated that since they are extracting natural resources, the "*hana kūpono*" (proper things to do) would be to provide a give back. He added that if those within the industry have an understanding of how to properly care for a fish in a tank, he believes that some of the targeted fish species could be farm raised, which could be used to restock the ocean or to supply the industry.

NOHEA KA ʻAWA, MEL JOHANSEN, JOHN REPLOGLE, MEGHAN LAMSON, SHAYLAN CRYSDALE, AND LESTER GEBIN

On March 28, 2019, ASM staff contacted Nohea Kaʻawa, a *lawaiʻa* practitioner and educator from Waiʻōhinu, Kaʻū. Nohea invited five other community members to lend their *manaʻo* to this study and on June 12, 2019, Lokelani Brandt, Matt Clark, and Aoloa Santos conducted a group interview with six individuals representing several communities from the Kaʻū and South Kona Districts. Participants included employees of The Nature Conservancy (TNC), Nohea Kaʻawa (Hawaiʻi Island Forest Program Coordinator), Mel Johansen (Kona Hema Field Coordinator), Shalan Crysdale (Hawaiʻi Island Forest Program Coordinator) and Lester Gebin (Field Coordinator); Former TNC employee, John Replogle, and Megan Lamson, a coral reef fish biologist. While the individuals spoke at various points throughout the talk-story, for readability, their individual thoughts and insights have been compiled into paragraph form and are presented below.

Nohealani Kaʻawa: Born and raised in Waiʻohinu, Kaʻū, Nohealani "Nohea" Kaʻawa currently resides with her family in the Palauhulu Ahupuaʻa in Kaʻū. She is the Hawaiʻi Island Forest Program Coordinator for TNC and has worked for the Hawaiʻi Wildlife Fund. She serves in various capacities within her district including a volunteer and educational outreach teacher for the ʻImi Pono No Ka ʻĀina program with the State of Hawaiʻi's, Department of Forest and Wildlife in partnership with Three Mountain Alliance in addition to serving as a board member of Ka ʻOhana O Honuʻapo. She is also working with the Department of Hawaiian Homelands to develop a management plan for the South Point area. Nohea has long-standing genealogical ties to Kaʻū where she and her family continue to reside. She learned many of her cultural values and traditional practices from her *ʻohana*, particularly her grandfather, which has been passed down in their family over the generations.

When asked if she was aware of any traditional practices and beliefs within the WHRFMA and with any of the fish on the "white species" list, Nohea named the fish she was most familiar with and elaborated on some of her family's traditions, customs, and beliefs. She also described fish characteristics and behaviors which she has observed as a fisher and diver that are important for certain traditional practices and customs. Nohea explained that many of these family traditions and beliefs were learned from direct experience. She emphasized that unless you ask the why questions, the elders will not openly disclose that kinds of information. Described below are some of the cultural practices and beliefs that were shared by Nohea.

Nohea stated that the *pākuʻikuʻi*, is sometimes referred to as *pākakui* or *pākukui*. She explained that this fish is symbolically connected to the *kukui*, or the candlenut tree (*Aleurites moluccana*). Nohea described that when a family member passes away, it is customary to bring a *lei* made of *kukui* to the funeral as this plant is believed to bring enlightenment so that the *ʻuhane* (spirit) can transition into the afterlife. She shared that the beliefs and customary practices associated with the afterlife may differ between families but the practice of bringing a *lei kukui* to a funeral continues to be an important part of the funerary rituals maintained in her *ʻohana*. Nohea added that if the deceased was "an ocean person," then *pākukui* was gathered for the *ʻaha ʻaina make*, or funerary feast. She explained when this fish is cooked it produces a distinct bright yellow color, which is something that does not occur when cooking other fish. In explaining why the *pākukui* was consumed during the *ʻaha ʻaina make*, Nohea explained that to consume this fish during such an event "served as an added layer of protection." Nohea elaborated on this practice, stating that:

> …so just as the *pele*, the sulphur, the yellow is a layer of protection or when you wear your *kīhei* (traditional garb), you dye your *kīhei* yellow with *ʻōlena*, the *pākukui* kinda serves as that layer of bodily protection…your body possessed a lot of oils and so to um, consume the fish and to have that oil a part of the things running throughout the system of your body, all of the *wai*, all of that *ʻau* going on, the currents moving, the *pākukui* kind serves as that shield of protection.

Nohea then pointed out the *hilu* and explained how this fish is utilized in the rituals associated with depositing a child's *piko* (umbilical cord). Nohea explained that all fish, like humans, have personalities and the *hilu* is considered as an easy-going, "go with the flow" type of fish that is not fearful of human nor does it stick around during times of danger. Nohea expressed that although there are different rituals that are used when depositing a child's *piko*, she described that in her family, the *piko* was deliberately placed into the mouth of a *hilu* and the fish was allowed to swim away. The belief is that as the child grows it takes on the characteristics of the *hilu*, which was much desired by certain family members because "the *piko* is an extension of the physical person."

With respect to the *hīnālea ʻakilolo*, Nohea described how this fish was used medicinally to treat brain-related trauma or illness. She described how the *hīnālea ʻakilolo* was used to treat an uncle that had suffered a stroke. Nohea explained that when the family became aware of this person's condition, some family members ordered the gathering of the *hīnālea ʻakilolo*. She explained that this fish is valued for its medicinal properties and is used specifically to treat brain-related trauma or illness. She described that there are differing opinions with the use of the *hīnālea ʻakilolo*, noting that some *ʻohana* believe that it will improve brain function because it *ʻaki* (snip) at the *lolo* (brain) thereby removing those things that have brought confusion to the brain, while others contend that consuming the fish may worsen a person's condition and make them more *lōlō* (feeble-minded).

Nohea spoke about the cultural beliefs associated with the *kīkākapu* fish, noting that this fish along with other fish species are considered a *kapu* class of *iʻa*. She explained that just as the *kauā* was set aside as a *kapu* class of people, there was also a *kapu* class of fish which included the *kīkākapu* and other fish species that have a black marking on its forehead. Nohea expressed that the distinct black colored band or marking on the forehead of the fish resembled the tattoo that was inked onto the forehead of the *kauā* class of people and for this reason, this fish was not intentionally caught.

In referencing the *kala*, Nohea shared that this fish is used in the rituals that accompany *hoʻoponopono*, a ceremonial process held to resolve disputes and restore peace between feuding family members. She emphasized that the *kala*, whose meaning translates to forgive is a part of the repertoire of rituals items that were utilized in this ceremony.

Nohea expressed that the *kūpuna* of Kaʻū fought hard to protect their area from overexploitation and development and that this sentiment and practice continues to be maintained by the people of Kaʻū. She added that today, especially during large fishing tournaments, many people flock to Kaʻū because they have fished out their areas. She described aquarium collectors as just another group that comes to Kaʻū to take its resources and lamented that "it's hard to watch." Nohea added that many people come to Kaʻū just to take its resources and that these people do nothing to give back to these resources. She expressed that seeing these kinds of extractive practices have significantly altered her family's fishing practices to the point that today, she and her family "rarely go *holoholo* at the *kai* because there's just too much taking and the balance is not in place anymore." Nohea then reflected on the efforts at Kaʻūpulehu in North Kona and noted that since the implementation of the fishing ban, they have seen a tremendous increase in the fish population. She noted that although there was protest regarding the creation and implementation of the fishing ban at Kaʻūpulehu, it has, however, allowed the fish population to flourish.

Nohea also expressed concern for the size of fish harvested by aquarium collectors and related memories from her childhood where she learned about the role of juvenile fish in the ecosystem. She described that as a child her family would cross-net at Kaʻaluʻalu Bay and that the grandchildren would help to *paipai* (the act of slapping and scooping the surface of the water to excite the fish into the net) and were responsible for sizing the fish, a method that was done using their hands. Nohea added that any fish that was smaller than the length of their hand was returned to the ocean. She stated that although her uncles would pull in a large catch, "not everything went home with us" and what was taken was just enough for the families to sustain themselves. She added that "when you start to take the *keiki* from the families, you're not going to have future *kupuna*."

Nohea then reflected on some of the potential cultural impacts that could result from the proposed action and expressed that many of the fish species listed on the "white-list" are widely used in various traditional practices and for subsistence purposes. Nohea cautioned that if these fish continue to be adversely impacted or their numbers continue to decline, it will indisputably have an adverse impact on many traditional Hawaiian cultural practices. Nohea stressed that these fish play an integral role in these customary traditions and rituals and opined that these traditions are critical to maintaining the traditional Hawaiian family system. She also stated that "by taking away the fish, you take away certain traditional practices" and *ʻike kupuna* (traditional knowledge), such as understanding the relationships between *mauka* (upland) and *makai* (ocean).

Mel Johansen: Mel Johansen was born and raised in Pāpā Ahupuaʻa and grew up in the areas of Manukā, Honomalino, Kapuʻa, and ʻĀlika—lands that are within a region known traditionally as Kapalilua in South Kona. He is an avid diver, pole and boat fisherman, and recalled spending many weekends and even weeklong expeditions where he camped and utilized the reef purely for subsistence purposes. Mel openly expressed that he is "totally against collecting fish that aren't yet ready for harvest because that seems like a totally different, opposite concept" than what he grew up with. Mel stated that he grew up with the understanding that when you took “resources from the reef it was for home use and to sustain yourself.” He added that all of the kūpuna he has ever encountered also shared in this same philosophy, which was “to take what you need and you take what’s ready...you don’t harvest small fish.” Mel stressed that taking small fish was never traditionally practiced and is an “odd concept” that he cannot relate to.

Mel reflected on the changes to the reef that he has observed over the past sixty years. He recalled the first time he had jumped into the water with a dive mask as a child and recalled seeing the reef covered with all kinds of colors and different varieties of fish. He shared that today when he visits this same place, he no longer sees the diversity of fish he experienced as a child—a change that he believes is associated with the increase in people utilizing the reef and its resources. He believes that the overall decrease in reef species and abundance should be a motivating factor to revive the traditional beliefs and practices of taking only what is needed and what is ready for harvest. Mel stated that some of the fishing grounds he frequented as a child are now protected from aquarium collecting and since the implementation of these no-take areas, he described seeing some recovery to the reef ecosystems but added that “it is still not the same as before.” Mel also stated that many of these coastal areas are historically significant and shared that Kapuʻa Bay is known to be one of the training grounds for Kekūhaupiʻo, a famed lua fighter. Mel stressed that the current aquarium collection practice of taking small fish to be sold elsewhere is “a terrible concept.” He equated the current aquarium collection practice with going to the forest and pulling young native plant species and selling them to another place.

In reviewing the “white-list” fish species and providing recommendations, Mel expressed that all fish have ecological value and that we do not know the impacts of removing too much of anyone species from the reef. Mel stated that for issues as important as the proposed action, he believes that the public and culture of the affected communities should be allowed to weigh-in on the issue and discuss the appropriateness of the fundamental concept of the industry—“is it a good concept or a bad one?” He stated that “what is important is the concept, not whether you can prove it scientifically.” He explained that culturally, everything he has ever learned about resource management stresses the importance of leaving juvenile fish so that they can mature, and taking only what is needed for subsistence purposes. Mel recommended that larger group interviews and public surveys should be included for issues that relate to the use of a public resource. He believes that the results from such interviews and surveys may offer a better understanding of the cultural appropriateness of the proposed action.

John Replogle: Born in Laupāhoehoe, Hilo District, John Replogle at the age of three moved to the Kaʻū District and currently resides in the Ocean View subdivision. He is retired from TNC where he served as an environmental outreach educator. During his youth he spent a lot of time fishing from the lands of Kaʻū. At age of twenty-three, around the same time John began his carrer as a cowboy, John began to notice the crisis of overfishing and made a personal decision to stop nearshore fishing. Although John no longer fishes regularly, he has, at times, accompanied his friends on subsistence focused fishing trips which has allowed him to witness the use and impacts of modern fishing equipment and technology, such as jet skis, scuba gear, and boats.

John shared that while growing up, access to the Kaʻū coast was often long and arduous and that the rough conditions severely limited human access to the coastal areas and its resources. He shared that at Waioʻahukini—a place that was frequented by his father—a private access road was built and despite this road, access was still very limited. He added that the *ulua* fishermen that wanted to get to Waioʻahukini had to hike down the *pali* (cliff) to get there. He noted that after his return from college, sometime shortly after 1974, his father informed him of a group of young fishermen that had come down to Waioʻahukini to night dive. In explaining the story shared to him by his father, John stated that this group of fishermen would spear the sleeping *ʻuhu*. John shared that “these young people saw no harm in what they did; filling coolers of *ʻuhu.* He referenced several images that he saw on the web that showed fishermen standing over a plethora of reef fish that were laid out in their garage. John opined that it’s these kinds of fishing practices that “have brought us to where we are at.” John sees the aquarium industry as “adding to this crisis.” John explained that today, access to nearshore resources is no longer limited to roads or trails as fishers now utilize modern technologies such as boats and jet skis which makes everywhere accessible to them. He added in the past, to get to Waioʻahukini took almost two hours by vehicle, but with boats and jet skis, people can access this area from South Point within minutes. In describing the importance of Waioʻahikini, John shared that Mary Kawena Pukui described it as a very rich fishing ground. In describing what makes this area rich, John explained that the Halaʻea current that sweeps around Ka Lae is nutrient-rich and as this current moves, it deposits a great deal of nutrients into the vicinity of Waioʻahukini.

In speaking about the history of aquarium fishing in West Hawaiʻi, John shared that during the late 1980s, when aquarium fishing began to expand, there were huge public rallies where people paraded through the streets of Kona to stop the taking of fish for the aquarium industry. He added that although there was tremendous public opposition, the State of Hawaiʻi continued to allow aquarium collecting because of the tax revenue.

John also raised concern for the mortality rate of the fish and noted that there have been several instances when bags of dead aquarium fish were dumped and "thrown out like garbage." He described that culturally when something of value needs to be disposed of, it is done so properly and cited the example of a *lei*, where once it is no longer needed, it is returned to the land. John contends that although only a few cases of dumped aquarium fish have made public headlines, he believes that such cases may be more common.

In describing some of his concern about the proposed action, John exclaimed that in fifty years from now, what will those people think of the culture that would allow this type of activity to happen. He stated that these marine resources are a part of a living culture and are a part of a living ecosystem that is intimately connected to the land. John stressed that currently, Hawaiʻi's reefs are under severe stress brought about by things like introduced toxins from sunscreen, overfishing, rising ocean temperatures, pollution, and unregulated fishing. He made reference to the hunting of the Pacific Sea Otter to near extinction, which led to an explosion of sea urchins that in turn created ocean floor deserts. John expressed that "man has no brakes" when it comes to the take of natural resources. He opined that we are surrounded by water and that in Hawaiʻi you don't need to have any license or education to use this resource. He exclaimed that today, all people need to do is go down to their local fishing store and "buy the stuff and catch um…catch as many as you can." John believes that this current mindset is tied to proving one's masculinity and dominance over Nature which he described as a "western civilization mindset.

In reflecting on the current state of land and marine resource management, John stated that "we can't even take care of where we are, what we have, and what we have been given responsibility for, yet we want to go and take more!" John added that "these reefs existed just fine without us and now it's a race to catch the next fish with no regard for the whole reef." John stated that "the State of Hawaiʻi is incapable of managing such an industry" as the State does not have the funding or the enforcement to regulate this industry. John stated that in Kaʻū and because of the way the management boundaries were drawn, DOCARE officers from both east and west Hawaiʻi have to patrol this district. He stated that this is problematic because depending on where the infraction occurred will determine what region will respond. He expressed that DOCARE on Hawaiʻi Island is under staffed and related a saying from a former DOFAW manager who exclaimed "I would rather poke my eye with a sharp stick than work in Kaʻū." John shared that this statement is not just about Kaʻū but is a reflection of the entire state and the "need to stop prostituting Hawaiʻi for personal gain."

John shared that there is a hand full of people collecting and about three million dollars in tax revenue is generated by the aquarium industry. John stated that the ecological value of Hawaiʻi's marine ecosystem to the islands and to the planet should supersede any dollar amount. He advocated, at the very least, for an ecosystems services fees and believes that we should not be freely giving away our natural resources. He argued that the state and county agencies are so "focused on visitors and pleasing the outside world" that we have overlooked proper management of our island resources. John shared that once a place is depleted of fish, fishers will just move to the next location. He expressed that this is one of the reasons why people come to Kaʻū, because they have fished out their areas and that it will only be a matter of time before Kaʻū is depleted of its marine resources. He also added that the rough ocean conditions in Kaʻū have helped to protect the area's resources because it limits accessibility. John does not support the taking of reef fish for the aquarium industry and believes that reef fish should only be collected for educational purposes within the State of Hawaiʻi. While he does support the taking of fish for subsistence purposes, he believes that even recreational fishing should be regulated because most fishers don't know the damage they are doing to the marine ecosystem. He reflected on the current hunting license fees and noted that if the fees were higher, it would generate more income that could be used to improve management of the resources and that people would be more invested in protecting their resources. He stated, "it cost money to take care of our resources." John shared that even in Pre-contact times, people had to learn about the ocean first before they caught their first fish. He would much rather see people visit the island and view fish in their natural habitat accompanied by knowledgeable practitioners. John stated that "we cannot take care of what we have and we want to give more…enough already! It's well past time to turn this trend around within the whole state, not just West Hawaiʻi."

Megan Lamson: Born and raised in California, Megan Lamson moved to Hawaiʻi and currently resides in Honalo Ahupuaʻa, South Kona. She has earned degrees in marine biology and tropical conservation biology and has a background in coral reef fish ecology and community-based resource management. She is a Board member for Ka

ʻOhana O Honuʻapo, a community organization based in Kaʻū. She also works for Hawaiʻi Wildlife Fund and the Pacific Cooperative Studies Unit for the Hawaiʻi Division of Aquatic Resources in Kona.

With respect to the role of technology in altering traditional fishing practices, Megan shared that access to the coast coupled with the advancement in technology has drastically altered traditional fishing practices. Additionally, Megan pointed out that changes to Hawaiʻi's commercial jetliners have aided in the transportation of aquarium fish, the bulk of which are shipped to offshore locations. She added that improved scuba technology now makes it possible for divers to go deeper and for longer periods of time.

Megan also spoke about the invasive species that are listed on the "white-list" (*roi* and *taʻape*) and noted that while most people believe removing these fish are good for the reef ecosystems, she shared that more recent scientific research is dispelling the anecdotal myths that associate declining reef health with *roi* (*Cephalopholis argus*). She stated that it is really easy to point to any one aspect as the leading cause of declining reef health, but she stressed that declining reef health is a consequence of multiple stressors. Megan pointed to the 2015 coral bleaching event that resulted in the loss of close to fifty percent of live coral covers in West Hawaiʻi. She added that the drastic reduction in coral has severely altered the very foundation upon which reef fish and other marine life need to survive. She emphasized that although some fish listed on the "white-list" are highly valued in Hawaiian culture, she explained that all fish have a role in maintaining the necessary balance of the ecosystem. She stressed that we don't fully understand the ecological relationships that exist between the different species. Megan explained that the forty species listed on the "white-list" was passed in 2012 when Governor Neil Abercrombie signed and approved it along with the "rules package" and noted that prior to this, people "could essentially take whatever." Megan clarified that it took years and the effort of many people and organization to get these rules approved. She added that these rules apply only to the WHRFMA and believes that all fisheries in the State of Hawaiʻi are deserving of such stricter legislative protection. Megan also pointed to the endemic species on the "white-list" and stated that there should be no taking of any endemic species because these species are found only here in Hawaiʻi and should be protected.

With respect to her personal thoughts on aquarium collecting, Megan shared that unless these fish are being used as an instructional tool to teach the current and next-generation about fish and marine ecosystem or environmental education (such as in public aquariums and schools/university classrooms), she stated that she cannot fully support the take of fish for the aquarium industry. Megan added that from a scientific perspective, she would like "to support sustainable harvest of any species as long as it is not detrimental to native wildlife." Reflecting on the data that has been analyzed for the no-aquarium take areas in the WHRFMA that goes back to 1998, Megan stated that there has been an overall increase in fish abundance, but noted that when analyzing specific species, the population of *pākukui* has been decimated. For this reason, Megan strongly opposes the take of *pākukui*. Megan further explained that *pākukui* is one of the top three fish species that is collected within the WHRFMA.

Megan added that despite the WHRFMA being one of the best-managed fisheries in the state, the State of Hawaiʻi still does not have the capacity to manage all of the aquatic resources on its own, and needs continued support from communities and other partner agencies. She added that historically for West Hawaiʻi, the State of Hawaiʻi relies heavily on funding from partner agencies such as the National Oceanic and Atmospheric Administration (NOAA) to monitor the effectiveness of the aquarium fishery within the WHRFMA to help best manage the fishery. She believes that every fishery in the State of Hawaiʻi deserves to have environmental and cultural impact assessment study because even one fish taken from the reef, whether for home consumption or for an aquarium, has the same impact to the reef. She explained that there are, however, different ethical and cultural concerns with respect to collecting fish for subsistence purposes and for the aquarium industry. Megan also contends that the State should look into options to charge marine usage fees for anyone who utilizes the ocean resources, which could then go towards improving the management of Hawaiʻi's fisheries.

Shalan Crysdale: Shalan Crysdale is the Hawaiʻi Island Forest Program Coordinator for TNC and has worked in the conservation field for over fifteen years, with some five years in dryland forest management. Born in California, Shalan currently resides in Waiʻōhinu with his family and has spent much of his time during the 1980s in the coast of South Kona.

When asked if he had any cultural knowledge of the "white-species" list or knew of any traditional practices and beliefs associated with these fish or in the region, he stated that he was unaware of any specific cultural practices. However, Shalan offered his perspective on "protected areas" stating that "when you assign protection to some area, you are necessarily diminishing the status of the areas that are not protected…if you have protection in one area, well, you can assume next door is getting pounded." Shalan also spoke about the ecological connection between species and noted that we do not fully understand the ecological relationship between different species. Shalan added that from his experience, a large amount of research has focused on species that threaten the broader ecosystem but has seen limited information on the positive relationships between species. He believes that understanding both positive and negative relationships between species may result in better management practices and regulation policies. Shalan concluded that the recognition to protect Hawaiʻi's resources is a common thread between different agencies, however, varying political agendas inhibit the development of necessary policies and regulations for the best interests of each region.

Lester Gebin: Born and raised in Kona, Lester now lives in Ocean View in Kaʻū and has been employed with TNC for the past thirteen years. Lester asked, "how many of fish they [aquarium collectors] catch survive?" He noted that depending on the depths at which these fish are caught, may require the air bladders to be manually punctured before they can be brought to the surface. Lester advocated for people to view fish in their natural habitat.

MIKE NAKACHI, LING NAKACHI, AND KAIAKEA NAKACHI

Mike Nakachi accompanied by his father and life-long fisher and waterman Ling Nakachi and his son Kaiakea Nakachi, currently a graduate student in the Tropical Conservation Biology and Environmental Science program at the University of Hawaiʻi at Hilo met with Lokelani Brandt on June 26, 2019, to share their insights about traditional cultural uses and knowledge with respect to the WHRFMA. Mike is a fisherman and owner of ʻOhana Moana, a Kona-based fishing and dive tour company. Mike has also served as a member of the West Hawaiʻi Fisheries Council and has on multiple occasions spoke publicly against the illegal take of fish for the aquarium industry. Mike shared that his family has always had a profound respect for the ocean and all of its life forms and that on his father's side, where his Hawaiian lineage comes from, they were *kahu manō* (caretakers of sharks). Because of years of daily interaction with the ocean in West Hawaiʻi, Mike has developed astute observation skills and can detect subtle color gradations, name ocean currents and its characteristics amongst many other attributes of the ocean environment.

When asked about any ongoing traditional cultural practices within the WHRFMA, Mike explained that women have always been the keepers of the cultural knowledge and traditions and that men are often tasked with some of the more physical aspects of these traditions. He spoke of several occasions when he was asked by certain respected women to gather specific fishes that were used ceremonially. He explained that I never questioned why certain species were requested or how it was used, rather I just do as the aunties and *kupuna* ask of me. Kaiakea added to this discussion, explaining that it's hard for some of the *kupuna* to gather certain resources. Mike also spoke of subsistence gathering of fish and other marine resources, which is used to supply food at traditional *lūʻau* celebrations and for household consumption. Mike also pointed out some of the cultural sites, such as fishponds and historically significant places (which are numerous) along the West Hawaiʻi region. In describing another long-standing Hawaiian customary practice, Mike spoke about *mālama ʻāina*, a deeply-rooted belief that was translated into daily practices that made the land and ocean resources *momona* (fertile, fruitful). Mike described these practices which promoted fertility and richness of the land and ocean as *mālama momona*. He stated that the aquarium industry does not apply this cultural practice at all to any part of their industry.

Mike spoke about the practice of showing respect while on the ocean, which includes providing a safe and respectful distance between others who are fishing or diving as well as showing respect for the resources. He described how this has changed over the years as more people that have no sense of the culture or the cultural significance of the ocean utilize it for various ocean activities. He described this new attitude and behavior as carrying an air of entitlement to the ocean resources and not having any sort of give-back to the resources. He noted that this change in attitude and behavior has at times led to intense conflicts between different ocean users. He described during his younger years while fishing with older fishermen, they would encounter collectors and described shouting matches that would occur on the water between aquarium collectors, fishermen, and dive-tour operators.

Mike made several references to the importance of having healthy coral and reef ecosystems explaining that many of the species found in West Hawaiʻi are endemic. He noted that in other parts of the Hawaiian archipelago, some reef systems are comprised purely of endemic species. He stressed that this means that these species are not found anywhere else in the world and described how this has led to a highly conflicted values assessment. Mike opined that culturally, preserving and caring for these resources is often motivated by cultural/familial values, uses, and beliefs associated with these resources, whereas the State of Hawaiʻi and others are solely motivated by the economic value of these resources. He noted that the Hawaiian cultural value of our reef resources as with other resources is never considered an integral component in management strategies, which as a result, continues to adversely impact Hawaiian cultural traditions, practices, and beliefs. Mike also shared that the reef system in West Hawaiʻi have and continue to be impacted by other external stressors such as rising sea temperatures and remarked on the 2015 coral bleaching event that resulted in acres of dead coral. Mike referenced the *Kumulipo* and clarified that the process described in this chant is ongoing, not merely something of the past. He described how healthy fish populations repair damaged coral reefs noting how certain fish like the *uhu* graze on dead coral thereby providing a clean foundation upon which new coral polyps can form.

With respect to the aquarium industry, Mike disclosed that in the past, he has been approached by several individuals to participate in this industry, but affirmed that he has never participated in it because it never felt right in his *na'au* (guts, moral nature). He expressed that the feelings that come with taking fish to be sold outside of Hawai'i to be placed in someone's tank never felt appropriate to him nor does it contribute to the health of the ocean. He acknowledged knowing several Native Hawaiians that have participated in this industry but stated that many of them have left after learning about the workings of the industry. Mike lamented that in some smaller Hawaiian communities, especially in South Kona where traditional methods of harvesting fish are still practiced, the aquarium industry has created serious discord and tension amongst its members, which he feels is very sad and unfortunate.

Mike worries that since the banning of aquarium collecting in West Hawai'i, many of the collectors have migrated and are now impacting other areas around the island, including eastern Ka'ū and emphasized that the impacts to these areas are not being assessed in this process. Although aquarium collecting is prohibited within the WHRFMA, it is still occurring in other parts of the island, which is worrisome for Mike. He believes that an assessment should be conducted for all of the islands, not just West Hawai'i. He described the aquarium industry as keeping a low-profile and working under the radar and noted that they are not active in any other community issues other than those that pose a direct threat to the viability of their industry. He believes that this type of veiled operation has not lent to the credibility of their industry. Additionally, Mike described several instances when collectors were caught illegally harvesting fish which he believes has led to a degraded public profile. Mike believes that it is important to give back to the communities and to the ecosystem which you depend upon.

Mike also shared his thoughts on the regulatory component and lamented on the fact that there are very few DOCARE officers that patrol this massive region and its resources. He expressed that currently there is not enough enforcement to regulate all of the different kinds of activities that are occurring in West Hawai'i, including the aquarium industry. He stated that the lack of enforcement has led communities to implement Makai Watch, where community members have taken on the responsibility of raising awareness about the resources and reporting illegal activities. Mike expressed that there is little reliance on the State to execute their fiduciary responsibilities to care for and properly manage our resources.

In contrasting the past to the present and looking to the future, Mike strongly believes that we are now in a new time, where cultural traditions are being practiced and Hawaiian youth are actively engaged in their culture in innovative and meaningful ways. He described today, more people being culturally aware and that knowledge of our cultural places are being revitalized, preserved, and passed on to the next generation. Mike hopes that he can continue to pass on his love and knowledge of the ocean to his grandchildren as has been done in his family for generations. He hopes this tradition can be carried on. He described the knowledge of the ocean as understood by *kupuna* as being profound and is still highly applicable to us today. Mike was very earnest in his feelings regarding the capture and selling of Hawai'i's reef fish to places outside of Hawai'i and believes this is not *pono*.

WILFRED KAUPIKO, KA'IMI KAUPIKO, AND GREG ASNER

Lokelani Brandt contacted Ka'imi Kaupiko, a Hawaiian fishing practitioner and educator with long-standing genealogical ties to the Hawaiian fishing village of Miloli'i in South Kona. Ka'imi extended the invitation to other family and community members, to which his father Wilfred "Uncle Willy" Kaupiko, and Greg Asner with the latter residing in the adjacent Miloli'i beach lot subdivision responded to Ka'imi's request. On June 28, 2019, Lokelani Brandt met with these individuals at Miloli'i to discuss past and ongoing traditional cultural practices and beliefs associated with Miloli'i and the adjacent coastal areas including Papa Bay and to get their general thoughts on the proposed action. All of the community members openly expressed that they were not aware that an EIS was being prepared and were disappointed that no community meetings had been held by the applicant to discuss their proposed action. Both Ka'imi and Uncle Willy spoke about their involvement with the 2017 Hawai'i Supreme Court ruling that invalidated all permits issued pursuant to HRS §188-31 until compliance with the Hawai'i Environmental Policy Act (HEPA) is met.

When asked about their knowledge of any past and or ongoing traditional cultural practices, Uncle Willy shared that he comes from a long line of Hawaiian *'ōpelu* fishers, and noted that his father was a *'ōpelu* fisherman and that his uncles were master fishers, having in-depth knowledge of the ocean, fish behavior and habitat, and fishing techniques. He described spending a lot of time with his uncles where he learned how to fish according to the practices of his *kupuna*. He informed that they spoke *'Ōlelo* (Hawaiian language), often times speaking only Hawaiian amongst each other. He described that while growing up, men were the primary *ʻōpelu* fishers but that women would often accompany the men. He also expressed that some women, particularly those that were skilled and strong *ʻōpelu* fishers would go out on the ocean alone. Uncle Willy recalled memories of his youth where the reef at Miloliʻi Bay was teeming with fish. He reminisced that when the church bell rang, it would cause the fish to flutter on the surface of the sea.

Uncle Willy described in detail how many of the old practices including the enforcement of certain *kapu* were still practiced well into the 20th century and stated that on Sundays, "fishing was *kapu*" and people were encouraged to rest. Uncle Willy described the process of *ka ʻai*, which he described as the feeding and taming of fish. He detailed the preparation of vegetable chum which included locally grown vegetable such as pumpkin and *kalo* that was used to *hānai* (feed) the *ʻōpelu*. Uncle Willy explained how the fishers would load the prepared vegetables on the canoe and take it to the *koʻa* where it was released. He described how each fisher would tap on their canoe in a certain manner to call the fish up from the depths of the ocean. Uncle Willy recalled watching the dark-colored ball of *ʻōpelu* dance in the sea and the efforts of the fishermen to move swiftly to lower the nets, herd the *ʻōpelu*, and raise the nets. He stated that much of the fishing that was done during his youth was for commercial and recalled a time when *ʻōpelu* was sold at ten cents per pound. He stated that any excess fish was cleaned, salted, sun-dried and later sold to customers across the island. Uncle Willy also expressed that women were particularly adept at cleaning and preparing fish. He stated that despite the adoption of more modern fishing technology, one "still needs to know the secrets of the ocean," including the winds and currents. Uncle Willy referred to the ocean current that runs south just outside of Miloliʻi as the *kamaʻāina* current or the Kaʻū current. He stated that when fishing for *ʻōpelu*, one needs to be very aware of the current and winds as certain types create challenges for the *ʻōpelu* fishers.

When asked about cultural uses, traditions, and beliefs associated with any of the "white-list" species, Uncle Willy stated that many of the fish are used for subsistence purposes. Kaʻimi noted the use of *pākuikui* and *kole* in certain ceremonies and that red fish is used in their *Makahiki* ceremonies. Uncle Willy added that yellow tang was and still is used as an important indicator species because it attracts other valued fish such as *maiko*, *manini*, and *uhu*. Kaʻimi added that each fish has a role in the ecosystem and stated that the "white-list" is not *pono*. Uncle Willy described that in West Hawaiʻi, the reefs are short and steep which transition abruptly into very deep water and that this unique environment provided an abundance and diversity of marine resources.

With respect to the adoption and use of fishing technology, Uncle Willy recalled being told by his father to "work smart, not hard" and noted that when gas-powered engines and other fishing devices were introduced to Miloliʻi, the fishermen, including himself adopted some of these technologies which they incorporated into their traditional fishing practices. While *ʻōpelu* fishing occurs in deeper waters, Uncle Willy described several near shore fishing techniques including the use of a crossnet to catch *akule*, lay nets, throw nets, poles, and spears to catch other reef fish. He also spoke about using homemade wire baskets which were used to remove the spines from *wana*. He also noted the use of fishing *imu* which was constructed by each family in the nearshore reefs. He explained that the stones were piled on the reef and that fish like *manini* would dwell in the *imu*. Uncle Willy described the use of a throw net which was placed over the *imu* while the stones were dismantled resulting in the entanglement of the fleeing fish in the net. Of the fishing techniques described by Uncle Willy, he indicated that only the latter is no longer practiced. Uncle Willy stated that although many new technologies have made their way into this fishing village, they still depend heavily on the land and ocean and laughingly stated: "we still use *kukui hele pō* (lanterns) at night." Uncle Willy also spoke about their use of certain plants such as *lehua piha* (fully blossomed *lehua*) and *hala* (pandanus) as indicators for when certain marine species were ready to harvest.

In contrasting the practices he learned as a child to today, Uncle Willy expressed that a lot has changed and stated that in the past things were "real strict." Both Kaʻimi and Uncle Willy described changes to peoples' behavior and attitude towards the ocean resources and noted the gradual changes to the ocean environment and decline in fish abundance at Miloliʻi. Uncle Willy pointed out that while growing up, they were always taught to *mālama* and stay in their respective *ahupuaʻa* and not to *mahaʻoi* (intrude) in other people's places. He stated that today, people fish wherever they can access and take everything they can. He reflected on the traditional preparation of vegetable chum and stated that some people began using meat and noted that meat chum disrupts the fishes' diet. Both Uncle Willy and Kaʻimi expressed that community members who acted out of the cultural norms in the fishing village were held accountable for their actions and were punished by the community.

Kaʻimi added that Miloliʻi was always known for its abundance and is one of the last places to maintain traditional Hawaiian fishing practices, which is why Kaʻimi and his father have played a key role in developing educational programs for the *ʻohana* and youth of Miloliʻi. When asked about the types of educational programs they offer, Kaʻimi stated that they focus on teaching the *keiki* about traditional *ʻōpelu* feeding, net making, developing fluency in traditional Hawaiian fishing related terminology, seasonal changes, Hawaiian moon calendar, and other *pono* ways of fishing. Uncle Willy and Ka'imi expressed that many of the *kupuna* and fishing practitioner have passed away but there are "plenty *kamali'i*" in the village. They described a pressing need to teach the next generation about the cultural traditions unique to Miloli'i so that they can *maka'ala* (remain watchful) and *mālama* (care for) these traditions, place, and resources into the future. Ka'imi stated that today, the Miloli'i community and its ocean resources are in a "vulnerable state" and expressed that the seasonal patterns are off, which creates challenges for their subsistence lifestyle.

While all four interview participants were aware of the Miloli'i FRA, which prohibits that taking of reef fish for the aquarium industry, they noted that in the adjacent Pāpā Bay, aquarium collection is allowed. Uncle Willy stated that while growing up, he learned that Pāpā Bay is where the fish are born. Greg Asner, who has been diving and conducting coral and fish surveys at Pāpā Bay for the past twenty-three years highlighted some of his research findings. Greg explained that the science he has been conducting puts numbers to what people like Uncle Willy grew up learning and knowing. Greg described a phenomenon known as "bio slicks" which are visible from land as glass-like, meandering streaks that appear on the ocean surface. Greg explained that these drifting slicks contain larvae fish and invertebrates, algae, and debris and serve as an important habitat during the early growth stages of these organisms. Greg stated that these slicks are common in and near Pāpā Bay but are not generated within Miloli'i Bay. He emphasized that coastal areas share important biological connections and from his research, he has learned that fish migrate to different areas to live out their life cycle. He went on to explain that Pāpā Bay and Miloli'i share important biological connections because some of the larvae fish that are carried on these slicks are deposited into adjacent bays. Greg stressed that what happens at Pāpā Bay impacts Miloli'i and other areas. Both Greg and Gail confirmed fish population crashes at Pāpā Bay and have recorded collectors walking on and damaging coral, which they expressed is key to maintaining a healthy marine ecosystem. The group stated that they have seen aquarium collectors day after day collecting fish from the same areas and feels that this intensive harvesting does not give the fish and the ecosystem a chance to recouperate from previous biological removals. Greg believes that the destructive methods used by certain aquarium collectors are dismantling this integrated system. Additionally, Ka'imi and Greg described other events, one of which included the 2015 mass coral bleaching which devastated the corals in West Hawai'i. Uncle Willy recalled that after this bleaching event, the *'ōpelu* were missing.

When asked about their thoughts on the proposed action, they explained some of the reasons why they were not in support of the proposed action. The four individuals explained that while aquarium collection is not permitted within Miloli'i Bay, they noted that aquarium collectors often launch their boats and utilize water at the Miloli'i dock to fill their tanks. Ka'imi and Uncle Willy described several instances when they have caught aquarium collectors illegally harvesting fish within the FRA which they reported to DLNR. Uncle Willy stated that for the past ten years and because the State cannot fulfill its duties, the Miloli'i community has been implementing Makai Watch, a community-based watch and outreach program promoted by DLNR. Despite numerous complaints and reports to DLNR about the illegal taking of fish by collectors, Ka'imi and Uncle Willy opined that DLNR has failed in their responsibility as they do not follow up or issue citations to violators. For these reasons and many others, Uncle Willy feels that the "State cannot take care of our resources." Greg questioned, how does the "aquarium industry fit into the State's 30x30 initiative" which promotes effective management of 30% of nearshore marine areas by the year 2030? Uncle Willy stated that tropical fish divers *hana'ino* (cause trouble) in Kona. Uncle Willy added that aquarium collectors take small fish and that this kind of practice is not good for the ocean. He explained that they have wiped out areas in North Kona and have made their way to South Kona. Additionally, Ka'imi described aquarium collectors driving over the *'ōpelu ko'a* with their boats which he stated disrupts the fish and the *'ōpelu* fishing process. Ka'imi expressed that there are virtually no rules for aquarium collectors and believes that the industry is unsustainable. He also spoke about the mortality rate of aquarium fish and believes that this kind of practice is not *pono*. Because of such events, practices, and interactions, they explained that their relationship with the collectors has been contentious. They believe that these sorts of interactions have ultimately ruined the communities interest and trust in the industry.

Ka'imi described scuba certifications classes taking place at Miloli'i, which attracted many local people including family members. He stated that these certification classes were used to simultaneously recruit community members into the industry. He has been saddened by the conflict that the aquarium industry has brought into their community and family. Ka'imi expressed that while some family members participate in the industry as a way to support their family, many of them struggle with the internal conflict because the practices of the industry run counter to their familial and cultural practices and beliefs. Ka'imi expressed that some of them have left the industry because of the internal conflict.

Ka'imi and Uncle Willy shared their future hopes and vision for Miloli'i. They spoke about their current initiative to develop a Community Based Management Plan for Miloli'i and the steps they have taken to develop a more in-depth understanding of the breeding and spawning cycles for various marine species. They have partnered with several scientists and research groups to help establish baseline data which will help with their management plan. Ka‘imi stated that they have a passion to protect their cultural ways so that they and the future generation can fish for the rest of their lives. He expressed that for them, fish are next to kin and is a staple of their diet. Uncle Willy stated that native rights have always been overlooked and that native rights always have to be negotiated. Uncle Willy advocated for the creation of protected areas that are built around the traditional Hawaiian *pu‘uhonua* (places of refuge) concept. Uncle Willy would like to see stiffer fines as a way for people to take more seriously their actions and impacts to Hawai‘i’s marine resources. He expressed that many of the current laws are obsolete and need to be revised and that in future management efforts, all parties need to *hana like* (work together).

SHANE PALACAT-NELSON

Shane Palacat-Nelson, who traces his family lineage to the lands of Kealakekua, South Kona for more than 500 years was interviewed by Lokelani Brandt on June 28, 2019. In discussing the potential cultural impacts that may result from the proposed action, Shane emphasized that Cultural Impact Assessments (CIA’s), can provide crucial information that can help determine an approach on how to moving forward on controversial issues. In referencing Kealakekua Bay, Shane stated that the current state of the bay is unknown because there is not enough fish count, water quality, or reef health data to provide feedback on the potential impacts to the area. He further related that schools of fish can be depleted in one season, but if there is no data to detect these depletions then communities witnessing the depletion of their own resources are left with no support or evidence to resolve these on-going problems. He believes that restricted areas “are not working properly” and therefore declined to comment until there is a thorough study done within these areas. With the lack of data, he is unable to accept the commercialization of aquatic fisheries until these issues are addressed. With regard to areas where aquarium collecting is allowed, Shane believes that fishery inventory studies need to be updated and assessed more frequently. Shane voiced that he is not against aquarium collecting and shared that “everyone has a place in community,” but there needs to be thorough research and community engagement. He added that it has to be more than just developing a set of rules and regulations, rather creating a lifestyle.

KEALOHA PISCIOTTA

On July 5, 2019, Lokelani Brandt met with Kealoha Pisciotta, a Hawaiian practitioner to discuss the proposed action and to identify any past or ongoing cultural practices and belief associated with the WHRFMA as well as any cultural uses and beliefs associated with the forty “white-list” species. Kealoha shared that her family, the Oneha and Ka‘anape‘a’s come from the Island of Kaua‘i and that they were *kahu* (guardians) of Mauna Kea through their worship of the gods ‘Io and Kāne. Kealoha fondly recalled memories of her childhood, where she walked the shores of Waikīkī and developed her knowledge and interest in Hawai‘i’s reef fish and other intertidal species. She vividly recalled her grandmother giving her “*pū‘olu*” (bundle) containing offerings that were used to feed and acknowledge the *akua* as *kinolau* and to acknowledge *‘aumākua*. She had become so well-acquainted with these species that as a child she became involved with the Waikīkī Aquarium where she was responsible for taking care of the intertidal species and monk seals. Her involvement with the Waikīkī Aquarium began when she was invited by her friend’s mama to collect specimens for her reef teaching class. Kealoha playfully recalled gathering different species, delivering and caring for them, then returning them to the ocean after the class. She did this for a number of years before working at Sea Life Park where she helped with taking care of the reef fish tank. Kealoha’s family later relocated to Volcano on Hawai‘i Island at which time she began to develop a personal relationship with the ocean in West Hawai‘i.

In conveying her cultural connection to the West Hawai‘i region, Kealoha referenced the *Kumulipo* and noted that upon moving to Hawai‘i Island as a child, she gave her first *ho‘okupu* (offering) at Kahalu‘u. She explained that because her family lived in Volcano, it was easy for them to travel to the Kona side and for her, the ocean there “felt more like home.” Kealoha continued to visit the Kahalu‘u area and noted that she has had bad experiences, particularly with people “who don’t understand practitioner use” of the ocean. She described being invited to the ReefTeach program at Kahalu‘u where she educated the volunteers about Article XII of the Hawai‘i Constitution. She explained that while she supported the ReefTeach initiative of protecting coral reefs, she noted that many of the workers did not have an understanding of the unique cultural environment in which they worked. She related that Article XII codified native rights and that these laws are “about us being able to continue our practice.” Kealoha added that while the law spells out the right for Hawaiians, she acknowledged that though she is not a *kama‘āina* (native-born resident) of Kahalu‘u she is *kama‘āina* (acquainted) with the *‘ohana* of Kahalu‘u, meaning that she shares a kinship connection to the marine life at Kahalu‘u. She described instances when she was conducting ceremonies in the ocean at Kahalu‘u and being approached and apprehended by people who blatantly stated that she cannot give *ho‘okupu*. Kealoha emphasized that when people abruptly approach you during a ceremony, it immediately shifts the mental and physical aspects of the ceremony.

With respect to traditional cultural knowledge and practices, Kealoha related that Kūkahau‘ula, an *akua* who is associated with Mauka Kea and is one of the lovers of the goddess Poli‘ahu “is also an *akua* for the fishermen.” She explained that the blue rock used to make *lūhe‘e* (octopus lure) was sourced from an area near the summit of Mauna Kea and brought down near Hale Pōhaku where it was refined. Kealoha elaborated on this practice, stating that for this reason, Kūkahau‘ula was worshipped by fishermen and is associated with the *he‘e* (octopus) and *mūhe‘e* (squid). She explained:

> The rosy hue that he [Kūkahau‘ula] is also I think is a signal for the fishers outside. Because where the sun hits on the opposite side is the shadow… so the great shadow of Mauna Kea becomes its own kind of sacred feature that traverses these certain things that make our *kilo* of timing…

Kealoha related that the only time when Kūkahau‘ula and Poli‘ahu meet is during sunrise and sunset and it is during these times that Kūkahau‘ula’s great light reaches the low-lying clouds on the Kona coast—clouds that were also favored by the fishermen of Kona. Kealoha also spoke about her experience with watching Hokule‘a depart from the Kona coast during sunset and how the shadow from Mauna Kea created a unique light formation on the ocean. Kealoha also spoke about the relationships of animals and *‘aumakua* (family guardian or god) and the deeper connections between *‘aumakua* and their interactions with *kanaka*, *‘ohana* and communities they care for. She connected this traditional belief to a *mo‘olelo* concerning the *hīhīmanu* (stingray) of Māhukona that were fed by the people during times of famine and in return, the *hīhīmanu* drove heaps of fish to the shore to feed the people.

Kealoha stated that each species has key characteristics that associate them with certain *akua.* She spoke particularly of the “animals with spots or that are spiny,” such as *hīhīmanu*, the Hawaiian whitespotted puffer (*Canthigaster jactator*), *kala* (*Naso lituratus*), *puhi* (*Gymnothorax ruepelliae*), and their relationship to the *akua* Kāne. She also shared that fish with “pokey” tails or bodies, such as *kala* and pufferfish, are protected under Kāne and are considered *kapu*. These fish were most often avoided but if they were accidentally caught, fishermen immediately asked for forgiveness because they did not want any bad omens to befall upon them or their families and to maintain their relationship with their *akua*. She also shared that species whose bodies resemble a kite are associated with Kanaloa and added that the common fish shape bears this kite-like characteristic and are therefore connected to Kanaloa. *Hīnālea*, or specifically the “rock mover” wrasse were known to be *‘aumakua* and connected to Pele.

When asked about the use of fish for traditional cultural practices or ceremonies, Kealoha shared that red-colored fish were commonly reserved for *ali‘i*. She shared that her *‘ohana* witnessed and participated in a funeral procession of the queen in which red fish were included in the ceremony. She also shared that fish were placed on a *lele*, or fishing altar, to perpetuate the practice of *‘āina momona*—traditional practices that promote abundance and fertility of both the land and sea. Kealoha also added that *kala* along with *limu kala* was placed on the altar when asking for forgiveness, as *kala* means to forgive. She also witnessed the use of fish in ceremonies to re-consecrate sacred places including chiefly *heiau* in the Kona region.

With respect to the cultural uses of the nearshore areas, Kealoha explained that traditionally, women were the caretakers of this part of the ocean. She stated that today, this traditional practiced is not acknowledge. She described how the women would create *hīnālea* houses to attract this fish. She described that in areas with heavy reef cover, it was a common practice of the ancient people to carve out trails in the reef. Kealoha opined that “our people did a lot of engineering, but engineering that’s different from modern engineering.” She stressed that traditional engineering focused on increasing the abundance of a resource and cited the example of the traditional fishpond. In reflecting on the differences between traditional and modern concepts of engineering, Kealoha stated that the current practice of the aquarium industry is purely extractive and added that if they were helping to grow the abundance of Hawai‘i’s marine resources, it would be an entirely different situation. She referenced a recent Stanford University report that provided suggestions on how to improve the fisheries in Hawai‘i, which explicitly stated the importance of following traditional Hawaiian ocean resource management strategies. Kealoha emphasized that in Precontact times, people who stole resources were severely punished and that these sorts of acts were socially unacceptable. She pointed out that while Hawaiians today no longer follow some of the ancient practices, such as punishable by death, she stressed that there are traditional management strategies that are still highly relevant and applicable.

Kealoha mentioned that fish names serve as indicators of the physical or behavioral attributes of a fish as well as its spiritual or sacred function. The yellow tang, or as her *tūtū* taught her *lau‘īkapu*, were considered fish that were off-limits, made evident from the word “*kapu*” rooted within the name. She added that *lau‘īkapu* are major contributors to the marine eco-system in that it maintains diversity and abundance of the reef thus serving as a key indicator of *‘āina momona*. Therefore, the cultural perspective surrounding this fish correlates to its significant ecological relationship and contribution to the reef and the ocean. She also shared that although some Hawaiian fish names have been lost over time, the correlations of modern classification and Hawaiian taxonomy demonstrates that connections between fish were well understood through "thousands of years of observations." Kealoha expressed that all ocean life were *kinolau*, or bodily forms, of *kupuna, ʻaumakua* or *akua*. She stated that the presence of *manini* or *āholehole* in the vicinity indicates that Kanaloa, the deity of the ocean, is present and so one must always be cognizant of these fish and then conduct themselves accordingly to respect this *akua*. She explicated that the *Kumulipo* provides a catalog of life forms that are interconnected with each other and within those listings are *kaona*, or hidden meanings, identifying connections that were both physical and sacred. She added that in the first line of the *Kumulipo*, the *papa* (reef) is acknowledged thus emphasizing the value of the reef to all ocean life.

Kealoha identified *kala* as popular eating fish and *kole,* which she described as a "serious food fish that is very much eaten here on this island [Hawaiʻi Island] more than other places." She also referenced the *hīnālea*, stating that although not a personal favorite, it is a fish regularly caught and consumed by fishermen. Kealoha duly noted *lauwiliwili nukunuku ʻoiʻoi*, although a very beautiful fish, she expressed that it should not be collected at all. She shared that reef fish, despite the threat of diseases such as ciguatera, are still caught for subsistence by fishermen.

Kealoha spoke candidly about her thoughts on the aquarium industry and exclaimed that "it is non-sustainable and it can't be sustained and that it needs to be shut down." While she understands that people are making a living from this industry, she believes that "we can do better" and that "we can figure out better ways of living that don't frustrate our cultural or traditional ways or disrupt the healing of the *ʻāina*." She stressed that "right now, that's [healing the *ʻāina*] the priority and anything that would frustrate the reef recovery on any level…we can't accept." Kealoha explained that systemically, the ocean depends on all of these species. She worries that if we continue to piecemeal management of the ocean, it will no longer be able to provide for us. She stated that the ocean has different ecosystem levels, but it does not have boundaries. She imparts that the industry has detrimental effects on the health and well-being of our ocean environment and as a consequence, instigates mental and traumatic stress on living communities that are witnessing the desecration of their "sacred houses." Kealoha found that issues surrounding the responsibility of caring for these resources often burden folks standing on both ends of the issue, primarily those of Hawaiian descent. She edified that the health of the land is intrinsically tied to the collective health of communities and thus stated within the United States Public Law 103-150, informally known as the Apology Resolution or Bill, she described "that Native Hawaiians are inherently tied to the land. So, what happens to the land, happens to us and what happens to us, happens to the land." She added that by "recovering," or rebuilding the symbiotic relationship between *kanaka* and *ʻāina* is congruent to the health and existence of all living species. Kealoha emphasizes that we need to acknowledge and honor these relationships that clearly outlines the impacts, not only to the environment but to the health and well-being of *kanaka*. Additionally, Kealoha expressed that she is aware that many of the fish on the "white-list" are being removed from the reef in large numbers. She expressed concern for the lack of enforcement by DLNR of these unsustainable fishing practices. She also acknowledged that the lack of enforcement is due mainly in part by not having the capacity to conduct such regulations, such as not having an adequate amount of DOCARE officers. Her concern is also that the aquarium fishing industry is "self-reporting and self-regulating" and modern concepts of "if I don't get mine then someone else going get em," are notions far removed from traditional perspectives. To further explain she shared that her *tūtū* always scolded them about wasting water and wisely explained that "we don't waste the *akua*'s gift." She added that these resources are a valuable gift that requires a reciprocated relationship to maintain the health and well-being of the environment, not only for *kanaka* but for all living forms thus arguing that the industry is:

> Extractive and it's frustrating our ability to heal the ocean but more than heal, but make it *ʻāina momona*. You know, 'fat the land' and that is the point where our rights are being affected because if it is our tradition to make 'fat the land,' when we can't make 'fat the land' its all wrong and it takes us out of our natural way of being and then into a way that's foreign to us and then forces us to possibly have to act in ways against our own cultural beliefs.

Kealoha contends that although there are fish on the "white-list" that may not necessarily be consumed, these fish are still an important component to reef health. Kealoha's observations and interactions with fish and sea animals over the years helped cultivate much of her knowledge of ocean wildlife. These interactions aided her understanding of the various functions within the ecosystem and the connections between all living forms that are directly related to the concept of *ʻāina momona*. Consequently, Kealoha strongly advocates that these relationships need to be protected and that while there are competing interests for these resources, the interest in the "protection of *ʻāina"* should take precedence. Kealoha shared her frustrations with the current environmental review process and stated that "if the process has integrity, so will the outcome." She added that:

> I don't know, I'm very frustrated because my feeling is though, there are *puka*s that people are swimming through…that make it so that it shifting the burden onto the public to regulate, and that, that I think is not fair.

When asked if she had any recommendations to address her concerns, Kealoha expressed that "they need to really work with us to do better." She strongly believes that if businesses are basing their motive on profit margins it will inevitably fail and campaigns that "profits are not a right, it's a privilege." She stated that "if they need us to advocate for them, they need to let us know and stop treating us like we're enemies," because the "rights of the reef precede profit." She also suggested developing a hybrid system that implements traditional *kapu* practices that are established by communities and with the state to assist in regulating those policies. Kealoha believes that in order to move forward genuine conversations need to take place and creating spaces to "maximize our communities' ability to share the impacts." She expressed that through dialogue it can increases awareness, strengthens individual perspectives, and develop respect between opposing views. Kealoha concluded that this process if done correctly and with good intention, will help to overcome cognitive dissonance for all involved.

KUPA O HOʻOKENA: DAMIEN KENISON, JOE BALSIMO, STANFORD CHO, AND HAWILA ALANI

On August 1, 2018, Lokelani Brandt was invited by Damien Kenison to conduct a group interview with members of the non-profit community-based organization Kamaʻāina United to Protect the ʻĀina (KUPA), which consists of roughly ten board members and officers. Participants in this interview were Damien Kenison, Joe Balsimo, Standford Cho, and Hawila Alani, all of whom share genealogical ties to the Hoʻokena and or the greater South Kona District. Damien shared that KUPA was created in 1996 in response to the growing number of aquarium fish collectors who were conducting their operations in the waters fronting Hoʻokena village. Despite the growing conflict between local fishermen and aquarium fish collectors, Damien shared that this conflict prompted the community to get organized. For them, establishing KUPA has resulted in a strong push to improve management of their area in addition to garnering support to ensure the perpetuation of their living cultural practices.

Damien Kenison: When asked about any past or ongoing cultural practices, Damien explained that for them, the ocean and all of its living lifeforms therein are an important part of their Hawaiian cultural identity. He added that fishing and caring for the nearshore waters has always been an important part of their lifeways. Damien exclaimed that coming onshore with fish in their canoes is what makes them feel Hawaiian and he noted that his sense of cultural identity is strongest when he is on his canoe fishing. Damien expressed that fishing is part of a process that maintains and strengthens their family bonds. He explained that catching, cleaning, and eating fish are activities that bring people together and being able to maintain this cultural custom well into the future is important to him.

Damien also related that "all fish are part of the ecosystem" and when parts of that ecosystem are removed, it will have an impact on the ecosystem. Additionally, he shared that when that ecosystem is disrupted, it has a direct impact on their cultural practices. He stressed that reef fish, in particular, play a vital role in maintaining healthy reefs because these fish keep *limu* populations in check. He added that too much *limu* on the reef will overtime, smother and kill the reef altogether. He emphasized that being able to harvest fish from the ocean is highly dependent upon a healthy reef and if the reef life continues to be degraded it will impact their ability to provide for their families in addition to perpetuating their cultural traditions.

Damien stressed that traditionally the values were based on respect for the laws, the resources, and the communities. DLNR does not have the resources to enforce fishing rules. He added that for many years, the aquarium industry had gone unregulated and noted that any "unregulated commercial venture will wipe out the fish."

Damien shared that for him, he feels that the take of fish for aquarium purposes is a "wasteful practice" and expressed that it is a cultural value not to waste fish. He opined that this practice from a Hawaiian perspective is *mahaʻoi* (rude and impudent). He feels that "tropical fish collectors have no respect for the resource and the communities" and described instances when coolers of dead tropical fish were found. He stated that the aquarium industry does not have a stake in the local communities. He expressed that dealing with this growing conflict has been stressful for the community.

Stanford Cho: Stanford explained that caring for natural resources is something that is not unique to Hawaiʻi, but is a common practice seen in many cultures around the world, especially those who rely on such resources. He drew parallels between other parts of the world where sport and commercial fishing has resulted in a serious decline of marine resources. Stanford contends that such examples should prompt us to be more careful in managing fish take from different user groups. In looking at the "white-list" species, Stanford explained that he has grown up having seen all of these fish in the ocean and whether they were eaten or not, seeing them in their natural habitat is something he is accustomed to. He added that things change and evolve naturally in nature, but when people begin to impact these resources and when there are indicators that show adverse impacts caused by humans, this is concerning to him. Stanford emphasized that these fish have been on this earth longer than we have and we must show respect to these creatures

Stanford also shared his thoughts on the take of fish for the aquarium industry and shared that there's a long history of mistrust and no openness between local fishers and aquarium collectors. He noted that this has escalated the conflict between different user groups. He explained that native Hawaiians are often viewed as hostile and aggressive but clarified that such a view is often a direct result of either not being included in important decision-making processes that directly impact native Hawaiians or their concerns are disregarded. He also spoke about a mentality change and noted that there are people that come here to exploit the resources. Stanford exclaimed that for such people who share the "take mentality," cultural impacts are not of value to them because they have no investment in the communities they take from.

Joe Balsimo: Joe explained that all fish play a role in maintaining a healthy marine ecosystem and that for native Hawaiians the ocean is often referred to as their "refrigerator." Joe does not support the take of fish for aquarium purposes and stated that he "doesn't agree with raiding the refrigerator." He stressed that caring for and improving the state of our marine resources is vital if we hope to have healthy reefs in the future so that they may be enjoyed by future generations. He explained that many Americans today are "apathetic to global and community issues" and that the "take mentality" is resulting in a degraded marine environment and more conflict between those who are trying to improve the state of our resources and those who want to take from it. Joe also raised concerns over the number of casualties associated with the collection of aquarium fish. Joe also spoke about the lack of DOCARE enforcement officers because of their limited resources and stated that ensuring compliance with all laws pertaining to the aquarium industry is a difficult thing to enforce. He added that the lack of enforcement means that the state relies on the "trust system," which for him is unacceptable.

KEVIN AWA

Over the phone, on September 7, 2019, Robert Rechtman interviewed Kevin Awa, a multi-generational fisherman and long-time resident of the South Kona area on Hawai‘i Island. Although born in Germany, Kevin moved to Kona at age 9, and his ties to the South Kona area are through his father and grandfather, both of whom were fisherman. His grandfather worked on fishing sampans operating out of Keauhou Bay. Kevin is employed at Kona Coast Marine and provides repair and upgrade work for many of the fishing vessels operating within the WHRFMA. He is a fishing practitioner who is actively engaged in *‘ōpelu*, *ahi*, and bottom fishing, making his own *‘ōpelu* nets; and recognizes these activities as traditional practices. Kevin has also worked under contract with NOAA, providing local knowledge to scientific researchers with respect to local fishing practices, fish habitat, and environmental factors that affect both practices and habitat. When asked if there were any potential cultural impacts associated with the proposed action, Kevin stated that generally he foresees "no problems" with issuing aquarium fishing permits, but added that cautions should be taken to not overly impact the edible species on the White List, such as *pākukui* and *kole*, which are also target species of subsistence fishing.

JOSEPH "MCGEE" AKIU, JR.

In a brief phone conversation on September 10, 2019, Robert Rechtman interviewed McGee Akiu, a multi-generational fisherman and life-long (42 years) resident of the South Point area. McGee considers himself a "jack of all trades" fisherman. When asked about cultural practices and any potential cultural impacts associated with the proposed action, he was emphatic that there was "nothing bad" about aquarium fishing, and he believed that it could help the environment by controlling the amount of fish that in his view are too abundant. He also suggested that aquarium fishing could help get rid of invasive species such as *ta‘ape*. McGee insisted that regulators should let the aquarium fishers be as they have always done a good job, and rather focus on the problem of plastic in the nearshore waters as that is killing more fish than anything else.

CHELSEY FAAVESI

Over the phone, on September 23, 2019, Robert Rechtman interviewed Chelsey Faavesi, who was born (in 1989) and raised, and still resides in the South Kona fishing village of Miloli‘i. Chelsey's maternal family is generationally tied to Miloli‘i, and her father is of Samoan ancestry. Chelsey described her family as closely tied to the ocean, as fishing is a way of life for them. They are multigenerational commercial fishers and her grandparents procured fish for both food and to sell to provide for their family. These traditions continue as the family is still involved in commercial fishing and Chelsey has been involved with the aquarium fishing industry for four years as a diver/collector working for a third party business owner. Chelsey insisted that her practice is an extension of the traditions that her family has practiced for generations—making their livelihood from procuring ocean resources. She uses protocols for access to, and takes care of, the collection locations, which she noted are typically not accessed by subsistence collectors. She also suggested that during the winter months, when the sea is rougher and collecting is less frequent, the decreased pressure on the fish leads to increased fish populations. When asked if there were any potential cultural impacts associated with the proposed action, Chelsey indicated that she does not see any impacts as long as the potential permit holders treat the resource habitat respectfully and act responsibly by not overfishing and depleting the resource.

5. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially, these are natural features of the landscape and historic sites, including traditional cultural properties. A working definition of traditional cultural property is present here:

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape, as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property, or traditional cultural property, must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa'akai O Ka 'Āina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present, and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

Based on a review of the culture-historical background material presented above, and as indicated by many of the consulted parties, the nearshore waters of the WHRFMA have, since Precontact times, served as the foundation for the subsistence lifestyle of the Kānaka Maoli. While the deeper marine environment provided a wealth of pelagic resources, the nearshore waters have and continue to be the primary place where Kānaka Maoli of all ages and genders engage in the long-standing traditional practice of *lawai'a.* Within the nearshore waters, Kānaka Maoli—since their initial arrival to the west coast of Hawai'i Island to the present day—have always utilized an array of harvesting methods and apparatuses to gather a wide variety of nearshore marine resources, including, but not limited to, reef-fish, seaweed, urchin, shellfish, crab, octopus, shrimp, and salt. Although many of the harvesting apparatuses and means of transportation have adapted to the changing times and technologies, the act of fishing, whether for subsistence or commercial use (some of those interviewed for this study place aquarium fishing into this latter category) is an ongoing and ever-evolving cultural practice. Another more specific traditional fishing practice that was identified through the background research, and was discussed by several of the consulted parties, includes the use and maintenance of traditional fishing *ko'a* that are designed to gather certain pelagic species, most notably *'ōpelu*. While the above described practices focus on the tangible elements of past and ongoing traditional fishing practices, the ocean is also culturally valued for its spiritual significance.

As identified during the interview process, and supported by the culture-historical background, the ocean is considered the pathway of the ancient people and gods who, through their episodic migrations from Kahiki, came to settle these islands. In Kānaka Maoli cosmology, the ocean is an embodiment of the male deity Kanaloa, who also assumes other body forms including, but not limited to, certain marine species such as the *hīnālea*, *he'e*, *palaoa*, and others large marine mammals. The nearshore waters are also associated with a number of additional significant deities in the Hawaiian pantheon including Hina (Hinapukui'a), Kū'ula, and their son 'Ai'ai, all of whom figure prominently in the spiritual aspect of Hawaiian fishing practices and the creation of *loko i'a*. Likewise, the *'āko'ako'a* (coral head), as identified in the *Kumulipo*, and as articulated by several consulted parties, is the foundation from which all life is derived. Several of the consulted parties also spoke about the use of the ocean for certain healing and cleansing rituals. Additionally, the nearshore waters of West Hawai'i Island are associated with several significant Historic Period events, including the arrival of the first Europeans and American missionaries, that forever changed the trajectory of Hawaiian culture. The interactions with these early Euro-American arrivals, and with subsequent migrant populations (and their introduced technologies), resulted in opportunistic adaptions of traditional Kānaka Maoli culture and fishing practices; adaptations that allowed them to maintain a leading role in the island's commercial fishing industry into the early 20th century. It is clear that the nearshore waters of West Hawai'i Island, along with all of its contributing tangible and intangible elements and associations, could be considered a traditional cultural property significant under Criteria a, b, and e. Having a comprehension of the traditional cultural significance of nearshore waters of West Hawai'i Island by all of its user constituencies, is a first step in ensuring that the activities of any one user group does not in any significant way conflict with the activities of another user group. As part of any future permitting processes associated with the WHRFMA, it is recommended that DLNR-DAR provide to potential permit issuees a document that provides a synopsis of the traditional cultural significance of the fishery.

Another significant component of this study focused on the cultural uses of the forty white-list species. A review of the culture-historical background material, coupled with the information discussed by multiple consulted parties, resulted in the identification of traditional names, and/or past and/or ongoing cultural uses for thirty-three of the forty fish species. Types of identified cultural uses included subsistence, medicinal, ritual, and ceremonial. The cultural knowledge associated with these fish varies, however, as some are extensively referenced in traditional accounts and ethnographic literature, while others are mentioned only in passing with no additional descriptive details. While all of the thirty-three fish species for which traditional cultural information was found appear to have been eaten, some species, particularly wrasses, tangs, surgeonfishes, and triggerfish were, and still are, more commonly consumed. The *hīnālea 'akilolo* (*Coris gaimard*) and the *lau'īpala* (*Zebrasoma flavescens*), on the other hand, were noted in the culture-historical literature, as well as in the consultation, for their medicinal value. One category of white-list species in particular, the butterflyfishes (*Chaetodon* sp.), appears to primarily have been used for rituals and ceremonial purposes. Several consulted parties expressed that these fishes was never intentionally caught for subsistence purposes because of their association with the *kauwā* class of people. Given that these particular white-list species are important for sustaining the above-described cultural practices, if the issuance of commercial aquarium permits leads to a significant depletion of the populations of the above mentioned species (either directly or indirectly through habitat disruption), then the result would be a cultural impact. Conversely, if the biological assessments (conducted by others) indicate that the issuance of the fourteen commercial aquarium permits will have no significant effect on either the fishes or their habitat, then the issuance of the permits would not result in a cultural impact.

Additionally, the background information gathered for two of the white-list species—the *Cephalopholis argus* (peacock grouper or *roi*) and the *Lutjanus kasmira* (bluestripe snapper or *ta'ape*)—indicates that these fishes are found in great numbers within the nearshore waters of West Hawai'i Island, and that reducing the overall population of these two species could improve reef-health and potentially yield long-term positive impacts. Although these fish were introduced during the mid-20th century to fill a fishery niche, there has been little success marketing them commercially, which has resulted in steady population growth. Many of the consulted parties saw a reduction in the population of these two species, which can out complete other species, as potentially beneficial for improving the overall health of the reef and fishery.

As part of this CIA, extensive oral interviews were conducted with numerous individuals from multiple user groups (including cultural practitioners, aquarium collectors, subsistence and commercial fishers, charter boat operators, and researchers) who represent various communities within the WHRFMA. While it is often difficult to disentangle each of these user groups from one another (because many, if not all, of the consulted individuals self-identify, or can be placed, with more than one of the groups), all of those interviewed expressed some degree of on-going cultural attachment to the ocean. For many, their introduction to the nearshore waters of West Hawai'i Island stems from long-standing familial ties to the land and the ocean. While some of the consulted individuals expressed specific cultural concerns with respect to the white-list species, others stressed the ecological importance of the fish, and the need for them to live out their life cycles in their natural habitats. As evident in the statements made by multiple individuals, the take of fishes for commercial aquarium purposes within the WHRFMA has a long and contentious history, and it remains a point of conflict. Despite efforts to address these issues, the conflict has diffused into different communities and even caused rifts within some families. While it is not the prerogative of the authors to attempt to explain or resolve these long-standing issues, they are nonetheless, very apparent. Addressing such issues necessitates developing, at a minimum, mutual respect and open dialogue between the different user groups, and amongst different government and private sector agencies who oversee the management of the WHRFMA. Addressing and mitigating potential impacts is one means of bringing diverse groups together in a way that promotes understanding and opens productive dialogues.

With that said, if the analyses in the EIS determine that the conditions of effect are met with respect to the potential cultural impacts described above, then the following recommendations for mitigation are offered. As echoed in the statements made by multiple individuals, extracting marine resources needs to be done with integrity and sensitivity, as the reef-fish and the habitat in which they are found are both ecologically and culturally valued. No matter how or why these fish are extracted, their removal constitutes an irrevocable loss of bio-cultural resources that could potentially have an adverse effect on the overall health and sustainability of the fishery. In light of this, the authors recommend that PIJAC, and any commercial aquarium fishers who intend to conduct their operations within the WHRFMA, consider developing or partnering with governmental and/or local organizations to help improve the management and sustainability of the nearshore fishery as a means to not only sustain, but actually improve reef-fish populations in the take areas. Such marine management practices should be a part of all commercial marine endeavors, and not exclusively imposed on any one user group. To further limit the potential for cultural impacts (through the depletion of culturally significant fish species), it is recommended that the existing bag limits and no-take areas within the WHRFMA remain in-place, but be monitored and adjusted periodically in order to account for fluctuations in the local fish stocks. Furthermore, it is recommended that the applicant (PIJAC) continue to work with the approving agency (DLNR), and the various other user groups within the WHRFMA, to help improve the transparency of the accounting methods for fish takes, and the enforcement of the existing rules and regulations that govern those takes.

With respect to limiting the potential for cultural impacts, DLNR-DAR plays a significant role in managing and enforcing the rules and regulations that are intended to support the sustainability, viability, and fecundity of the WHRFMA. As voiced by many of the consulted parties, the lack of support and funding have hampered DNLR-DAR's ability to fulfill its fiduciary responsibility, namely to enhance, protect, conserve, and manage Hawai'i's unique and limited resources, which are supposed to be held in public trust for the current and future generations of the people of Hawai'i *nei*, and visitors alike. While achieving this goal is not an easy task, and it certainly cannot be achieved by any single means, DLNR-DAR should be proactive in seeking additional funding sources, and work with the various user groups who are most familiar with the WHRFMA, including the commercial aquarium fishers, to improve its enforcement capacity. As expressed by multiple community members, the lack of enforcement by DLNR-DAR has resulted in community members feeling the need to police their respective areas themselves, which ultimately diverts time and energy from their desire to educate the next generation of Hawaiʻi fishers and to perpetuate their own cultural practices. As part of improving enforcement, as expressed by some of the consulted parties, the DLNR-DAR should consider incorporating more traditional Hawaiian fishery resource management practices (as detailed above) into the management of the WHRFMA, and representatives from the aquarium fishing industry should continue to work with the other user constituencies (i.e., Native Hawaiian organizations) that maintain an interest in the WHRFMA.

In summary, the recommendations provided here are intended to help ensure that the proposed issuance of fourteen commercial aquarium permits within the WHRFMA considers the knowledge, concerns, and thoughts shared by the consulted parties. While most people do not, in general, disagree with the practice of making a living from the ocean, these recommendations are also intended to remind those who may receive commercial aquarium fishing permits within the WHFRMA to be mindful of the unique cultural, historical, social, and ecological setting in which they earn their living. If commercial aquarium fishers assume ownership of their *kuleana*—privileges and responsibilities—to utilize the marine resources in a sustainable way, and take into consideration the broader socio-cultural efforts that are underway across the state to *mālama* and *hoʻomomona*—care for and increase abundance of—the marine resources, then any potential for cultural impacts will be lessened. Understanding the cultural resources, cultural practices and cultural beliefs associated with the nearshore waters of West Hawaiʻi Island, and implementation of the recommendations presented above with respect to the identified issues, will ultimately help to ensure that no such resources, practices, or beliefs are adversely affected by the proposed issuance of the fourteen commercial aquarium permits within the WHRFMA.

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APPENDIX A.
KA WAI OLA PUBLIC NOTICE

PUBLIC NOTICE

ASM Affiliates is preparing a Cultural Impact Assessment (CIA) in advance of the preparation of an Environmental Impact Statement for the proposed issuance of commercial aquarium permits for areas within the West Hawai'i Regional Fishery Management Area (WHRFMA) extending along the west coast of Hawai'i Island from 'Upolu Point, North Kohala to Ka Lae (South Point), Ka'ū, excluding the following areas: Lapakahi Marine Life Conservation District (MLCD), North Kohala Fish Replenishment Area (FRA), Puakō Bay and Puakō Reef Fisheries Management Area (FMA), Puakō-'Anaeho'omalu FRA, Ka'ūpūlehu FRA, Wāwāloli FMA, Kaloko-Honokohau FRA, Papawai Bay FMA, Old Kona Airport MLCD, Kailua Bay FMA, Kailua-Keauhou FRA, Keauhou Bay FMA, Red Hill FMA/FRA, Kealakekua Bay MLCD, Nāpo'opo'o-Hōnaunau FRA, Ho'okena FRA, Ka'ohe FRA, and the Miloli'i FRA.

We are seeking consultation with any community members that might have knowledge, or who are involved in, any ongoing cultural practices that may be occurring in any of the places outside of the restricted areas listed above. If you have and can share any such information please contact Lokelani Brandt lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula Street, Hilo, HI 96720.

APPENDIX B—COMMENTS AND APPLICANT RESPONSES

DLNR NOTICE OF DETERMINATION
FEA-EISPN 30-DAY COMMENT PERIOD
CONSULTED PARTIES COMMENT PERIOD

DLNR Notice of Determination (NOD) on FEA and Applicant Responses

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 26, 2018

Mr. Scott Glenn
Office of Environmental Quality Control
State of Hawaiʻi
235 S. Beretania Street, Room 702
Honolulu, Hawaii 96813

Re: HRS Chapter 343, Final Environmental Assessment, Notice of Determination

Project:	Issuance of Commercial Aquarium Permits for the Island of Hawaiʻi
Applicant:	Pet Industry Joint Advisory Council (PIJAC)
Applicant Contact:	Jim Lynch, KL Gates LLP, 206-370-6587
Approving Agency:	Department of Land and Natural Resources
Location:	Throughout the near shore region (to depths of 100 fathoms) of the island of Hawaiʻi except in those areas already designated as no collection areas such as Fish Replenishment Areas.
Proposal:	Issuance of Commercial Aquarium Permits ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats pursuant to Aquarium Fishing Permits issued under HRS §188-31

Dear Mr. Glenn,

Attached and incorporated by reference is the Final Environmental Assessment prepared by the Applicant for the Project. Based on the significance criteria outlined in Title 11, Chapter 200, Hawaii Administrative Rules, we have determined that the project may have a significant impact on the environment and therefore the preparation of an Environmental Impact Statement is required. Further analysis is necessary on the following significance criteria under HAR §11-200-12 for the issuance of Hawaiʻi aquarium permits:

(1) The take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources. The take of individual fish itself is loss or destruction of natural resources; the sustainability question is whether the annual take of cumulative numbers of fish as a percentage of estimated population results in irrevocable loss or destruction of populations of fish;

(2) The manner in which the take of aquarium fish curtails the uses of the environment, including aquatic invasive algae control, the tourism industry, and the overall integrity of diverse aquatic ecosystems;

(3) The extent to which the take of aquarium fish conflicts with the state's long-term environmental goals;

(4) The impact of the take of aquarium fish on cultural practices in the state; and

(8) The cumulative effect of the commercial take of aquarium fish using fine mesh nets when combined with the effects of:
(a) the commercial take of aquarium fish by other legal methods;
(b) the take of aquarium fish for recreational purposes; and
(c) the commercial and non-commercial take of aquarium fish species for consumption as food, particularly including Achilles Tang and kole.

It is also necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish in East Hawaiʻi using legal mesh nets.

The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection.

There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take.

With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty.

We also note that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly. Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.

The FEA asserts that certain types of fish such as Psychedelic Wrasse, Tinker's Butterflyfish, and Fisher's Angelfish inhabit waters deeper than the CREP monitoring studied, resulting in populations being underestimated and thus the annual take as a percentage of estimated population being overestimated.

In addition, we note the proposed alternatives for reduction in bag limits for Achilles Tang, but do not see a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.

Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modern technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.

Enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management, and should be analyzed as part of the environmental impact statement.

We appreciate that as an applicant action, the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish. We are interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes.

Overall, we appreciate that certain alternatives have been proposed, but believe they are more appropriately proposed as mitigation measures in an environmental impact statement to mitigate potential environmental impacts, rather than as alternatives in an environmental assessment which, if implemented, might result in a finding of no significant impact. The Department of Land and Natural Resources is obligated to ensure full analysis under HRS Chapter 343 of potential environmental impacts of its actions in issuing aquarium permits. We believe this is most appropriate in an environmental impact statement.

Based on the significance criteria outlined in Title 11, Chapter 200, Hawaiʻi Administrative Rules, we have determined that the preparation of an Environmental Impact Statement is required.

Please publish this FEA-EISPN in the next issue of the Office of Environmental Quality Control (OEQC) "Environmental Notice". We understand that publication in the Environmental Notice will initiate a 30-day public consultation period for parties to comment on the action and to request to become consulted parties in the preparation of the draft environmental impact statement.

We have enclosed one hard copy of the FEA-EISPN, as well as three Adobe Acrobat PDF copies on compact disc. We have also attached a completed OEQC publication form and Project summary, and we will submit the same publication form and Project summary via electronic mail to your office.

Please contact David Sakoda, State of Hawaii, Department of Land and Natural Resources, Division of Aquatic Resources, at (808)587-0104, david.sakoda@hawaii.gov, with any questions.

Sincerely,

Suzanne D. Case
Chair
Department of Land and Natural Resources
State of Hawai'i

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
Based on the significance criteria outlined in Title 11, Chapter 200, Hawaii Administrative Rules, we have determined that the project may have a significant impact on the environment and therefore the preparation of an Environmental Impact Statement is required. Further analysis is necessary on the following significance criteria under HAR §11- 200-12 for the issuance of Hawai'i aquarium permits:	Comment noted. A DEIS has been prepared. Responses to specific significance criteria are included in the DEIS and responded to below.
(1) The take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources. The take of individual fish itself is loss or destruction of natural resources; the sustainability question is whether the annual take of cumulative numbers of fish as a percentage of estimated population results in irrevocable loss or destruction of populations of fish;	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(2) The manner in which the take of aquarium fish curtails the uses of the environment, including aquatic invasive algae control, the tourism industry, and the overall integrity of diverse aquatic ecosystems;	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(3) The extent to which the take of aquarium fish conflicts with the state's long-term environmental goals;	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(4) The impact of the take of aquarium fish on cultural practices in the state; and	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
(8) The cumulative effect of the commercial take of aquarium fish using fine mesh nets when combined with the effects of: (a) the commercial take of aquarium fish by other legal methods; (b) the take of aquarium fish for recreational purposes; and (c) the commercial and non-commercial take of aquarium fish species for consumption as food, particularly including Achilles Tang and kole.	Comment noted. The impacts as they relate to this significance criteria have been summarized in Section 5.6 of the DEIS.
It is also necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish in East Hawai 'i using legal mesh nets.	Comment noted. The impacts of the No Action Alternative in the DEIS include an analysis of data on aquarium fish collection since the October 2017 ban on the use of fine mesh nets.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection.	Comment noted. The analysis period for the DEIS is five years, and cumulative impacts of commercial aquarium collection are also included in Section 5.4.3.
There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take.	Comment noted. The ecology of each White List Species is briefly described in Section 4.4. Impacts to populations, including available research on sustainable harvest, are included in Section 5.4.1.2 of the DEIS. In addition, data from the DAR (2019) show stable or increasing populations for 24 of the 40 White List Species. For the 12 species with documented declines, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. In addition, for the 12 species that have shown a significant decline in population size in one or more management area since establishment of the WHRFMA in 1999, commercial aquarium collection under any of the five alternatives would collect less than 1% of the island-wide population estimates for 10 of the species. For the remaining two species, Achilles Tang and the Pyramid Butterflyfish, commercial aquarium collection would collect less than 4% of the island-wide population.
With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty.	Comment noted. As summarized in Section 5.5.1, under the Preferred Alternative, collection of any of the 40 White List Species is anticipated to be below 5% of the island-wide populations.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	Response
We also note that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly. Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.	Comment noted. The Preferred Alternative in the DEIS includes limited issuance of permits, with the number of permits requested being set at 14 permits per year for the five-year analysis period. In addition, a reduction in the bag limit for Achilles Tang is also proposed. As described in Section 5.4, no impacts to populations of herbivores or the functions they provide to the reef ecosystem are anticipated. As described in Section 5.4 and 5.6, for the 12 White List Species that have been experiencing declines, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. Therefore, no additional bag limits are proposed at this time.
The FEA asserts that certain types of fish such as Psychedelic Wrasse, Tinker's Butterflyfish, and Fisher's Angelfish inhabit waters deeper than the CREP monitoring studied, resulting in populations being underestimated and thus the annual take as a percentage of estimated population being overestimated.	Comment noted. CREP (2018) population estimates are available for 38 of the 40 White List Species, though as noted, some species are not adequately surveyed. Nonetheless, impacts to populations are less than 5% for all species under the Preferred Alternative. For the two species which do not have population estimates, Flame Wrasse collection has been less than 175 individuals per year for the island of Hawai'i between 2000 and 2017 and Longfin Anthias collection has been less than 150 individuals per year for the island of Hawai'i.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	**Response**
In addition, we note the proposed alternatives for reduction in bag limits for Achilles Tang, but do not see a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.	Comment noted. Commercial aquarium collection takes a relatively small proportion of the Achilles Tang population (<5% under the current 10/day bag limit), and it is anticipated that implementation of a reduced bag limit and limited issuance of permits to only 14 fishers will reduce this by over 50%. However, as noted in the DEIS, commercial aquarium collection is not the only stressor on this species, and therefore, it is anticipated that additional conservation measures designed to address the other stressors (e.g., commercial and recreational fisheries) will need to be implemented in order to sustain the population. The Applicant does not have any control over those measures. The DAR (2019) supports this conclusion, stating that conservative bag limits, as proposed in the Preferred Alternative for commercial aquarium collection, should be considered for other fisheries as well. There are currently no bag limits for the Achilles Tang applied to any other fishery.
Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modem technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.	Comment noted. Cultural impacts are analyzed in depth in the Cultural Impact Assessment (Appendix A of the DEIS) and the DEIS addresses cultural impacts in Section 5.3.
Enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management, and should be analyzed as part of the environmental impact statement.	Comment noted. As noted in Section 4.4.7.1 of the DEIS, the DAR (2019) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors.

Responses to comments received from the DLNR's Notice of Determination (NOD) on the Final EA
NOD dated July 26, 2018

Comment	**Response**
We appreciate that as an applicant action, the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish. We are interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes.	Comment noted. As stated by the DLNR, the Applicant cannot ensure enforcement. The Applicant is proposing a limited issuance of permits, issuance of permits only for the WHRFMA, and a reduction in the Achilles Tang bag limit. The Applicant can only propose but not ensure regulations; therefore, it is up to the DLNR to make these binding (e.g., changing the law/regulation or including a a condition of the permit). Any permit issued would require the permit holder to abide by all conditions of the permit.
Overall, we appreciate that certain alternatives have been proposed, but believe they are more appropriately proposed as mitigation measures in an environmental impact statement to mitigate potential environmental impacts, rather than as alternatives in an environmental assessment which, if implemented, might result in a finding of no significant impact. The Department of Land and Natural Resources is obligated to ensure full analysis under HRS Chapter 343 of potential environmental impacts of its actions in issuing aquarium permits. We believe this is most appropriate in an environmental impact statement.	Comment noted. A DEIS has been prepared. Mitigation is discussed in Sections 5.2.4, 5.3.3, and 5.4.4. As noted in Section 5.6, no significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Nevertheless, the Preferred Alternative includes mitigative measures (see Section 5.0) such as a reduction in the number of aquarium permits that would be issued, limiting collection using fine mesh nets to the WHRFMA, and reducing the bag limit for the Achilles Tang, all of which would minimize impacts to biological resources.
Based on the significance criteria outlined in Title 11, Chapter 200, Hawai'i Administrative Rules, we have determined that the preparation of an Environmental Impact Statement is required.	Comment noted. A DEIS has been prepared.

Comments Received During the 30-day Comment Period on the FEA EISPN and Applicant Responses

From: Bob Flatt
To: Sakoda, David
Cc: jim.lynch@klgates.com; VanDeWalle, Terry
Subject: Comment on the scope of HI Aquarium Fishing EIS
Date: Monday, August 13, 2018 4:57:03 PM

The EIS needs to address the quality of current management data. The data quality is insufficient to make reliable management estimates of fish populations due to methodological bias, there is no basis for knowing if the harvest of uncounted species is sustainable.

The current methodology estimates the aquarium fish abundance by determining the abundance of a subset of the species harvested. The assumption is that this subset abundance represents the abundance of most or all aquarium species. This assumption might be correct if the harvesting pressure were equal on all aquarium species, but it is not.

Aquarium harvesting is an economic activity, between species the individual fish price varies 100 fold. The most common species have the lowest price, the least common species the highest price. Given a choice, a rational economic actor will choose to harvest the uncommon $50 fish over the common 50¢ fish. As a practical matter the management methodology samples the most common species. The sampled population data is not representative because the harvesting pressure on uncommon species is higher, this is the cause of the bias.

The resulting data are thus unreliable because they do not include the effect of the price bias. Thus any environmental impact estimates are unreliable.

The methodology from a statistical point of view does over-sample the common species. This oversampling does not address the cause of the price bias as it only increases the sample size of lower price fish species.

The issue is addressable. For example, this bias could be removed by only harvesting counted species. There may be other ways to address the issue, but as it stands there is no basis for knowing if the harvest of uncounted species is sustainable. This should be addressed in the EIS.

In summary (with apologies to Dr Seuss):
Money leads us to prefer harvesting fish that are 'blue'.
Managing by counting fish that are 'red' just wont do.

Robert Flatt
Captain Cook, HI

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Responses to comments received from Robert Flatt
Comment dated August 13, 2018

Comment	Response
The EIS needs to address the quality of current management data. The data quality is insufficient to make reliable management estimates of fish populations due to methodological bias, there is no basis for knowing if the harvest of uncounted species is sustainable. The current methodology estimates the aquarium fish abundance by determining the abundance of a subset of the species harvested. The assumption is that this subset abundance represents the abundance of most or all aquarium species. This assumption might be correct if the harvesting pressure were equal on all aquarium species, but it is not.	Comment noted. Descriptions of fish population survey methods, including limitations, are discussed in Section 4.4.7. Confidence intervals are provided for CREP data, and population trend data from WHAP includes tests of statistical significance. This information is all included in Section 5.0 of the DEIS, including population estimates for 38 of the 40 White List Species. As noted in the DEIS, Flame Wrasse do not have a CREP population estimate, but collection has been less than 175 individuals per year for the island of Hawai'i between 2000 and 2017. Longfin Anthias also do not have a CREP population estimate, but collection has been less than 150 individuals per year for the island of Hawai'i.
Aquarium harvesting is an economic activity, between species the individual fish price varies 100 fold. The most common species have the lowest price, the least common species the highest price. Given a choice, a rational economic actor will choose to harvest the uncommon $50 fish over the common 50¢ fish. As a practical matter the management methodology samples the most common species. The sampled population data is not representative because the harvesting pressure on uncommon species is higher, this is the cause of the bias. The resulting data are thus unreliable because they do not include the effect of the price bias. Thus any environmental impact estimates are unreliable. The methodology from a statistical point of view does over-sample the common species. This oversampling does not address the cause of the price bias as it only increases the sample size of lower price fish species. The issue is addressable. For example, this bias could be removed by only harvesting counted species. There may be other ways to address the issue, but as it stands there is no basis for knowing if the harvest of uncounted species is sustainable. This should be addressed in the EIS.	Comment noted. The DEIS uses the best available data for population estimates. Descriptions of fish population survey methods, including limitations, are discussed in Section 4.4.7.

Final Environmental Assessment,
Issuance of Commercial Aquarium Permits for the Island of Oahu

The final environmental assessment (FEA) for the Oahu commercial aquarium fishery states a finding of no significant impact but the Department of Land and Natural Resources (DLNR) has determined the need for a full environmental impact statement (EIS) instead. To initiate the EIS review, DLNR has announced the EIS preparation notice. The reasons why DLNR has determined the need for an EIS are listed in their letter dated July 26, 2018 to Mr. Scott Glenn, Office of Environmental Quality Control. The letter has two main sections: 1) a list of areas where the FEA needs further analysis and 2) a series of reasons for the determination. My comments will be in the form of, a general comments section, followed by my thoughts on each of the DLNRs two sections.

Section 1: General Comments
I find the DLNR comments full of assumptions and inaccuracies. I also find their reasoning for now requiring an EIS, illogical and not factually based. Given these observations, I am concerned that DLNR no longer has the technical expertise to adequately and objectively evaluate this document.

It appears the DLNR doesn't understand its own regulations. The aquarium permit is somewhat of a misnomer. The aquarium permit issued under Section 188-31, HRS, is a small mesh net exemption and not a general aquarium collecting permit. The legal minimum net mesh size is two inches stretched. An exemption to this minimum net mesh size is authorized by permit. This seeming small difference is important because the agency action is issuance of the permit that provides a small mesh net exemption (SMNE). The permit is not to collect aquarium fish, regardless of gear used. For purposes of clarity, I will use the term SMNE permit instead of aquarium permit in this document. The attempts to expand the analysis into non-permit activities are outside of the scope of the action.

It sounds like DLNR response was written by someone obviously biased against aquarium collecting and could have been crafted by the plaintiffs in the recent lawsuit against the DLNR. The thinking and the words chosen seem strangely familiar of the arguments made during the legal action. I also disagree with the Department's reasons for requiring an EIS and continue to support the FEA determination of no significant impact. My arguments for my disagreement will be further explained later in this document.

The DLNR appears to have completely changed its position that the aquarium fishery is sustainable to a position that it is now believes the fishery is unsustainable, despite the fact that collecting under permit has been stopped since the beginning of 2018, resulting in the impacts of collecting being drastically reduced. The DLNR does not explain why they have reversed their position.

Regarding the areas where the FEA were lacking, I disagree with most of the points made. Even if, for discussion only, the FEA were lacking these points, this would not trigger the need for an EIS. A revised DEA, including all these points, could have adequately addressed these concerns. It was my understanding that DLNR intended to work with the applicant to address any deficiencies prior to acceptance of the FEA. This, apparently, did not happen.

Section 2: My Comments on DLNR's Identified Analysis Needs

1) The take of aquarium fish as an irrevocable commitment to loss or destruction of natural or cultural resources. The take of individual fish itself is loss or destruction of natural resources;

the sustainability question is whether the annual take of cumulative numbers of fish as a percentage of estimated population results in irrevocable loss or destruction of populations of fish;

DLNRs thinking seems to be that the loss of an individual fish constitutes a loss under Chapter 343, HRS, then all actions taken by anyone anywhere would similarly require an EA. Does DLNR also consider the take of living microscopic organisms should be included in its broad application of the view of loss of natural resources? Does DLNR also believe that a State camping permittee breathing the air at a designated camp site requires an EA/EIS? How does it conclude that a 5% to 25% take of a species to be a "destruction of populations of fish?"

Chapter 343, HRS, focus is on the significant effect of use of the resources and not whether such use constitutes a loss. In many cases, the use of a resource results in its inevitable loss. To be relevant, the loss of a fish should to be viewed within the context of whether that use causes a significant effect. It's obvious that the loss of one fish doesn't mean the extinction of the species and doesn't constitute a significant effect. As such, going down the "rabbit hole" of trying to identify and characterize each loss is irrelevant to the question of significant effect. It should therefore, also be considered irrelevant for the purposes of Chapter 343, HRS.

Conclusion: By making Comment #1, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.

2) The manner in which the take of aquarium fish curtails the uses of the environment, including aquatic invasive algae control, the tourism industry, and the overall integrity of diverse aquatic ecosystems;

It is unclear how the collecting of aquarium fish is related to invasive algae control and the tourism industry. The causes of alien algae introductions are unrelated to aquarium collecting. The current regulatory measures include rules on ballast water and hull fouling. Once alien species are found in Hawaii, control methods include, among others, physical removal and urchin plantings. The premise that aquarium fish collecting is a controlling factor for alien algae growth and spread is wildly speculative. No scientific evidence supports this contention.

As noted in my comments on Comment #1, the permit impacts to tourism are outside of the environmental impacts requirement of Chapter 343, HRS, and outside of the scope of the agency action. Tourism is man-made, not part of the natural environment, and is irrelevant to this analysis. It would be an analysis of permit impacts on tourism's impacts on the environment.

It is unclear what the term "overall integrity of diverse aquatic ecosystems" means. It is a popular term and non-scientific. Biologically, ecosystems are dynamic and ever changing. Because natural conditions are always changing, the ecosystem constantly adjusts to these changes. If one component of the system no longer functions, the system compensates for this and creates a different function. This is the nature of living systems. It is unclear what "overall integrity" of an ever-changing system means. If integrity of the ecosystem functions is what is intended, then any change to the system that doesn't cease the system's ability to function, does not cease its integrity. Ecosystems are also viewed relative to scale. The ecosystem within a drop of water is different from the ecosystem within the region of the Hawaiian Islands is different from the ecosystem of the Pacific basin. It is unclear which ecosystem Comment #2 is referring to. Lastly, I am assuming “aquatic” should be limited to “marine” instead.

Conclusion: By making Comment #2, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.

3) The extent to which the take of aquarium fish conflicts with the state's long-term environmental goals;

Governor Ige’s 30 by 30 Sustainability Plan calls for the effective management of at least 30% of the State’s shorelines by the year 2030. The fishery does not conflict with, and would actively support, the plan. The DLNR has obviously taken the position that the fishery is unsustainable and in conflict with the plan. The requirement to have an SMNE permit and the issuance of those permits is a form of effective management of the shoreline and consistent with the plan. It is unclear how having the permit isn’t in support of plan.

Conclusion: By making Comment #3, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.

4) The impact of the take of aquarium fish on cultural practices in the state; and

Conclusion: By making Comment #4, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed. For further comments, see Section 3, Reason #7.

5) The cumulative effect of the commercial take of aquarium fish using fine mesh nets when combined with the effects of:
   (a) the commercial take of aquarium fish by other legal methods;
   (b) the take of aquarium fish for recreational purposes; and
   (c) the commercial and non-commercial take of aquarium fish species for consumption as food, particularly including Achilles Tang and kole;

Conclusion: Comment #5 appears to include non-permit actions. Such an analysis would be outside of the scope of the EA and should not be included. See my further discussions under Comment #6 immediately following this discussion.

6) It is also necessary to analyze the potential impacts under the no action alternative resulting from non-issuance of aquarium permits, including the increased take of larger, reproductively mature aquarium fish using legal mesh nets.

Comment #6 is an interesting take on the no action alternative. It is unclear whether the no action alternative is required as part of the Chapter 343, HRS, analysis. If it is not required, then Comment #6 would be discretionary. For the sake of discussion only, if the no action alternative is included, what is the no action alternative being taken? Section 188-31, HRS, authorizes the Department to issue aquarium permits. It has done so since the 1970s. The government action then is clearly the issuance of aquarium permits. As the Legislature authorized the Department to require and issue SMNE permits, the Department doesn't have the legal option to issue or not issue SMNE permits, it must issue the permits.

The Supreme Court did not invalidate the authority of the State to require SMNE permits, but that the process of permit issuance was subject to Chapter 343, HRS. The issuance of permits is on hold, until the Chapter 343, HRS, review is completed. In my view, there is no actual no action alternative. The agency action, then, is to issue SMNE permits or not. Since not issuing permits is not a legal option, the DLNR must issue small mesh net exemption permits.

Conclusion: Since the agency action is the issuance of permits, activities not requiring a small mesh net exemption permit, should not be considered within the scope of the EA.

Section 3: My Comments on DLNR's Reasons for EIS Requirement

DLNR has issued a previous FONSI determination for a "programmatic" EA for the Fish Aggregating Device System and did not require an EIS. I've listed all of the stated DLNR reasons and will provide my specific responses/comments to each reason as follows.

1) The FEA identifies the scope of analysis as one year and states that an EA with updated data and analysis would need to be completed on an annual basis. This improperly segments the analysis which must include the long-term and cumulative impacts over time of aquarium collection.

Disagree: The FEA provided a detailed analysis of commercial aquarium landings over a broad number of years to document patterns of collections that would be used to further determine "impacts" at the species level for those species most often collected. This long term review of the data is in response to the need for the analysis of potential long term impacts and is not an annual determination as reason #1 seems to imply. The draft Environmental Assessment (DEA) suggested annual reviews, which I noted in my previous comments as inappropriate for EAs, as a follow up measure for future EAs. This suggestion did not limit the analysis to only a one year time period and should not be assumed to be an annual analysis. As such, the document does not support the contention that the EA "segments the analysis" into solely an annual analysis. The document uses multiple years of historical data to provide a long-term analysis to come to a current determination. The document also provides a methodology for future reviews but should not be viewed as a predictor of events that have not yet occurred.

Conclusion: The DLNR's contention that the lack of a long term analysis provides a valid reason for requiring an EIS is not supported.

2) There is no statistical analysis of population growth compared to the life span of each fish and the number of years to and size of first reproduction against which this annual proposed take can be measured for purposes of estimating sustainable take.

Agree: There is no analysis of population growth because such an analysis would be an unnecessary waste of time and resources. My reasons why this is unnecessary are many. The data needed to conduct a population analysis, as implied by reason #2, does not currently exist. I am assuming that reason #2 should actually read each fish **species** and not each fish as currently worded. To attempt to determine this information at the individual fish level would increase the cost over a million fold, assuming that each species has more than a million individuals. One estimate of the number of individual fish in the aquarium fishery are likely over 10 million. Current scientific thinking suggests that roughly 99% of individuals born will not survive to adulthood. Even if such a study were initiated, most individuals would not survive long enough to provide information useful to this analysis.

Current scientific approaches to determine sustainable take levels instead look at fishery wide data rather than species or individual level data. The most common and practical approach combines all species within the fishery into one combination species and to analyze this one species to look at this question. This approach would also be useful in determining a cumulative impact analysis. This enables at least a preliminary indicator of the sustainability of a fishery. Regardless of the method chosen, the eventual goal is to determine a sustainable take level.

Disagree: A sustainable take level is required to manage this fishery.
I would argue that a calculated or set take level is not necessary to manage a fishery. The sustainable take level is a man-made goal and a theoretical estimate of a biological threshold. Under the federal model, the overfishing limit is an estimate because the status of the resources is constantly changing. There is also an element of risk that the overfishing limit is inaccurate given scientific uncertainty. The level of risk one is willing to take is subjective. The base level of risk is 50%. At this risk level, there is a 50% chance that the overfishing limit will be reached. However, the less data there is to calculate the overfishing limit, the more uncertain that estimate.

The DLNR has historically managed the State's marine resources without a known sustainable take level. It appears that not having a take level does not prevent DLNR from managing those resources. The State was managing the take of its resources long before the concept of a sustainable take level was developed.

Disagree: A sustainable take level is required to be in compliance with Chapter 343, HRS.
Chapter 343, HRS, requires a review of action impacts on the environment. A sustainable take level is one of many ways to measure those impacts. It is not the only way and sometimes it is not the best way. A sustainable take level is only as good as the data used to calculate it. A better way is by monitoring fishing effort derived from commercial landings data and then to confirm any results with the fishers to verify if the data is an accurate reflection of their experiences in the fishery. The fishers can tell when something is wrong with the resources long before any data shows it. Fishing performance is arguably a better way to measure resource status in some cases. The model used to calculate sustainable take may be flawed. The model also is dependent on good data. If either the model or the data are flawed, then the take level is flawed.

Conclusion: Given that the data needed to conduct an analysis on population growth does not currently exist and is not expected to exist within the next five years, no analysis could be done because the necessary information does not exist. The argument that an EIS should be done because there was no such analysis done in the EA is illogical since it could not be done for an EIS either. Requiring an EIS would not magically cause such an analysis to be possible.

Conclusion: The DLNR's contention that an EIS should include a statistical analysis of population growth is not supported.

3) With regard to proposed levels of sustainable catch, using "5% to 25%" annual take of estimated populations as proposed in several research papers, we note that 5% to 25% is a wide range, and the precautionary principle calls for applying the lowest estimated percentage of sustainable take in the absence of scientific certainty.

Disagree: The precautionary principle "implies that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk (Wikipedia)." Some people might take the next step and state further that the principle also calls on decision makers to act, even when there is a lack of scientific information. The DLNR misrepresents that the principle calls for the lowest estimated percentage to be applied. This would be inconsistent with the tenets of the precautionary principle. Neither does the principle stipulate that the lowest percentage of sustainable take be applied to all species in the fishery. Either the DLNR is uninformed about what the precautionary principle actually says or they're purposely trying to distort the principle to fit their needs.

Conclusion: The DLNR's contention that the precautionary principle provides a valid reason for requiring an EIS is not supported.

4) We note also that there are no bag limits for most species, and that the fishery as currently regulated does not limit the number of permits, so that the annual take as a percentage of estimated population could rise significantly. Alternatives of overall annual take limits, a limited entry aquarium fishery program, and restrictions including full moratoria on the take of herbivores, species of special concern, and species evidencing severe population declines have not been proposed or analyzed.

Disagree: It is not within the scope of the FEA to place restrictions on the fishery. Such decisions are solely within the purview of the DLNR and it is their responsibility to propose restrictions it deems necessary. It is also not within the scope of the FEA to analyze imaginary regulatory restrictions that are DLNR purview and responsibility. It is the agency responsibility to explain why there are so few bag limits, not the applicant.

Disagree: No bag limits for most species. Bag limits are a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. Bag limits are a way to distribute or allocate effort in a fishery. Its purpose is to maximize the number of fishers who can participate in the fishery and prevents the fishery from being captured by only a few fishers. The aquarium fishery is already subject to bag limits in excess of those placed on any other type of fishery. For example, non-commercial SMNE permittees are limited to five organisms per person per day. No other person is limited in the same way. The reason this bag limit was implemented for SMNE permittees was not because of a concern of "overfishing" but that the non-commercial SMNE permittee did not have a need to take more than this daily number to supply their personal aquariums. Those who did have such a need could apply for a commercial SMNE permit and not be subject to this restriction. Oahu commercial SMNE permittees are under existing bag limit restrictions for those species that would normally be taken in larger numbers. No other person is limited in the same way. Again, the purpose of these restrictions was not because of a concern for overfishing but to reduce the potential for waste in the fishery resulting when new entrants in the fishery, who do not have the experience to know the carrying capacity of their vessels, overcrowd their holding facilities onboard. Overcrowding of onboard holding facilities causes unnecessary damage to fish as they suffer split fins, body cuts, and other injuries that would render the animal unsuitable for commercial sale.

Disagree: Limit the number of aquarium permits. Limited entry (LE) is a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. LE is an economic tool and not a biological one. The main purpose for LE systems is to prevent overcapitalization in the fishery. Overcapitalization occurs when there are too many fishers in a fishery to economically support all fishers. Those fishers who are marginally operating in the fishery will fish harder, which produces more fish but reduces fish prices, thereby exacerbating their financial problems. They end up fishing harder but making less money. Lower fish prices hurt everyone in the fishery as all fishers try to recover this revenue drop. The resources suffer in this scenario and LE artificially limits the number of fishers that potentially harm the fishery. The number of commercial aquarium collectors on Oahu has decreased since 2008 so there is no evidence that there are too many fishers. With the fishery currently not experiencing overcapitalization, there would be no justification for a LE system for this fishery. The DLNR seems to think that aquarium take will rise significantly, but provides no evidence of such a contention. The reality is the opposite. Hawaii is losing market share to overseas suppliers and expansion in the Hawaii market does not appear imminent in the foreseeable future.

It is unclear why DLNR is asking the applicant to consider additional restrictions on a fishery that is operating sustainably at its current level. There are a multitude of measures that could be analyzed but what would be the point? The DLNR has stated in its testimonies on several bills in 2017 (HB1457, SB 1240, and SB 220) that it believes that the fishery is operating sustainably. It is also unclear why the DLNR is requiring an EIS when the DEA and its own legislative testimony contend that the fishery is fine. The aquarium fishery has been essentially closed since the beginning of 2018 so there is likely no new information that would suggest that the fishery has suddenly changed from sustainable to unstainable, given the current situation.

Conclusion: The DLNR’s contention that the lack of alternative analysis provides a valid reason for requiring an EIS is not supported.

5) The FEA asserts that certain types of fish such as Flame Wrasse, Psychedelic Wrasse, and Fisher's Angelfish inhabit waters deeper than the CREP monitoring studied, resulting in populations being underestimated and thus the annual take as a percentage of estimated population being overestimated. In addition, we note the proposed alternatives for reduction in bag limits for Flame Wrasse, but do not see a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population.

Reason #5 seems to suggest that the DLNR is confused. Since the DLNR has not refuted the FEA findings that 1) the current Flame Wrasse population is being underestimated (there is a high likelihood that there are more individuals in the wild than the survey data indicate) and 2) that the current levels of take are sustainable (even with the population being underestimated), then there would be no scientific or biological evidence that suggests that further reductions are needed. Put simply, the current analysis should be biased towards showing a significant impact but it doesn’t. It shows that despite this bias, there still is no significant impact. What would be the point in doing an analysis of an additional reduction (bag limits) if there is no significant impact already? The Flame Wrasse bag limits are being suggested as a social remedy to the misguided perception that Flame Wrasses are being unsustainably fished. The DLNR seems to be asking the FEA to show that a proposed new bag limit for Flame Wrasses would be enough to sustain a population that is already being sustainably fished, without the new bag limit. If the Flame Wrasse is being sustainably fished without a bag limit, wouldn't it be more sustainable with an additional bag limit? Why would you need to scientifically prove this?

Conclusion: The DLNR's contention that the lack of an analysis for a proposed Flame Wrasse bag limit somehow provides a valid reason for requiring an EIS is not supported.

6) We note the proposed alternative for an expansion of the Waikiki Marine Life Conservation District, but do not see a scientific review of the beneficial impact of Fishery Replenishment Areas on restoring populations, such as has been demonstrated in West Hawai'i, nor an analysis of the optimal placement of Fishery Replenishment Areas on O'ahu to protect and restore populations of aquarium fish.

Reason #6 seems to imply that the DLNR is not convinced that there are benefits from marine managed areas (MMAs) and wants to see a review of these benefits in the EIS to justify this contention. If this is the case, then why is the DLNR promoting MMAs as a possible mechanism to manage fisheries. The DLNR should already have its own scientific review of the Waikiki MLCD since this is their facility. It is expected that the DLNR should already be fully aware of the pros and cons of MMAs and would not need to see such a review in the EIS. Ultimately, the DLNR should decide whether more MMAs are needed to increase fish populations, how many and how large these MMAs need to be, and most importantly, what would be the management goals for establishing or expanding such areas. Where would one place Oahu if there were no need to restore those populations? It would seem to me that the proposed MMA measures are an option for the DLNR to consider rather than the applicants responsibility to analyze all such options in an EIS.

DLNR appears to be confused about the purposes of MMAs. MMAs are an ecosystem management tool, not a fishery management tool. Put simply, MMAs manage the area within their boundaries but do not manage the fishery beyond the boundaries. A fishery management tool manages the take of the fishery wherever it occurs.

Conclusion: The DLNR's contention that the lack of a scientific review of the benefits of the Waikiki Marine Life Conservation District provides a valid reason for requiring an EIS is not supported.

7) Cultural impacts of aquarium fishing need significantly more analysis than provided in the FEA. The OEQC guidelines should be followed for assessing cultural impacts, including consulting with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts. Traditional Hawaiian practices and subsistence uses, local place-based and life-cycle knowledge, and traditional Hawaiian cultural significance of each type of aquarium fish taken should be reviewed. The indirect impact of modem technologies for highly efficient catch methods on traditional harvest capabilities should be included in the analysis.

It is my understanding that the Chapter 343, HRS, requirements regarding cultural impacts fall into the category of what impacts the aquarium fishery might have on traditional and cultural uses of the resources. As aquarium collecting was never part of a Hawaiian traditional or cultural use, it is unclear how such collecting might impact such uses. If the contention is that collecting removes those organisms that are also used by native Hawaiians, then provided the agency action still allows native Hawaiians to continue to practice their traditional and culture use, there would be no significant impact to those practices.

Regarding the “modern technologies” contention, the equipment used to collect aquarium fish has not significantly changed since the mid-1950s when SCUBA was developed. Monofilament nets were developed many years before the 1950s and were in use before World War II. If over 70 years old technologies are what are being referred to here, these technologies have existed longer than the fishery itself.

Even if DLNR believes that the cultural impacts analysis (CIA) were not adequately addressed in the FEA, why did DLNR accept the FEA and not instruct the applicant to expand on this small portion of the DEA prior to publishing the FEA? Revising the DEA to include the CIA would have precluded the need for an EIS. The cultural impacts analysis is required in both the EA and EIS so the same analysis would have been needed in both documents.

Conclusion: The DLNR’s contention that the lack of an adequate CIA provides a valid reason for requiring an EIS is not supported in view of the availability of other options.

8) Enforcement and compliance needs and challenges are key factors in the effectiveness of fisheries management, and should be analyzed as part of the environmental analysis.

Chapter 343, HRS, requires a written document that describes the potential environmental impacts and concerns of the aquarium fishery. It is my understanding that enforcement and compliance are state government functions and are not required as part of these environmental requirements. They should not be included in this EA nor an EIS. I have not seen any EA or EIS that includes such an analysis.

Conclusion: The DLNR’s contention that an enforcement and compliance analysis should be included in the EA or EIS is not required under State law.

Thank you for this opportunity to provide comments.

Alton Miyasaka
September 3, 2018

Responses to comments received from Alton Miyasaka
Comment dated September 3, 2018

Comment	Response
I find the DLNR comments full of assumptions and inaccuracies. I also find their reasoning for now requiring an EIS, illogical and not factually based. Given these observations, I am concerned that DLNR no longer has the technical expertise to adequately and objectively evaluate this document. It appears the DLNR doesn't understand its own regulations. The aquarium permit is somewhat of a misnomer. The aquarium permit issued under Section 188-31, HRS, is a small mesh net exemption and not a general aquarium collecting permit. The legal minimum net mesh size is two inches stretched. An exemption to this minimum net mesh size is authorized by permit. This seeming small difference is important because the agency action is issuance of the permit that provides a small mesh net exemption (SMNE). The permit is not to collect aquarium fish, regardless of gear used. For purposes of clarity, I will use the term SMNE permit instead of aquarium permit in this document. The attempts to expand the analysis into non-permit activities are outside of the scope of the action.	Comment noted. A DEIS has been prepared. The proposed action is issuance of commercial aquarium permits in the WHRFMA; however, additional details have been added to the No Action Alternative to quantify the collection that would occur without issuance of these permits (in East Hawai'i).
It sounds like DLNR response was written by someone obviously biased against aquarium collecting and could have been crafted by the plaintiffs in the recent lawsuit against the DLNR. The thinking and the words chosen seem strangely familiar of the arguments made during the legal action. I also disagree with the Department's reasons for requiring an EIS and continue to support the FEA determination of no significant impact. My arguments for my disagreement will be further explained later in this document.	Comment noted.
The DLNR appears to have completely changed its position that the aquarium fishery is sustainable to a position that it is now believes the fishery is unsustainable, despite the fact that collecting under permit has been stopped since the beginning of 2018, resulting in the impacts of collecting being drastically reduced. The DLNR does not explain why they have reversed their position.	Comment noted.
Regarding the areas where the FEA were lacking, I disagree with most of the points made. Even if, for discussion only, the FEA were lacking these points, this would not trigger the need for an EIS. A revised DEA, including all these points, could have adequately addressed these concerns. It was my understanding that DLNR intended to work with the applicant to address any deficiencies prior to acceptance of the FEA. This, apparently, did not happen.	Comment noted.
DLNRs thinking seems to be that the loss of an individual fish constitutes a loss under Chapter 343, HRS, then all actions taken by anyone anywhere would similarly require an EA. Does DLNR also consider the take of living microscopic organisms should be included in its broad application of the view of loss of natural resources? Does DLNR also believe that a State camping permittee breathing the air at a designated camp site requires an EA/EIS? How does it conclude that a 5% to 25% take of a species to be a "destruction of populations of fish?"	Comment noted.
Chapter 343, HRS, focus is on the significant effect of use of the resources and not whether such use constitutes a loss. In many cases, the use of a resource results in its inevitable loss. To be relevant, the loss of a fish should to be viewed within the context of whether that use causes a significant effect. It's obvious that the loss of one fish doesn't mean the extinction of the species and doesn't constitute a significant effect. As such, going down the "rabbit hole" of	Comment noted. Section 2.5 of the DEIS defines the scope of analysis, including that the impact to the fish species is analyzed at the population level.

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trying to identify and characterize each loss is irrelevant to the question of significant effect. It should therefore, also be considered irrelevant for the purposes of Chapter 343, HRS.	
Conclusion: By making Comment #1, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.	Comment noted.
It is unclear how the collecting of aquarium fish is related to invasive algae control and the tourism industry. The causes of alien algae introductions are unrelated to aquarium collecting. The current regulatory measures include rules on ballast water and hull fouling. Once alien species are found in Hawaii, control methods include, among others, physical removal and urchin plantings. The premise that aquarium fish collecting is a controlling factor for alien algae growth and spread is wildly speculative. No scientific evidence supports this contention.	Comment noted. The impact of commercial aquarium collection on tourism and herbivores/algae control is discussed in Section 5.0 of the DEIS.
As noted in my comments on Comment #1, the permit impacts to tourism are outside of the environmental impacts requirement of Chapter 343, HRS, and outside of the scope of the agency action. Tourism is man-made, not part of the natural environment, and is irrelevant to this analysis. It would be an analysis of permit impacts on tourism's impacts on the environment.	Comment noted. The impacts of commercial aquarium collection on the tourism industry is discussed in Section 5.0 of the DEIS.
It is unclear what the term "overall integrity of diverse aquatic ecosystems" means. It is a popular term and non-scientific. Biologically, ecosystems are dynamic and ever changing. Because natural conditions are always changing, the ecosystem constantly adjusts to these changes. If one component of the system no longer functions, the system compensates for this and creates a different function. This is the nature of living systems. It is unclear what "overall integrity" of an ever-changing system means. If integrity of the ecosystem functions is what is intended, then any change to the system that doesn't cease the system's ability to function, does not cease its integrity. Ecosystems are also viewed relative to scale. The ecosystem within a drop of water is different from the ecosystem within the region of the Hawaiian Islands is different from the ecosystem of the Pacific basin. It is unclear which ecosystem Comment #2 is referring to. Lastly, I am assuming "aquatic" should be limited to "marine" instead.	Comment noted. The scope of analysis for the DEIS is the nearshore waters of the island of Hawai'i.
Conclusion: By making Comment #2, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.	Comment noted.

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Governor Ige's 30 by 30 Sustainability Plan calls for the effective management of at least 30% of the State's shorelines by the year 2030. The fishery does not conflict with, and would actively support, the plan. The DLNR has obviously taken the position that the fishery is unsustainable and in conflict with the plan. The requirement to have an SMNE permit and the issuance of those permits is a form of effective management of the shoreline and consistent with the plan. It is unclear how having the permit isn't in support of plan.	Comment noted.
Conclusion: By making Comment #3, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed.	Comment noted.
Conclusion: By making Comment #4, DLNR seems to have totally ignored the whole DEA/FEA. It should more clearly identify why it believes the FEA did not adequately address the question of impacts. The statement does not provide enough guidance on how the applicant should proceed. For further comments, see Section 3, Reason #7.	Comment noted.
Conclusion: Comment #5 appears to include non-permit actions. Such an analysis would be outside of the scope of the EA and should not be included. See my further discussions under Comment #6 immediately following this discussion.	Comment noted. A DEIS has been prepared, and cumulative impacts are discussed in Section 5.0 of the DEIS.
Comment #6 is an interesting take on the no action alternative. It is unclear whether the no action alternative is required as part of the Chapter 343, HRS, analysis. If it is not required, then Comment #6 would be discretionary. For the sake of discussion only, if the no action alternative is included, what is the no action alternative being taken? Section 188-31, HRS, authorizes the Department to issue aquarium permits. It has done so since the 1970s. The government action then is clearly the issuance of aquarium permits. As the Legislature authorized the Department to require and issue SMNE permits, the Department doesn't have the legal option to issue or not issue SMNE permits, it must issue the permits. The Supreme Court did not invalidate the authority of the State to require SMNE permits, but that the process of permit issuance was subject to Chapter 343, HRS. The issuance of permits is on hold, until the Chapter 343, HRS, review is completed. In my view, there is no actual no action alternative. The agency action, then, is to issue SMNE permits or not. Since not issuing permits is not a legal option, the DLNR must issue small mesh net exemption permits. **Conclusion**: Since the agency action is the issuance of permits, activities not requiring a small mesh net exemption permit, should not be considered within the scope of the EA.	Comment noted. A No Action Alternative is included in the DEIS and includes commercial aquarium collection without the use of fine mesh nets. Since a fine mesh net permit is required to collect aquarium fish in the WHRFMA, no commercial aquarium collection would occur within the WHRFMA under the No Action Alternative, as outlined in the DEIS.

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Disagree: The FEA provided a detailed analysis of commercial aquarium landings over a broad number of years to document patterns of collections that would be used to further determine "impacts" at the species level for those species most often collected. This long term review of the data is in response to the need for the analysis of potential long term impacts and is not an annual determination as reason #1 seems to imply. The draft Environmental Assessment (DEA) suggested annual reviews, which I noted in my previous comments as inappropriate for EAs, as a follow up measure for future EAs. This suggestion did not limit the analysis to only a one year time period and should not be assumed to be an annual analysis. As such, the document does not support the contention that the EA "segments the analysis" into solely an annual analysis. The document uses multiple years of historical data to provide a long-term analysis to come to a current determination. The document also provides a methodology for future reviews but should not be viewed as a predictor of events that have not yet occurred. **Conclusion**: The DLNR's contention that the lack of a long term analysis provides a valid reason for requiring an EIS is not supported.	Comment noted. The analysis period for the DEIS has been revised to 5 years.
Agree: There is no analysis of population growth because such an analysis would be an unnecessary waste of time and resources. My reasons why this is unnecessary are many. The data needed to conduct a population analysis, as implied by reason #2, does not currently exist. I am assuming that reason #2 should actually read each fish **species** and not each fish as currently worded. To attempt to determine this information at the individual fish level would increase the cost over a million fold, assuming that each species has more than a million individuals. One estimate of the number of individual fish in the aquarium fishery are likely over 10 million. Current scientific thinking suggests that roughly 99% of individuals born will not survive to adulthood. Even if such a study were initiated, most individuals would not survive long enough to provide information useful to this analysis. Current scientific approaches to determine sustainable take levels instead look at fishery wide data rather than species or individual level data. The most common and practical approach combines all species within the fishery into one combination species and to analyze this one species to look at this question. This approach would also be useful in determining a cumulative impact analysis. This enables at least a preliminary indicator of the sustainability of a fishery. Regardless of the method chosen, the eventual goal is to determine a sustainable take level.	Comment noted. The DEIS uses the best available science, including recent data from the DAR (2019) on population trends of the 40 White List Species.
Disagree: A sustainable take level is required to manage this fishery. I would argue that a calculated or set take level is not necessary to manage a fishery. The sustainable take level is a man-made goal and a theoretical estimate of a biological threshold. Under the federal model, the overfishing limit is an estimate because the status of the resources is constantly changing. There is also an element of risk that the overfishing limit is inaccurate given scientific uncertainty. The level of risk one is willing to take is subjective. The base level of risk is 50%. At this risk level, there is a 50% chance that the overfishing limit will be reached. However, the less data there is to calculate the overfishing limit, the more	Comment noted. The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). Additionally, population trend data from the most recent WHAP surveys have been added to the DEIS. DAR (2019) reported that total abundance of nearshore fishes has had a significant

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Comment	**Response**
uncertain that estimate. The DLNR has historically managed the State's marine resources without a known sustainable take level. It appears that not having a take level does not prevent DLNR from managing those resources. The State was managing the take of its resources long before the concept of a sustainable take level was developed. Disagree: A sustainable take level is required to be in compliance with Chapter 343, HRS. Chapter 343, HRS, requires a review of action impacts on the environment. A sustainable take level is one of many ways to measure those impacts. It is not the only way and sometimes it is not the best way. A sustainable take level is only as good as the data used to calculate it. A better way is by monitoring fishing effort derived from commercial landings data and then to confirm any results with the fishers to verify if the data is an accurate reflection of their experiences in the fishery. The fishers can tell when something is wrong with the resources long before any data shows it. Fishing performance is arguably a better way to measure resource status in some cases. The model used to calculate sustainable take may be flawed. The model also is dependent on good data. If either the model or the data are flawed, then the take level is flawed.	positive trend in all management areas (open areas, FRAs and MPAs) since 2003. As discussed in the DEIS, population trends for the two top collected species (Yellow Tang and Kole) show significantly increasing population trends. For the next eight most commonly collected species, six species have had long-term population increases. For the two species with long term declines, these declines were in both FRAs (where commercial aquarium collection is not allowed) and in Open Areas, with larger declines seen in FRAs than in Open Area, suggesting that some factor other than commercial aquarium collection is driving the decline. For one of these species, the Achilles Tang, a reduced bag limit is proposed in the Preferred Alternative to reduce impacts to this species. For the additional 10 White List Species with significant declines between 1999 and 2017, the DAR (2019) found that declines were occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating the aquarium collection is not driving the decline. While commercial aquarium collection does contribute to the cumulative impact, it is a less than significant factor in the observed declines. Additionally, measures included in the Preferred Alternative (e.g., limited permit issuance, reduced Achilles Tang bag limit) may mitigate potential impacts by limiting the number of aquarium permits issued as well as the number of Achilles Tang that can be collected by commercial aquarium collectors each day.
Conclusion: Given that the data needed to conduct an analysis on population growth does not currently exist and is not expected to exist within the next five years, no analysis could be done because the necessary information does not exist. The argument that an EIS should be done because there was no such analysis done in the EA is illogical since it could not be done for an EIS either. Requiring an EIS would not magically cause such an analysis to be possible. **Conclusion**: The DLNR's contention that an EIS should include a statistical analysis of population growth is not supported.	Comment noted. A DEIS has been prepared using the best available science, including updated data from the DAR (2019).
Disagree: The precautionary principle "implies that there is a social responsibility to protect the public from exposure to harm, when scientific investigation has found a plausible risk (Wikipedia)." Some people might take the next step and state further that the principle also calls on decision makers to act, even when there is a lack of scientific information. The DLNR misrepresents that the principle calls for the lowest estimated percentage to be applied. This would be inconsistent with the tenets of the precautionary principle. Neither does the principle stipulate that the lowest percentage of sustainable take be applied to all species in the fishery. Either the DLNR is uninformed about what the precautionary principle actually says or they're purposely trying to distort the principle to fit their needs. **Conclusion**: The DLNR's contention that the precautionary principle provides a valid reason for requiring an EIS is not supported.	Comment noted.

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Comment dated September 3, 2018

Comment	Response
Disagree: It is not within the scope of the FEA to place restrictions on the fishery. Such decisions are solely within the purview of the DLNR and it is their responsibility to propose restrictions it deems necessary. It is also not within the scope of the FEA to analyze imaginary regulatory restrictions that are DLNR purview and responsibility. It is the agency responsibility to explain why there are so few bag limits, not the applicant. Disagree: No bag limits for most species. Bag limits are a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. Bag limits are a way to distribute or allocate effort in a fishery. Its purpose is to maximize the number of fishers who can participate in the fishery and prevents the fishery from being captured by only a few fishers. The aquarium fishery is already subject to bag limits in excess of those placed on any other type of fishery. For example, non-commercial SMNE permittees are limited to five organisms per person per day. No other person is limited in the same way. The reason this bag limit was implemented for SMNE permittees was not because of a concern of "overfishing" but that the non-commercial SMNE permittee did not have a need to take more than this daily number to supply their personal aquariums. Those who did have such a need could apply for a commercial SMNE permit and not be subject to this restriction. Oahu commercial SMNE permittees are under existing bag limit restrictions for those species that would normally be taken in larger numbers. No other person is limited in the same way. Again, the purpose of these restrictions was not because of a concern for overfishing but to reduce the potential for waste in the fishery resulting when new entrants in the fishery, who do not have the experience to know the carrying capacity of their vessels, overcrowd their holding facilities onboard. Overcrowding of onboard holding facilities causes unnecessary damage to fish as they suffer split fins, body cuts, and other injuries that would render the animal unsuitable for commercial sale. Disagree: Limit the number of aquarium permits. Limited entry (LE) is a common fishery management tool used worldwide but the DLNR does not appear to understand this basic fishery management tool and what it is used for. LE is an economic tool and not a biological one. The main purpose for LE systems is to prevent overcapitalization in the fishery. Overcapitalization occurs when there are too many fishers in a fishery to economically support all fishers. Those fishers who are marginally operating in the fishery will fish harder, which produces more fish but reduces fish prices, thereby exacerbating their financial problems. They end up fishing harder but making less money. Lower fish prices hurt everyone in the fishery as all fishers try to recover this revenue drop. The resources suffer in this scenario and LE artificially limits the number of fishers that potentially harm the fishery. The number of commercial aquarium collectors on Oahu has decreased since 2008 so there is no evidence that there are too many fishers. With the fishery currently not experiencing overcapitalization, there would be no justification for a LE system for this fishery. The DLNR seems to think that aquarium take will rise significantly, but provides no evidence of such a contention. The reality	Comment noted. Regulations and enforcement are within the purview of the State of Hawai'i. Nevertheless, the DEIS Preferred Action does include a new bag limit for the Achilles Tang and limits the issuance of permits to 14.

Responses to comments received from Alton Miyasaka
Comment dated September 3, 2018

Comment	Response
is the opposite. Hawaii is losing market share to overseas suppliers and expansion in the Hawaii market does not appear imminent in the foreseeable future. It is unclear why DLNR is asking the applicant to consider additional restrictions on a fishery that is operating sustainably at its current level. There are a multitude of measures that could be analyzed but what would be the point? The DLNR has stated in its testimonies on several bills in 2017 (HB1457, SB 1240, and SB 220) that it believes that the fishery is operating sustainably. It is also unclear why the DLNR is requiring an EIS when the DEA and its own legislative testimony contend that the fishery is fine. The aquarium fishery has been essentially closed since the beginning of 2018 so there is likely no new information that would suggest that the fishery has suddenly changed from sustainable to unstainable, given the current situation. Conclusion: The DLNR's contention that the lack of alternative analysis provides a valid reason for requiring an EIS is not supported.	
Reason #5 seems to suggest that the DLNR is confused. Since the DLNR has not refuted the FEA findings that 1) the current Flame Wrasse population is being underestimated (there is a high likelihood that there are more individuals in the wild than the survey data indicate) and 2) that the current levels of take are sustainable (even with the population being underestimated), then there would be no scientific or biological evidence that suggests that further reductions are needed. Put simply, the current analysis should be biased towards showing a significant impact but it doesn't. It shows that despite this bias, there still is no significant impact. What would be the point in doing an analysis of an additional reduction (bag limits) if there is no significant impact already? The Flame Wrasse bag limits are being suggested as a social remedy to the misguided perception that Flame Wrasses are being unsustainably fished. The DLNR seems to be asking the FEA to show that a proposed new bag limit for Flame Wrasses would be enough to sustain a population that is already being sustainably fished, without the new bag limit. If the Flame Wrasse is being sustainably fished without a bag limit, wouldn't it be more sustainable with an additional bag limit? Why would you need to scientifically prove this? **Conclusion**: The DLNR's contention that the lack of an analysis for a proposed Flame Wrasse bag limit somehow provides a valid reason for requiring an EIS is not supported.	Comment noted. The DEIS is limited to the island of Hawai'i, which never proposed a bag limit for the Flame Wrasse. The DEIS includes population estimates for 38 of the 40 White List Species. As noted in the DEIS, Flame Wrasse do not have a CREP population estimate, but collection has been less than 175 individuals per year for the island of Hawai'i between 2000 and 2017. Longfin Anthias also do not have a CREP population estimate, but collection has been less than 150 individuals per year for the island of Hawai'i.
Reason #6 seems to imply that the DLNR is not convinced that there are benefits from marine managed areas (MMAs) and wants to see a review of these benefits in the EIS to justify this contention. If this is the case, then why is the DLNR promoting MMAs as a possible mechanism to manage fisheries. The DLNR should already have its own scientific review of the Waikiki MLCD since this is their facility. It is expected that the DLNR should already be fully aware of the pros and cons of MMAs and would not need to see such a review in the EIS. Ultimately, the DLNR should decide whether more MMAs are needed to increase fish populations, how many and how large these MMAs need to be, and most importantly, what would be the management goals for establishing or expanding such areas. Where would one place Oahu if	Comment noted. The DEIS is limited to the island of Hawai'i and does not include Oahu where the additional protected area was proposed.

Responses to comments received from Alton Miyasaka
Comment dated September 3, 2018

Comment	Response
there were no need to restore those populations? It would seem to me that the proposed MMA measures are an option for the DLNR to consider rather than the applicants responsibility to analyze all such options in an EIS. DLNR appears to be confused about the purposes of MMAs. MMAs are an ecosystem management tool, not a fishery management tool. Put simply, MMAs manage the area within their boundaries but do not manage the fishery beyond the boundaries. A fishery management tool manages the take of the fishery wherever it occurs. **Conclusion**: The DLNR's contention that the lack of a scientific review of the benefits of the Waikiki Marine Life Conservation District provides a valid reason for requiring an EIS is not supported.	
It is my understanding that the Chapter 343, HRS, requirements regarding cultural impacts fall into the category of what impacts the aquarium fishery might have on traditional and cultural uses of the resources. As aquarium collecting was never part of a Hawaiian traditional or cultural use, it is unclear how such collecting might impact such uses. If the contention is that collecting removes those organisms that are also used by native Hawaiians, then provided the agency action still allows native Hawaiians to continue to practice their traditional and culture use, there would be no significant impact to those practices. Regarding the "modern technologies" contention, the equipment used to collect aquarium fish has not significantly changed since the mid-1950s when SCUBA was developed. Monofilament nets were developed many years before the 1950s and were in use before World War II. If over 70 years old technologies are what are being referred to here, these technologies have existed longer than the fishery itself.	Comment noted. A Cultural Impact Assessment (CIA) has been developed and is included as Appendix A of the DEIS.
Even if DLNR believes that the cultural impacts analysis (CIA) were not adequately addressed in the FEA, why did DLNR accept the FEA and not instruct the applicant to expand on this small portion of the DEA prior to publishing the FEA? Revising the DEA to include the CIA would have precluded the need for an EIS. The cultural impacts analysis is required in both the EA and EIS so the same analysis would have been needed in both documents. **Conclusion**: The DLNR's contention that the lack of an adequate CIA provides a valid reason for requiring an EIS is not supported in view of the availability of other options.	Comment noted. A Cultural Impact Assessment (CIA) has been developed and is included as Appendix A of the DEIS.
Chapter 343, HRS, requires a written document that describes the potential environmental impacts and concerns of the aquarium fishery. It is my understanding that enforcement and compliance are state government functions and are not required as part of these environmental requirements. They should not be included in this EA nor an EIS. I have not seen any EA or EIS that includes such an analysis. **Conclusion**: The DLNR's contention that an enforcement and compliance analysis should be included in the EA or EIS is not required under State law.	Comment noted.

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STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAI'I 96817

HRD 18-8560B

August 30, 2018

Suzanne Case, Chair
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Re: Comments on Final Environmental Assessment for the Issuance of Commercial Aquarium Permits for the Island of Hawai'i

Aloha e Chair Case:

The Administration of the Office of Hawaiian Affairs (OHA) is writing to comment on the Final Environmental Assessment for the Issuance of Commercial Aquarium Permits for the Island of Hawai'i (FEA), which was prepared by the applicant, Pet Industry Joint Advisory Council (PIJAC). OHA previously commented on the Draft Environmental Assessment (DEA) in a letter dated April 30, 2018.

We appreciate that the DLNR has determined that the project may have a significant environmental impact, thus requiring the preparation of a Draft Environmental Impact Statement (DEIS). OHA notes that the applicant has submitted an FEA with an anticipated finding of no significant impact, contrary to DLNR's finding that the action may have a significant impact. OHA is concerned that several issued raised in our April 30, 2018 letter have not been addressed in the FEA but we are hopeful that through appropriate consultation, the DEIS will address these issues.

OHA is the constitutionally established body responsible for protecting and promoting the rights of Native Hawaiians. Hawai'i law mandates OHA to "[s]erve as the principal public agency in the State of Hawai'i responsible for the performance, development, and coordination of programs and activities relating to native Hawaiians and Hawaiians; . . . and [t]o assess the policies and practices of other agencies impacting on native Hawaiians and Hawaiians, and conducting advocacy efforts for native Hawaiians and Hawaiians." Hawai'i Revised Statutes (HRS) § 10-3.

Proposed Action and Scope of Analysis

As stated in our April 30, 2018 letter, the proposed action remains unclear. According to the FEA's title and throughout the FEA, the FEA identifies the proposed action as the issuance of permits.[1] For example, the FEA states that the "DLNR's issuance of Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts."[2] The project summary also states that the proposed action is the issuance of permits "ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats pursuant to Aquarium Fishing Permits issued under HRS §188-31."[3] It is OHA's understanding that the action that requires compliance with the Hawai'i Environmental Policy Act (HEPA) is aquarium collection conducted under permits issued pursuant to HRS § 188-31.[4] OHA recommends that the DEIS clarify the proposed action and that the applicant ensures that environmental impacts associated with the collection of commercial aquarium fish are analyzed.

As raised in OHA's April 30, 2018 letter, the DLNR has determined that the one-year scope of analysis "improperly segments the analysis, which must include the long-term and cumulative impacts over time of aquarium collection."[5] OHA anticipates that the DEIS will include a broader scope of analysis and include a consideration of all consequences on the environment, including both direct and indirect effects, in accordance with Hawai'i Administrative Rules § 13-200-17(i).

Alternatives Analysis

The FEA considers three alternative actions, the proposed action (preferred alternative), issuance of commercial permits under existing regulations (identified as "status quo" in the FEA), and no action. The preferred alternative is the issuance of permits under existing regulations with a reduced bag limit within the West Hawai'i Regional Fishery Management for commercial aquarium collection of Achilles Tang from ten to five per day and bag limit of five per day for all other fisheries.[6] OHA appreciates that the applicant has identified a new alternative in the FEA but recommends that the DEIS consider additional alternatives as suggested in our April 30, 3018 letter, and gives particular attention to "alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, and risks."[7]

Cultural Impacts

OHA appreciates the DLNR has determined that the cultural impacts of the proposed action need significantly more analysis than provided in the FEA.[8] The FEA maintains, however, that the proposed action "does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource."[9] OHA reiterates its concerns about the FEA's almost complete lack

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[1] Final Environmental Assessment, Issuance of Commercial Aquarium Permits for the Island of Hawai'i (June 2018) (FEA) at 1, 14, 15, 16.
[2] FEA at 15.
[3] FEA at Project Summary.
[4] *See* Umberger v. Dep't of Land and Natural Resources, SCWC-13-0002125 35 (September 6, 2017).
[5] Letter dated July 26, 2018, from Suzanne D. Case, Chair, DLNR, to Scott Glenn, OEQC, regarding Final Environmental Assessment, Notice of Determination (DLNR July 26, 2018 Letter).
[6] FEA at 16.
[7] HAR§ 11-200-17(f).
[8] DLNR July 26, 2018 Letter.
[9] FEA at 104.

of analysis regarding the significant potential cultural impacts of the action. In our April 30, 2018 letter, we raised concerns that the cultural resource section of the DEA provided only limited, general information from two sources without addressing the potential impacts the proposed action may have on cultural resources and practices, including practices specific to both species and place. OHA appreciates that the applicant included one additional source, Volume 1: Ka Hana Lawaiʻa a me Nā Koʻa o Nā Kai ʻEwalu: A History of Fishing Practices and Marine Fisheries of the Hawaiian Islands (Maly and Maly 2003),[10] in the FEA and that the cultural resources section acknowledges that "the ocean, its ecosystem, and the practice of fishing were and continue to be important in Native Hawaiian culture and tradition."[11] OHA is concerned, however, that the applicant has determined that the preferred alternative would have a less than significant direct impact on cultural resources[12] without conducting a cultural impact assessment in accordance with the Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts (guidelines).[13]

Although the FEA's discussion of cultural resources includes valuable information from Maly and Maly, the FEA fails to include other relevant information from this source that could have been useful in identifying cultural impacts. For example, the FEA states,

> In comments received from (OHA), OHA expressed a concern that traditional practices included gathering and consuming recently recruited juveniles. However, the source cited by OHA (Maly and Maly 2003) states that traditional practices included collecting smaller species of fish, but did not specifically state that subsistence fishers target juvenile fish of certain species.[14]

Contrary to this statement, Maly and Maly, does in fact, provide various examples of subsistence uses of juvenile fish species. For example, the source states,

> The following small-fry are seen along shore – they are swift of motion: the young (*pua* or flowers) of the mullet or *anae* (when of medium size it is called *ama-ama*), of the *awa*, *aholehole*, *hinana*, *nehu*, *iao*, *piha*, *opuu-puu*, *ohua-palemo*, *paoa*, *oluhe-luhe*, *ohune*, *moi-lii*, and the *akeke*. All of these fish are used as food. Doubtless I have omitted the mention of some.[15]

OHA again recommends that the applicant apply the guidelines for assessing cultural impacts and consult with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts and include this information in the DEIS. In addition to conducting consultation, the guidelines recommend conducting ethnographic and other culturally related documentary research and lists

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[10] KEPĀ MALY & ONAONA MALY, VOLUME 1: KA HANA LAWAIʻA A ME NĀ KOʻA O NĀ KAI ʻEWALU: A HISTORY OF FISHING PRACTICES AND MARINE FISHERIES OF THE HAWAIIAN ISLANDS (2003).
[11] FEA at 23.
[12] FEA at 73.
[13] Office of Environmental Quality Control, *Guide to the Implementation and Practice of the Hawaii Environmental Policy Act* (Guidelines) (2012), http://oeqc2.doh.hawaii.gov/OEQC_Guidance/2012-GUIDE-to-the-Implementation-and-Practice-of-the-HEPA.pdf.
[14] FEA at 72.
[15] MALY & MALY at 10.

various examples of research materials. OHA recommends that the applicant refer to these guidelines when conducting its cultural impacts assessment for the DEIS.

OHA looks forward to participating in consultation for the development of the DEIS. Should you have any questions, please contact Teresa Kaneakua, OHA Lead Compliance Specialist, at (808) 594-0231 or teresak@oha.org, or Wayne Tanaka, Senior Public Policy Advocate at (808) 594-1945 or waynet@oha.org.

ʻO wau iho nō me ka ʻoia ʻiʻo,

Kamanaʻopono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC:tk

C: David Sakoda, DLNR (*via email: david.sakoda@hawaii.gov*)
Jim Lynch, Pet Industry Joint Advisory Council (*via email: jim.lynch@klgates.com*)
Terry VanDeWalle, Stantec Consulting Services, Inc.
(*via email: terry.vandewalle@stantec.com*)

Responses to comments received from State of Hawai'i Office of Hawaiian Affairs
Comment dated August 30, 2018

Comment	**Response**
As stated in our April 30, 2018 letter, the proposed action remains unclear. According to the FEA's title and throughout the FEA, the FEA identifies the proposed action as the issuance of permits.' For example, the FEA states that the "DLNR's issuance of Aquarium Permits is not anticipated to result in significant beneficial or adverse impacts." The project summary also states that the proposed action is the issuance of permits "ensuring lawful, responsible, and sustainable commercial collection of various aquarium fish species from nearshore habitats pursuant to Aquarium Fishing Permits issued under HRS § 188-31 ." It is OHA's understanding that the action that requires compliance with the Hawai'i Environmental Policy Act (HEPA) is aquarium collection conducted under permits issued pursuant to HRS § 188-31. OHA recommends that the DEIS clarify the proposed action and that the applicant ensures that environmental impacts associated with the collection of commercial aquarium fish are analyzed.	Comment noted. As stated in the DEIS, the proposed action is issuance of 14 Aquarium Permits for the WHRFMA. The environmental consequences include the impacts of commercial aquarium collection that would occur if these 14 permits were issued.
As raised in OHA's April 30, 2018 letter, the DLNR has determined that the one-year scope of analysis "improperly segments the analysis, which must include the long-term and cumulative impacts over time of aquarium collection." OHA anticipates that the DEIS will include a broader scope of analysis and include a consideration of all consequences on the environment, including both direct and indirect effects, in accordance with Hawai'i Administrative Rules § 13-200-17(i).	Comment noted. The DEIS includes a 5-year analysis period.
The FEA considers three alternative actions, the proposed action (preferred alternative), issuance of commercial permits under existing regulations (identified as "status quo" in the PEA), and no action. The preferred alternative is the issuance of permits under existing regulations with a reduced bag limit within the West Hawai'i Regional Fishery Management for commercial aquarium collection of Achilles Tang from ten to five per day and bag limit of five per day for all other fisheries. OHA appreciates that the applicant has identified a new alternative in the FEA but recommends that the DEIS consider additional alternatives as suggested in our April 30, 3018 letter, and gives particular attention to "alternatives that might enhance environmental quality or avoid, reduce, or minimize some or all of the adverse environmental effects, costs, and risks."	Comment noted. Additional alternatives have been evaluated in the DEIS.
OHA appreciates the DLNR has determined that the cultural impacts of the proposed action need significantly more analysis than provided in the FEA. The FEA maintains, however, that the proposed action "does not involve an irrevocable commitment or loss or destruction of any natural or cultural resource." OHA reiterates its concerns about the FEA's almost complete lack of analysis regarding the significant potential cultural impacts of the action. In our April 30, 2018 letter, we raised concerns that the cultural resource section of the DEA provided only limited, general information from two sources without addressing the potential impacts the proposed action may have on cultural resources and practices, including practices specific to both species and place. OHA appreciates that the applicant included one additional source, Volume 1: Ka Hana Lawai'a a me Na Ko'a o Na Kai 'Ewalu: A History of Fishing Practices and Marine Fisheries of the Hawaiian Islands (Maly and Maly 2003), in the FEA and that the cultural resources section acknowledges that "the ocean, its ecosystem, and the practice of fishing were and continue to be important in Native Hawaiian culture and tradition." OHA is	Comment noted. A Cultural Impact Assessment has been developed and is included in Appendix A of the DEIS.

Responses to comments received from State of Hawai'i Office of Hawaiian Affairs
Comment dated August 30, 2018

Comment	Response
concerned, however, that the applicant has determined that the preferred alternative would have a less than significant direct impact on cultural resources without conducting a cultural impact assessment in accordance with the Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts (guidelines).	
Although the FEA's discussion of cultural resources includes valuable information from Maly and Maly, the FEA fails to include other relevant information from this source that could have been useful in identifying cultural impacts. For example, the FEA states, "In comments received from (OHA), OHA expressed a concern that traditional practices included gathering and consuming recently recruited juveniles. However, the source cited by OHA (Maly and Maly 2003) states that traditional practices included collecting smaller species of fish, but did not specifically state that subsistence fishers target juvenile fish of certain species." Contrary to this statement, Maly and Maly, does in fact, provide various examples of subsistence uses of juvenile fish species. For example, the source states, "The following small-fry are seen along shore — they are swift of motion: the young (*pua* or flowers) of the mullet or *anae* (when of medium size it is called *ama-ama*), of the *awa, aholehole, hinana, nehu, iao, piha, opuu-puu, ohua-palemo, paoa, oluhe-luhe, ohune, moi-lii*, and the *akeke*. All of these fish are used as food. Doubtless I have omitted the mention of some."	Comment noted. Additional cultural information on the 40 White List Species has been added to the DEIS, and a Cultural Impact Assessment was developed and is included in Appendix A of the DEIS.
OHA again recommends that the applicant apply the guidelines for assessing cultural impacts and consult with traditional cultural practitioners and other knowledgeable informants and sources about cultural resources, cultural practices, and the proposed action's potential impacts and include this information in the DEIS. In addition to conducting consultation, the guidelines recommend conducting ethnographic and other culturally related documentary research and lists various examples of research materials. OHA recommends that the applicant refer to these guidelines when conducting its cultural impacts assessment for the DEIS.	Comment noted. A Cultural Impact Assessment has been developed and is included in Appendix A of the DEIS.

From:	imagtek@imagtek.com
To:	Sakoda, David
Subject:	Issuance of Hawaii Island Commercial Aquarium Permits
Date:	Friday, August 10, 2018 1:37:12 PM

I stand firmly opposed to the issuance of commercial permits for the capture of reef dwelling fish for the aquarium trade.

I am appalled by the idea that an industry advocacy group is considered reliable and competent to issue guidance on an environmental issue of such consequence and long lasting impact.

I have snorkeled in the meager reefs of both East and West Hawaii Island, and even a non-specialist can easily see that the fish populations have been decimated.

We are told that '50 jobs' are at stake by the aquarium industry. 50 jobs.
And how many jobs are at stake of people who serve the tourist trade of those who come from all over the world to Hawaii to see... tropical fish?
500 jobs?

And what is the impact on their jobs if what people come to see disappears? It is not a win/win situation.

And what sort of jobs is the aquarium industry talking about?
These are zero wage, 'gig jobs' with zero benefits where people are paid for something they go out and catch.
In the process of capture, mortality of the fish being being hunted between capture and delivery is never zero.

Natural systems exist in an extremely fragile state of balance between predation and breeding evolved over vast timescales.
It is a verified fact that introduction of only a few humans to the predator mix can drastically upset an ecosystem and push it into undesirable states of decline that are difficult to reverse once they pass critical thresholds.

The Hawaii Department of Natural Resources has indicated the opinion that existing populations of fish are already stressed and dangerously close to thresholds of precipitous decline.

We need healthy reefs with thriving populations of fish more than we need 50 low paying gig jobs.

Harvesting of reef fish in Hawaii should be banned. Period.

An entire tourist industry employing hundreds of people is already based on the presence of these fish. Jeopardizing this industry for a handful of gig jobs would be extraordinarily foolish for too many reasons to enumerate.

John Powers
PO Box 898

Pahoa, HI 96778

703-626-6265

Responses to comments received from John Powers
Comment dated August 10, 2018

Comment	**Response**
I stand firmly opposed to the issuance of commercial permits for the capture of reef dwelling fish for the aquarium trade. I am appalled by the idea that an industry advocacy group is considered reliable and competent to issue guidance on an environmental issue of such consequence and long lasting impact. I have snorkeled in the meager reefs of both East and West Hawaii Island, and even a non-specialist can easily see that the fish populations have been decimated.	Comment noted. Public support/opposition of commercial aquarium collection is discussed in Section 1.2.3 of the DEIS. Population trend data is discussed in Section 5.0 of the DEIS.
We are told that '50 jobs' are at stake by the aquarium industry. 50 jobs. And how many jobs are at stake of people who serve the tourist trade of those who come from all over the world to Hawaii to see... tropical fish? 500 jobs? And what is the impact on their jobs if what people come to see disappears? It is not a win/win situation. And what sort of jobs is the aquarium industry talking about? These are zero wage, 'gig jobs' with zero benefits where people are paid for something they go out and catch. In the process of capture, mortality of the fish being being hunted between capture and delivery is never zero.	Comment noted. Impacts on socioeconomics, including jobs, are included in Section 5.0 of the DEIS.
Natural systems exist in an extremely fragile state of balance between predation and breeding evolved over vast timescales. It is a verified fact that introduction of only a few humans to the predator mix can drastically upset an ecosystem and push it into undesirable states of decline that are difficult to reverse once they pass critical thresholds. The Hawaii Department of Natural Resources has indicated the opinion that existing populations of fish are already stressed and dangerously close to thresholds of precipitous decline.	Comment noted. Existing population sizes and population trends are discussed in Section 5.0 of the DEIS.
We need healthy reefs with thriving populations of fish more than we need 50 low paying gig jobs. Harvesting of reef fish in Hawaii should be banned. Period. An entire tourist industry employing hundreds of people is already based on the presence of these fish. Jeopardizing this industry for a handful of gig jobs would be extraordinarily foolish for too many reasons to enumerate.	Comment noted. Impacts on socioeconomics, including jobs and tourism, are included in Section 5.0 of the DEIS

From: Patty Shenker
To: Sakoda, David; jim.lynch@klgates.com; VanDeWalle, Terry
Subject: Issuance of Commercial Aquarium Permits for the Island of Hawai'i--Final EA (EISPN)
Date: Friday, September 07, 2018 2:23:57 PM

To All Concerned-
Every summer, my family and I vacation on the Big Island. We have for 26 years. We love Hawaii & love to enjoy the amazing natural environments there. At the Mauna Lani's bay, where we always stay, there are many coral fish babies who we delight in seeing. I call it the "Nursery". This summer, I did not see as many so I became concerned. Then I read in the West Hawaii Today paper about this debate between the aquarium industry & environmentalists. So we want to comment our concern.
We feel very strongly that these fisheries be left alone and not depleted for captivity in aquariums. The capture of these sensitive fish often causes death itself & there are so many environmental issues facing our oceans and the marine & fish life who depend on it. They don't need this one too!
We believe that this will definitely cause harm to the environment & lead to the depletion of these beautiful beings who depend on you to protect them and their Hawaiian waters.
Please keep the ban on fine mesh nets & the ban on aquarium fishing in West Hawaii & do not issue any more permits.
Thank you for your time & attention.
Patty Shenker & Doug & Julia Stoll
5927 Cahill Ave.
Tarzana, Ca. 91356

Responses to comments received from Patty Shenker & Doug and Julia Stoll
Comment dated September 7, 2018

Comment	Response
We feel very strongly that these fisheries be left alone and not depleted for captivity in aquariums. The capture of these sensitive fish often causes death itself & there are so many environmental issues facing our oceans and the marine & fish life who depend on it. They don't need this one too! We believe that this will definitely cause harm to the environment & lead to the depletion of these beautiful beings who depend on you to protect them and their Hawaiian waters. Please keep the ban on fine mesh nets & the ban on aquarium fishing in West Hawaii & do not issue any more permits.	Comment noted. The impact of commercial aquarium collection on populations of reef fish are discussed in Section 5.0 of the DEIS. The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). As discussed in Section 2.5 of the DEIS, the DEIS focuses primarily on the effects of aquarium fishing on wild populations of White List Species, as it is at the population level that DAR measures changes in White List Species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population.

From:	Robert Culbertson
To:	Sakoda, David
Subject:	AQ testimony - FEA
Date:	Wednesday, September 05, 2018 8:41:06 PM

I am filing these remarks in response to the recently issued Final Environmental Assessment on the application for issuance of commercial Aquarium permits. The logic of finding "No Significant Impact" and favoring the industry's "preferred alternative" belies the facts on the ground and dismisses the cogent testimony of local stakeholders, concerned visitors, the State Senate Committee on Water and Land, State Division of Aquatic Resources, Office of Hawaiian Affairs and most notably, the plethora of authentic conservation groups in Hawaii. Thankfully, an honorable rendering of its inadequacies has led the accepting authority to further require a more in depth study - a full Environmental Impact Statement.

It is troubling that the documents proffered so far have failed to give any appreciation to the background of complaints and conflicts that led to the need for a change in policy in the first place. Despite unfounded assertions (and circular 'conclusions') that the current Aquarium activities and practices are having no "significant" impacts, the deficient records (only about 50% reporting compliance) and flawed studies (shining examples of sustainability from the Philippines?) and the historical accounts of user conflicts on every island begs to differ! This is a classic example that 'death by a thousand cuts' or in these cases 'flipper crunches' and other routine injuries to living coral colonies (including the symbiotic relationships with fish being extracted!) amounts to a **considerable** and undeniable impact as weighed against leaving the marine organisms unmolested. In a time when the mounting threats to the health of *our* reefs from unavoidable causes such as global warming loom large, *having any impacts that are avoidable and gratuitous can certainly tip the balance to a point of no return sooner than we think*!

It is obvious that carefully crafted limiting alternatives were created to frame the industry's predilection for industrial proficiency and serving consumer demand rather than serving the public interest. As a former Department of Aquatic Resources administrator Frazer McGilvray noted in public testimony before the Board of Land and Natural Resources, "These rules, driven by the demands of the trade, are contrary to good natural resource management...There appears to be no scientific basis for the bag limits for each species. The majority of yellow tang allowed to be taken under this rule are immature and have not contributed to the future of the species."

The applicant also fails to appreciate or detail among the various socioeconomic impacts, the immeasurable value of the marine ecosystem in aesthetic and culturally meaningful terms. The applicant's use of visitor arrival trends and statistics is a poor proxy for the importance of our near shore environment for visitors and residents. In fact, the authors of the document simply dismiss the aesthetic concerns by saying. "the FEAs conclude that the percent of each population collected would be imperceptible to observers." On the contrary! Both residents and long time repeat visitors have testified on being, in many cases, 'shocked' at the perceived deficit of fishes in many memorable places. Perhaps worst of all are the Hawaiian cultural values which are summarily dismissed through blatant disregard. Obviously, there is no "Aloha" in this business! And no Aloha means no Hawaii as it is known around the world!

The drive for unregulated profits in this business over the last few decades has succeeded only in pauperizing our resources while for centuries they had been used for subsistence under wise guidance and management. But, as DLNR's management policies have evolved over time, they appear to have coincidentally begun to value and align more with traditional practices and philosophy again. Now, under the **"hierarchy of uses"** principle, that agency is required to preserve these 'public trust' resources first and foremost. Only a healthy ecosystem may admit to any other succeeding orders of human demands. Public use and recreation is the next step down to consider if no patterns of abuse and damage are resulting. Then, and *only if* and when the other priorities are met can some commercial interests be permitted under the most stringent oversight ***exactly because*** the lucrative and often insatiable demands of capitalism will tempt the participants to cut corners (exceed bag limits), to shirk responsibilities (fail to make required reports), and even try to 'capture' the regulating authorities with political and/or financial favors. This applicant must not attempt to contort this policy and the legal process, ethical norms and traditions in pursuit of profits for a few!

I must also note for the record this report's socioeconomic analysis painstakingly skirts the public's interest in ending the trade as it has been measured numerous times; always overwhelmingly in opposition, and always progressing in that sentiment as more time passes.

Finally, I conclude that this piece of busy work adds nothing constructive to the challenge of conserving Hawaii's environment and preserving its iconic sea creatures. After reading its voluminous repetitions of canned responses to hundreds of testimonies, this document has the appearance of having been delivered on order of an industry that knows its days, much like those in the past of the commercial whaling industry, the devastating Sandalwood trade, and the latest retreats from captive animal exhibits, are ending. Likewise, it is time to end this destructive trade now!

Mahalo,

Mark Tang
Hilo, HI

Responses to comments received from Mark Tang
Comment dated September 5, 2018

Comment	Response
I am filing these remarks in response to the recently issued Final Environmental Assessment on the application for issuance of commercial Aquarium permits. The logic of finding "No Significant Impact" and favoring the industry's "preferred alternative" belies the facts on the ground and dismisses the cogent testimony of local stakeholders, concerned visitors, the State Senate Committee on Water and Land, State Division of Aquatic Resources, Office of Hawaiian Affairs and most notably, the plethora of authentic conservation groups in Hawaii. Thankfully, an honorable rendering of its inadequacies has led the accepting authority to further require a more in depth study - a full Environmental Impact Statement.	Comment noted. A DEIS has been prepared.
It is troubling that the documents proffered so far have failed to give any appreciation to the background of complaints and conflicts that led to the need for a change in policy in the first place. Despite unfounded assertions (and circular 'conclusions') that the current Aquarium activities and practices are having no "significant" impacts, the deficient records (only about 50% reporting compliance) and flawed studies (shining examples of sustainability from the Philippines?) and the historical accounts of user conflicts on every island begs to differ! This is a classic example that 'death by a thousand cuts' or in these cases 'flipper crunches' and other routine injuries to living coral colonies (including the symbiotic relationships with fish being extracted!) amounts to a **considerable** and undeniable impact as weighed against leaving the marine organisms unmolested. In a time when the mounting threats to the health of *our* reefs from unavoidable causes such as global warming loom large, *having any impacts that are avoidable and gratuitous can certainly tip the balance to a point of no return sooner than we think*!	Comment noted. As noted in Section 4.4.7.1 of the DEIS, the DAR (2019) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. The environmental consequences of commercial aquarium collection are discussed in Section 5.0 of the DEIS.
It is obvious that carefully crafted limiting alternatives were created to frame the industry's predilection for industrial proficiency and serving consumer demand rather than serving the public interest. As a former Department of Aquatic Resources administrator Frazer McGilvray noted in public testimony before the Board of Land and Natural Resources, "These rules, driven by the demands of the trade, are contrary to good natural resource management...There appears to be no scientific basis for the bag limits for each species. The majority of yellow tang allowed to be taken under this rule are immature and have not contributed to the future of the species."	Comment noted. Additional alternatives have been added to the DEIS. Rulemaking is within the purview of the State of Hawaii.
The applicant also fails to appreciate or detail among the various socioeconomic impacts, the immeasurable value of the marine ecosystem in aesthetic and culturally meaningful terms. The applicant's use of visitor arrival trends and statistics is a poor proxy for the importance of our near shore environment for visitors and residents. In fact, the authors of the document simply dismiss the aesthetic concerns by saying. "the FEAs conclude that the percent of each population collected would be imperceptible to observers." On the contrary! Both residents and long time repeat visitors have testified on being, in many cases, 'shocked' at the perceived deficit of fishes in many memorable places. Perhaps worst of all are the Hawaiian cultural values which are summarily dismissed through blatant disregard. Obviously, there is no "Aloha" in this business! And no Aloha means no Hawaii as it is known around the world!	Comment noted. Impacts to socioeconomics and cultural resources are discussed in Section 5.0 of the DEIS. A Cultural Impact Assessment (Appendix A of the DEIS) has also been conducted. Population trend data are included in Section 5.0 of the DEIS.

Responses to comments received from Mark Tang
Comment dated September 5, 2018

Comment	Response
The drive for unregulated profits in this business over the last few decades has succeeded only in pauperizing our resources while for centuries they had been used for subsistence under wise guidance and management. But, as DLNR's management policies have evolved over time, they appear to have coincidentally begun to value and align more with traditional practices and philosophy again. Now, under the **"hierarchy of uses"** principle, that agency is required to preserve these 'public trust' resources first and foremost. Only a healthy ecosystem may admit to any other succeeding orders of human demands. Public use and recreation is the next step down to consider if no patterns of abuse and damage are resulting. Then, and *only if* and when the other priorities are met can some commercial interests be permitted under the most stringent oversight ***exactly because*** the lucrative and often insatiable demands of capitalism will tempt the participants to cut corners (exceed bag limits), to shirk responsibilities (fail to make required reports), and even try to 'capture' the regulating authorities with political and/or financial favors. This applicant must not attempt to contort this policy and the legal process, ethical norms and traditions in pursuit of profits for a few!	Comment noted. As noted in Section 4.4.7.1 of the DEIS, the DAR (2019) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors.
I must also note for the record this report's socioeconomic analysis painstakingly skirts the public's interest in ending the trade as it has been measured numerous times; always overwhelmingly in opposition, and always progressing in that sentiment as more time passes.	Comment noted. Public support/opposition of commercial aquarium collection is discussed in Section 1.2.3 of the DEIS. In addition, during the public comment period on the Draft Environmental Assessment, a total of 836 responses were received: 435 supported the conclusions of the DEA and issuance of commercial aquarium permits; 398 did not support the conclusions of the DEA and opposed issuance of commercial aquarium permits; and 3 did not express support or opposition. These comments, and the FEA, can be found online here: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf
Finally, I conclude that this piece of busy work adds nothing constructive to the challenge of conserving Hawaii's environment and preserving its iconic sea creatures. After reading its voluminous repetitions of canned responses to hundreds of testimonies, this document has the appearance of having been delivered on order of an industry that knows its days, much like those in the past of the commercial whaling industry, the devastating Sandalwood trade, and the latest retreats from captive animal exhibits, are ending. Likewise, it is time to end this destructive trade now!	Comment noted.

MS. JOJO TANIMOTO
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SEPTEMBER 1, 2018

RE: OPPOSITION TO THE AQUARIUM COMMERCIAL FISHING PERMIT-ENVIRONMENTAL ASSESSMENT (EA).

Dear Sirs:

I am a member of the Hawaii Island Aha Moku Council. I would like to offer my views and perceptions.

In 2012, the Hawaii State Legislature approved ACT 288, which created the Aha Moku Advisory Council (AMAC). This division is located within the Dept. Of Land and Natural Resources (DLNR). The AMAC is support by an island Council; the Hawaii Island Aha Moku Council (AMIC) has members from six traditional District boundaries (Moku)-Kohala, Kona, Ka'u, Puna, Hilo, ad Hamakua. The EA does not recognize the efforts of the AMAC nor the AMIC; which reflect incorrectly the sentiments of those ahupua'a communities.

Hawaii Constitution recognizes two languages: English and Hawaiian. This document heavily relies on the "White List" of fish species. However, this document provides only the scientific and common names of these fishes. The communities and fishing enthusiasts recognize the Hawaiian names of these fishes. This action dis-enfranchises many who are interested parties from participating in this process.

The National Park Service has provided much assistance to the communities by protecting, preserving and restoring the Ala Kahakai Trail system. These historic trails provided important access to the shoreline to engage in fishing activities. Restoration of these trails in current terms once again provide access to the shoreline. This data and the Trail system are missing.

Much is written about the West Hawaii Regional Fishing Management Areas (WHRFMA) and the on-going works of the West Hawaii Fishery Council (WHFC) with regard to sanctuary areas. A) DLNR has yet to research the impacts to neighboring communities in terms of the fishing communities who moved to new grounds to collect fish. This new data is essential in calculating whether fish population can sustain collection for aquarium uses. B) This new data should d determine whether more Kapu regulations are needed, and in what locations.

DLNR also needs to review some of the Policies in place, to recognize the change in methodology for catching fish species. There is little change in protecting and preserving fish habitats from lack of buoys. However, comments to protecting and preserving historic sites (fish koʻa and fish spawning areas) are also lacking in this document.

There is a need for added enforcement personnel for the increased volume of Permits and fish takes. This document offers no address to the issue.

The Aha Moku recognizes that land pollution is a major problem in keeping the fish population in ancestral locations. Rain storms create erosion, cesspools in Naʻalehu and Puako are recognized by the County Environmental Divisions. There are non-descript address to this added conflict of travelling vessels vs shoreline collection, in this document.

Thank you for the opportunity to provide comment. I and the Aha Moku await your reply.

Mahalo

Ms. Jojo Tanimoto
Aha Moku Island Council, Vice-Chairperson

Responses to comments received from Jojo Tanimoto, Aha Moku Island Council
Comment dated September 1, 2018

Comment	Response
In 2012, the Hawaii State Legislature approved ACT 288, which created the Aha Moku Advisory Council (AMAC). This division is located within the Dept. Of Land and Natural Resources (DLNR). The AMAC is support by an island Council; the Hawaii Island Aha Moku Council (AMIC) has members from six traditional District boundaries (Moku)-Kohala, Kona, Kaʻu, Puna, Hilo, ad Hamakua. The EA does not recognize the efforts of the AMAC nor the AMIC; which reflect incorrectly the sentiments of those ahupuaʻa communities.	Comment noted. A member of this group was contacted as part of the Cultural Impact Assessment (Appendix A of the DEIS).
Hawaii Constitution recognizes two languages: English and Hawaiian. This document heavily relies on the "White List" of fish species. However, this document provides only the scientific and common names of these fishes. The communities and fishing enthusiasts recognize the Hawaiian names of these fishes. This action dis-enfranchises many who are interested parties from participating in this process.	Comment noted. Hawaiian names of fish species (where applicable) have been added to the DEIS. A Cultural Impact Assessment has also been conducted (Appendix A of the DEIS).
The National Park Service has provided much assistance to the communities by protecting, preserving and restoring the Ala Kahakai Trail system. These historic trails provided important access to the shoreline to engage in fishing activities. Restoration of these trails in current terms once again provide access to the shoreline. This data and the Trail system are missing.	Comment noted. The analysis area for the DEIS is the nearshore waters and does not include terrestrial lands as no impacts will occur as a result of the proposed action. The impact of commercial aquarium collection on tourism and cultural resources is discussed in Section 5.0 of the DEIS.
Much is written about the West Hawaii Regional Fishing Management Areas (WHRFMA) and the on-going works of the West Hawaii Fishery Council (WHFC) with regard to sanctuary areas. A) DLNR has yet to research the impacts to neighboring communities in terms of the fishing communities who moved to new grounds to collect fish. This new data is essential in calculating whether fish population can sustain collection for aquarium uses. B) This new data should determine whether more Kapu regulations are needed, and in what locations.	Comment noted. The DEIS uses the best available data, including recent population estimates for fish populations.
DLNR also needs to review some of the Policies in place, to recognize the change in methodology for catching fish species. There is little change in protecting and preserving fish habitats from lack of buoys. However, comments to protecting and preserving historic sites (fish koʻa and fish spawning areas) are also lacking in this document.	Comment noted. The Cultural Impact Assessment (Appendix A of the DEIS) addresses cultural and historic resources.
There is a need for added enforcement personnel for the increased volume of Permits and fish takes. This document offers no address to the issue.	Comment noted. The Preferred Alternative in the DEIS includes a limited number of permits issued. Enforcement is within the purview of the State of Hawaii.
The Aha Moku recognizes that land pollution is a major problem in keeping the fish population in ancestral locations. Rain storms create erosion, cesspools in Naʻalehu and Puako are recognized by the County Environmental Divisions. There are non-descript address to this added conflict of travelling vessels vs shoreline collection, in this document.	Comment noted. Cumulative impacts are addressed in Section 5.0 of the DEIS.

September 7, 2018

David Sakoda
Hawai'i Department of Land and Natural Resources
Division of Aquatic Resources
1151 Punchbowl Street, Room 330
Honolulu, HI 96813-30813

Submitted via e-mail: david.sakoda@hawaii.gov

Re: Final Environmental Assessments – Environmental Impact Study Preparation Notices: Issuance of Commercial Aquarium Permits for the Islands of Hawai'i and O'ahu; Request for Consulted Party Status and Participation in Scoping Process

Dear Mr. Sakoda:

For the Fishes, the Humane Society of the United States, Center for Biological Diversity, Conservation Council for Hawai'i, and the other undersigned individuals and organizations (collectively, "Commenters"), are conservation and animal protection organizations and individuals with strong interests in preserving the State of Hawai'i's natural resources and protecting its delicate coral reefs. Commenters submit these comments on the Pet Industry Joint Advisory Council's (PIJAC's, or "Applicant's") Final Environmental Assessments (FEAs) purporting to analyze the environmental impacts of commercial aquarium fish collection on both the islands of Hawai'i and O'ahu and the Environmental Impact Statement Preparation Notice (EISPN) submitted by the Department of Land and Natural Resources (DLNR).[1]

We, the undersigned Commenters, request to be Consulted Parties on any Draft Environmental Impact Statements prepared to fulfill the requirements of the EISPN as a result of the determinations by the DLNR that environmental impact statements are required.

[1] Office of Environmental Quality and Control, The Environmental Notice at 3, 4 (Aug. 8, 2018), http://oeqc2.doh.hawaii.gov/The_Environmental_Notice/2018-08-08-TEN.pdf ; PIJAC, Final Environmental Assessment: Issuance of Commercial Aquarium Permits for the Island of Hawai'i (2018), http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf ("Hawai'i FEA"); PIJAC, Final Environmental Assessment: Issuance of Commercial Aquarium Permits for the Island of O'ahu (2018), http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-OA-FEA-EISPN-Oahu-Commercial-Aquarium-Permits.pdf ("O'ahu FEA").

We concur with DLNR's findings that the significance criteria in HAR § 11-200-12 have been met, and that the preparation of EISs is required to fully analyze the environmental impacts of commercial aquarium collection on both the islands of Hawai'i and O'ahu. The proposed actions have a significant impact on the environment including, but not limited to:

- Involving an irrevocable commitment to loss or destruction of any natural or cultural resource;
- Curtailing the range of beneficial uses of the environment;
- Conflicting with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;
- Substantially affecting the economic or social welfare of the community or State;
- Involving a substantial degradation of environmental quality;
- Cumulatively has considerable effect upon the environment or involves a commitment for larger actions;
- Substantially affects a rare, threatened, or endangered species, or its habitat;
- Affects or is likely to suffer damage by the activity/activities being located in an environmentally sensitive area such as a beach, erosion-prone area or coastal waters.

To this end, we expect the Applicant endeavor to develop fully acceptable EISs prior to the time the EISs is filed with the office, through a full and complete consultation process, and that the Applicant shall not rely solely upon the review process to expose environmental concerns.

We are also requesting to be parties to any public scoping meeting(s) convened to receive comments on the FEA-EISPNs and setting forth the scope of the draft EISs. [2]

Further, we expect our substantive comments on the FEAs, discussed below, to be responded to in writing and incorporated into the draft EIS by the Applicant prior to the filing of the draft EISs with DLNR. We also expect that the responses shall not be merely self-serving recitations of benefits and/or rationalizations of the proposed actions.

In addition, we expect the EIS's to disclose any and all adverse effects on cultural resources and traditional cultural practices, which are set forth in HAR § 11-200-10 and discussed in more detail below.

Finally we also expect the Draft EIS to include discussion and disclosure of climate change impacts, as envisioned by the proposed HAR § 11-200.1-13 Significance Criteria, Criterion 11 (based on the December 2017 Climate Change Mitigation and Adaptation Commission report) to address concerns related to climate change adaptation, such as impacts from increased hurricane frequency and/or intensity, potential endangered species migration, impacts on areas likely to experience wave inundation, increased exposure to hurricanes, or flooding, and further impacts discussed below.

[2] HAR §11-200-15 Consultation Prior to Filing a Draft Environmental Impact Statement.

I. **Introduction**

DLNR has the authority to issue permits for the taking of fish and other aquatic life for aquarium purposes.[3] While these permits are limited in duration to one year, DLNR has not put a limit on the number of animals that can be captured per commercial permit, nor on the number of permits the Agency issues.[4] In fact, in reality, DLNR automatically grants *every* commercial aquarium permit application, and allows the collection of *unlimited* numbers of animals under those permits.[5] DLNR also automatically grants every recreational permit application, and although recreational permits are limited to nearly 2,000 fish per year per permit, the automatic approval of every permit application effectively creates a system of unlimited recreational collection, as well.[6] Furthermore, while commercial collectors are required to report their collections (in practice, inaccurately), there is no similar requirement for recreational permits,[7] and therefore there is no definitive data on how many of each type of fish or other aquatic animal is taken from the State's delicate coral reef ecosystem each year—nor what level of take would be sustainable.

As earlier noted, the FEAs continue to be entirely inadequate under the Hawai'i Environmental Policy Act (HEPA, Haw. Rev. Chapter 343) and its implementing regulations. The environmental impact statements now required by DLNR must adequately address these and other notable flaws remaining in the FEAs:

- The FEAs fail to analyze the impacts of collection beyond one year;
- The FEAs fail to analyze the cumulative impacts of unlimited collection of aquatic life;
- The FEAs fail to analyze the cumulative impacts of commercial collection on the islands of Hawai'i and O'ahu along with collection in other parts of the State;
- The FEAs fail to analyze the cumulative impacts of commercial collection along with recreational collection;
- The FEAs fail to analyze impacts on cultural resources;
- The FEAs fail to analyze reasonable alternatives;
- The FEAs fail to analyze the impacts of harmful collection practices;
- The FEAs rely on inaccurate, misleading, and incomplete data;
- The FEAs fail to analyze mitigation measures; and
- The FEAs fail to incorporate input of Native Hawai'ian groups, experts, and affected citizens.

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[3] Haw. Rev. Stat. § 188-31(a).

[4] Haw. Rev. Stat. § 188-31(a); Haw. Code R. § 13-75-14(4).

[5] *See Umberger v. Dep't of Land and Nat. Resources*, 403 P.3d 225, 300, 304 (Haw. 2017).

[6] Haw. Code R. § 13-75-14(4); *Umberger*, 403 P.3d at 300, 304.

[7] *See* Haw. Rev. Stat. § 189-3; *Umberger*, 403 P.3d at 283, 295.

The Applicant's Preferred Alternatives do not ensure that commercial aquarium fish collection is lawful, responsible, and sustainable for any fish species from nearshore habitats on the Islands of Hawai'i and O'ahu or elsewhere in the state where collection is allowed. The FEAs' continued conclusions that the aquarium fisheries on the Islands of Hawai'i and O'ahu have "no significant impact" on targeted reef fish species, coral reefs, and the human communities that rely on them is unsupportable. EISs are required in order to evaluate the true cumulative effects (both primary and secondary, and both short- and long-term) of the Preferred Alternatives and proper mitigation must be proposed.

II. Cumulative and Long-Term Impacts Inadequately Analyzed

Perhaps the most glaring inadequacy that both FEAs display is their failure to consider cumulative impacts, both short- and long-term. HEPA requires that "agencies shall consider the sum of effects on the quality of the environment and shall evaluate the overall and cumulative effects of an action."[8] Furthermore, the Agency must consider "both primary and secondary" consequences, "and the cumulative as well as short-term and long-term effects of an action."[9] Notably, "cumulative impact" is defined as the impact resulting from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions," and "[c]umulative impacts can result from individually minor but collectively significant actions taking place over a period of time."[10]

A. Failure to Analyze Long-Term Impacts

The Applicant unlawfully limited its analyses to the time period of a single year.[11] PIJAC's reasoning for this is that each permit only lasts one year, and therefore a new EA would need to be completed on an annual basis.[12] However, while Commenters agree that it is critical for the Agency to continue to monitor the impacts that aquarium collection is having over time, the relatively short time period of the activity itself does not nullify HEPA's clear requirement for considering the long-term effects of that activity.[13] For example, a large excavation project could destroy habitat in an area of an island that takes decades to regrow—and even if the excavation itself was only for a year, HEPA would clearly require consideration of the impacts to the environment during the decades of regrowth. Similarly, the use of a pesticide could have known impacts on a species where serious or lethal effects are felt far beyond the time frame of the actual application of the pesticides—yet HEPA would clearly require consideration of those expected impacts. Thus, PIJAC's logic simply does not hold up. Additionally, stating that the Agency can simply reevaluate the consequences of a year-long permit *after* that year is up entirely contradicts HEPA's mandate to evaluate the potential consequences of an action *before* the Agency authorizes the action.

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[8] Haw. Code R. § 11-200-12.

[9] Haw. Code R. § 11-200-12.

[10] Haw. Code R. § 11-200-2.

[11] *See* Hawai'i FEA at 14; O'ahu FEA at 10.

[12] Hawai'i FEA at 14; O'ahu FEA at 10.

[13] *See* Haw. Code R. § 11-200-12.

Additionally, a 12-month timeframe that analyzes impacts is inadequate because the impact of fish removal will accumulate over time. Studies show that catch numbers from the commercial aquarium fishery in Hawai'i have significantly increased over the last few decades and are likely to increase even more.

The number of commercial aquarium permits issued per year has significantly increased over the last 18 years for the Island of Hawai'i (at ~35% per year, p=0.01) and for O'ahu (at ~29% per year, p=0.02) (see Fig. 1, see Appendix 1 for linear model results). In fact, these trends have been observed since the early 1980s.[14] It is likely that the number of commercial aquarium permits issued on the Islands of Hawai'i and O'ahu will continue to increase in the coming years due to the high demand for aquarium reef fish and their increasing market value.[15]

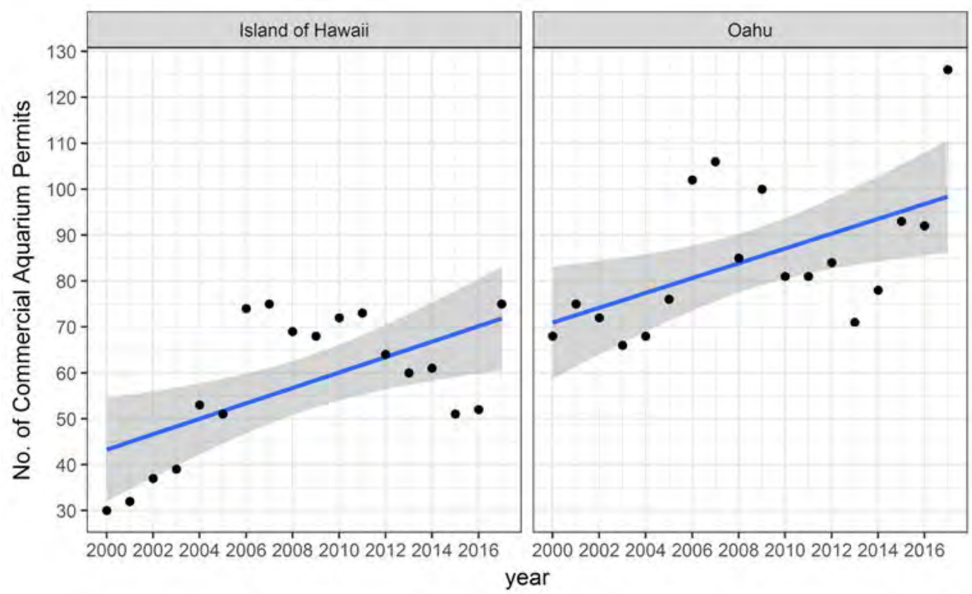

Fig. 1. Number of commercial aquarium permits issued annually for the Islands of Hawai'i (WHRFMA and East Hawai'i combined) and O'ahu from 2000 to 2017. Data from the O'ahu FEA (Table 2, p18) and Hawai'i FEA (Table 3, p21).

In response to this comment, the Applicant claims that the number of permits issued is "[not] necessarily indicative of the number of fish collected," however DLNR data shows a strong correlation between the number of permits issued and the level of catch (Fig. 2). Furthermore, the Hawai'i Supreme Court has made clear that the proper inquiry under HEPA is "the outer limits of what the permits allow . . . ."[16]

[14] Walsh et al. (2004); Friedlander et al. (2008); Walsh et al. (2014).

[15] Friedlander et al. (2008); Stevenson et al. (2011).

[16] *Umberger*, 403 P.3d at 294.

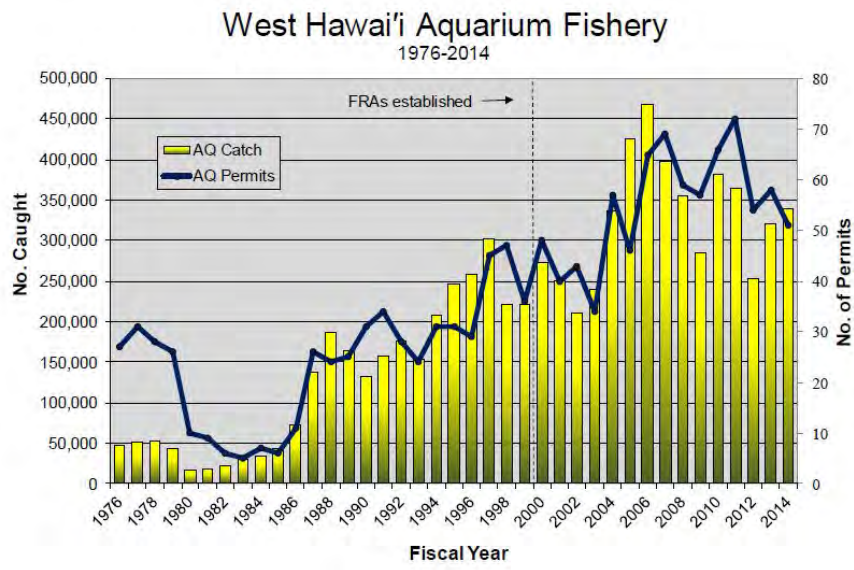

Fig. 2. Number of aquarium animals collected and number of commercial aquarium permits in West Hawai'i for Fiscal years 1976-2014.[17]

The relationship between the number of participants in a fishery and impacts to fish populations is well-established in the literature. The importance of restricting access to fisheries has been acknowledged and used for thousands of years to conserve and help sustain fish populations.[18]

The FEAs failed to take into account how increasing demand and increasing market value will affect already depleted targeted reef fish species in the coming years, thus result in significant environmental impact. For example, the market value of tropical reef fish (e.g., Yellow Tang) has increased and thus collection/fishing pressure is likely to increase in the near future. The commercial aquarium fishery in Hawai'i reports annual landings of over 579,000 organisms (fish and invertebrates combined).[19] The number of aquarium fish caught on the island of Hawai'i since 1976 has substantially increased by 645%.[20] Similarly, the adjusted value of the Hawai'i Island aquarium fishery increased by over 280% between 1976 and 2003.[21] This relationship must be analyzed in the EISs and permitting must be adjusted accordingly to account for populations declines. The FEAs' claim that the high fecundity and long lifespans of reef fishes combined with the limited targeting of adult brood-stock by the trade removes the certainty that the losses will accumulate over time is false. Studies show that populations of heavily targeted species, such as Yellow Tangs, are neither annually replenished, nor restored over time to their natural levels of abundance. On the contrary, they have been severely depleted over time, especially in the areas where they are collected. While the Hawai'i FEA noted that for Yellow Tang and *kole*, which represent two of the top three collected species, population trends are stable or increasing, it failed

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[17] DLNR (2014).

[18] Dewees and Weber (2001).

[19] DLNR Catch Reports.

[20] Walsh et al. (2004); Friedlander et al. (2008).

[21] Walsh et al. (2004).

to acknowledge that the increase in fish abundance is due to an anomalous recruitment pulse that coincided with warming waters in 2014.[22] Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines. [23]

The FEAs' failure to discuss the effects of the aquarium fishing industry beyond a one-year period is not only a legal flaw but also one of the main reasons that the FEAs do not find a significant impact of the aquarium fishing industry on targeted species and their habitat. By limiting the timeframe of their analysis to a single year, the FEAs have entirely failed to consider the impacts of one-year collection permits cumulatively with other "past, present, and reasonably foreseeable actions" "over a period of time." [24]

B. <u>Failure to Analyze Cumulative Impacts</u>

The FEAs also fail to consider other cumulative impacts. The Hawai'i FEA states that it only analyzes impacts that the aquarium permits issued for the island of Hawai'i will have; similarly, the O'ahu FEA states that it only analyzes the impacts that aquarium permits issued for O'ahu will have.[25] Neither FEA considers the cumulative impacts that permits issued for either island will have cumulatively with permits issued for the *other* island with a FEA—let alone cumulatively with permits issued for islands for which PIJAC conducted *no* FEA (e.g., Kauai and the islands that make up the County of Maui).

Coral reefs in Hawai'i are connected by ocean currents. Carried within these currents are the larvae of Hawai'i's reef fishes which typically settle downstream of the reefs where they originated. Most fishes on Hawai'i's reefs are the result of other fishes upstream of that reef.[26] Fish removed from a reef can re-populate as long as the capacity of the upstream larval reservoir isn't exceeded.[27] For example, the prevailing currents in Hawai'i mean that Hawai'i Island reefs "seed" the islands to the northwest—marine life spreads from the Hawai'i Island to the islands of Maui County and beyond. Reduced populations of reef fishes on Hawai'i Island can seriously impact reef fish abundance in the entire state.

Additionally, the FEAs still fail to even properly address the true nature of what the Applicant is requesting in its Preferred Alternatives. Under the Preferred Alternatives for both FEAs, "DLNR would issue Aquarium Permits for the island of Hawai'i under existing regulation set forth in HRS 188-31," and "DLNR would issue Aquarium Permits for the island of O'ahu under existing regulation set forth in HRS 188-31."[28] In other words, PIJAC's Preferred Alternative is collection of an *unlimited* number of fish and other coral reef inhabitants—the limits of what regulation allows. Additional bag limits, proposed only for Achilles Tangs in the Hawai'i FEA and Flame Wrasses in the

[22] Gove et al. (2016).
[23] Hawai'i FEA Fig. 5.
[24] Haw. Code R. § 11-200-2.
[25] Hawai'i DEA at 14; O'ahu EA at 10.
[26] Noland (1978); Christie et al. (2010).
[27] Noland (1978).
[28] Hawai'i FEA at 34; O'ahu FEA at 30.

O'ahu FEA, fail to limit total catch because these daily catch limits apply to a limitless number of people. Yet, the FEAs still consider only very *limited* collection. HEPA requires that an EA assess the potential cumulative impacts of what State regulations allow, not just what some permittees may claim they *intend* to do with their permits. As the Hawai'i Supreme Court clearly stated, "the properly defined activity for the purposes of the HEPA analysis must encompass the outer limits of what the permits allow and not only the most restrictive hypothetical manner in which the permits may be used."[29] The EISs must address this.

Likewise, although the FEAs purport to analyze impacts cumulatively with those of recreational collection permits, the FEAs still do not account for the fact that the Agency issues a permit for *every* application that is submitted, and therefore the take under recreational permits is potentially unlimited as well.[30] And the FEAs admit that, as there is no required reporting for recreational permits, it is currently impossible to know how many of each species are taken under those permits, and therefore, the impact of collection under these permits on species collected under these permits cannot be quantified.[31] This lack of data must be addressed in the EISs.

The analysis of cumulative impacts must include the impact of the commercial aquarium fishery, regardless of the gear used to capture the marine life, combined with non-aquarium commercial and recreational fisheries and other activities that impact population abundance. Commercial and recreational fishing combined with the aquarium fishery have a substantial impact on targeted species. The EISs must determine cumulative impact of all fishing on target species. In addition, the EISs must analyze indirect impacts from collection such as vessel traffic and accumulated reef damage due to vessel anchoring and collection practices.

As noted earlier, the EISs must also evaluate the potential of cumulative impacts of climate change (warming, coral bleaching, and ocean acidification) on targeted fish species such as decline of coral coverage which have been demonstrated to influence reef fish species diversity and abundance.[32] The FEAs recognize that climate change poses serious threats to Hawai'i's coral reefs and the species targeted by the Applicant, yet ironically claim that climate change impacts coupled with the impacts of implementing the three proposed alternatives are expected to be less than significant. These statements completely deny the research and data that demonstrate what is stated, that climate change impacts, specifically ocean warming, acidification and coral bleaching events will continue, thus further analysis of impacts and exacerbation of impacts due to climate change is required.[33]

It is clear from an analysis of cumulative impacts that many of HEPA's "significance criteria" apply.[34] Most directly, the proposed actions will likely have a significant effect on the environment due to at least: the loss or destruction of natural and cultural resources; curtailing the range of beneficial uses of the environment; substantial degradation of environmental quality; cumulative

[29] *Umberger*, 403 P.3d at 294.
[30] Hawai'i DEA at 88; O'ahu DEA at 60.
[31] Hawai'i FEA at 98; O'ahu FEA at 73.
[32] Jones et al. (2004); Friedlander et al. (2018).
[33] Hawai'i FEA at 104; O'ahu FEA at 77.
[34] Haw. Rev. Stat. § 11-200-12(b).

effects on the environment; and potentially substantially affecting rare, threatened or endangered species, or its habitat.[35] The scope of the EISs must address these effects. The scope must include a temporal baseline that captures the impacts of collection pressure over time, before the natural populations of targeted species were depleted by this activity. Proper examination of the magnitude of the effect of aquarium collecting on natural populations and the coral reef ecosystem over time requires a look-back period that in the very least begins in 1953 when the aquarium permits were authorized by the state.

III. **Statewide Impacts Inadequately Analyzed**

Environmental impacts from aquarium trade activities have been documented for over forty years. Under the Preferred Alternatives, every fish and marine creature, other than corals and those associated with live rock, could be removed from one, or all, of the State of Hawai'i's reefs—with catastrophic effects. This is not speculation: there is currently no law, regulation or enforcement capability that would prevent this from occurring. The potential for unlimited collection is a fact that encompasses the outer limits of what the aquarium permits allow, as was explained earlier.

Collecting individual species in high numbers poses a significant threat to coral reef health. As explained herein, herbivorous species, such as Yellow Tangs and Goldring Surgeonfishes, are the most heavily targeted.[36] Herbivorous fish are essential to avoid algal overgrowth of corals and concomitant degradation of the reef.

Hermit crabs are also collected in large numbers despite being essential to ecosystem health. Other important functional groups include: planktivores (e.g. Hawai'ian Dascyllus), corallivores (e.g. Fourspot Butterflyfish, Multiband Butterflyfish), fish predators (e.g. Hawkfishes, Hawai'ian Lionfish) and cleaner fishes (e.g. Hawai'ian Cleaner Wrasse). The collection of large numbers of invertebrates including hermit crabs and shrimps that are grazers, scavengers, or cleaners, could potentially have serious ecosystem impacts including reduced resiliency to other threats.

The reduction of natural populations of species taken by the aquarium trade in any area (e.g. specific site, zone, coastline, island or statewide), and by any amount, whether one or one hundred percent, indicates an irrevocable commitment and loss of a natural and cultural resource.[37] This very loss curtails the range of beneficial uses that would otherwise be provided by the natural abundance of these populations.[38]

As has been long recognized,

> The impact of commercial aquarium fish collecting is a complicated issue. The fish community members are highly dependent on one another. There is a constant interaction between predators and competitors, as well as other members of the food web. There is a lot of variability in the system, even when it is not disturbed by man.

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[35] Haw. Rev. Stat. § 11-200-12(b)(1), (2), (7), (8), (9).

[36] DLNR Catch Reports.

[37] Haw. Rev. Stat. § 11-200-12(b)(1).

[38] Haw. Rev. Stat. § 11-200-12(b)(2).

Reefs seem to undergo natural cycles. At times they may be very abundant. There is also natural variation in the fish community at different locations.[39]

The EISs and any discussion of "sustainable" must include the high aesthetic value of this beautiful marine life as well as impacts to the complex relationships inherent in coral reef ecosystems and impacts to overall coral reef health. "Animal communities" are included in the rule definition for "environment," however the FEAs still exclude any mention of the impact to fish and invertebrate communities.

The Hawai'i State Wildlife Action Plan (SWAP) states that "Excessive extractive use constitutes a threat to wildlife. Certain reef fishes are harvested for sale in the aquarium trade . . . These activities are not sustainable on a large scale and impact native wildlife."[40]

A. General Impacts on Targeted Species

The list of species of greatest conservation need includes at least 18 native fish species that are threatened by the aquarium trade and in need of conservation actions to reduce the risk of extinction (depicted in Fig. 3).

Fig. 3. Native fish species threatened by the aquarium trade.[41]

Butterflyfishes are among the most beautiful of coral reef fishes (see Fig. 4). Their bright yellow, white and black markings are especially striking against pale corals and deep blue waters. When encountered by snorkelers/divers the beauty of these species is often breath-taking. They are

[39] Noland (1978).
[40] DLNR, SWAP (2018).
[41] DLNR, SWAP (2018).

heavily targeted by the aquarium trade in Hawai'i. In 1976 five of the top ten most collected species were butterflyfish (see Fig. 5).[42]

Fig. 4. Most heavily targeted butterflyfishes on Hawai'i reefs, statewide: Fourspot Butterflyfish, Longnose Butterflyfish, Teardrop Butterflyfish, Forcepsfish, Multiband/Copperband Butterflyfish.[43]

TOP TEN MARINE AQUARIUM FISHES COLLECTED IN HAWAII
(Fiscal Year 1976)

	Species	Number	% of Total Catch	Estimated Value	% of Total Value	Estimated Value Per Fish
1.	*Zebra flavescens* (Yellow manini)	35,006	22	$ 43,235	18	$1.24
2.	*Forcipiger longirostris* (Long-nosed butterfly)	10,022	6	18,718	8	1.87
3.	*Centropyge potteri* (Potter's angel)	9,299	6	17,919	7	1.93
4.	*Acanthurus achilles* (Naenae)	9,233	6	18,920	8	2.05
5.	*Naso lituratus* (Kala)	6,478	4	14,536	6	2.24
6.	*Chaetodon quandrimaculatus* (Fourspot butterfly)	4,925	3	6,997	3	1.42
7.	*Zanclus canescens* (Kihikihi)	4,520	3	8,763	4	1.94
8.	*Chaetodon unimaculatus* (Teardrop butterfly)	4,496	3	6,502	3	1.45
9.	*Forcipiger flavissimus* (Long-nosed butterfly)	4,259	3	6,914	3	1.62
10.	*Chaetodon multicinctus* (Copperband butterfly)	3,623	2	3,343	1	.95
	TOTAL: top ten	91,861	58%	$145,938	61%	$1.67 (avg.)

Fig. 5. Five butterflyfish species were among the top ten marine aquarium fishes collected in 1976, statewide.[44]

[42] Katekaru (1978).
[43] Katekaru (1978).
[44] Katekaru (1978).

Reported aquarium harvest of those same five species has since plummeted (see Fig. 6). The same is true for other heavily targeted butterflyfish species that have been among the top twenty aquarium fishes collected by the trade since 1976.[45]

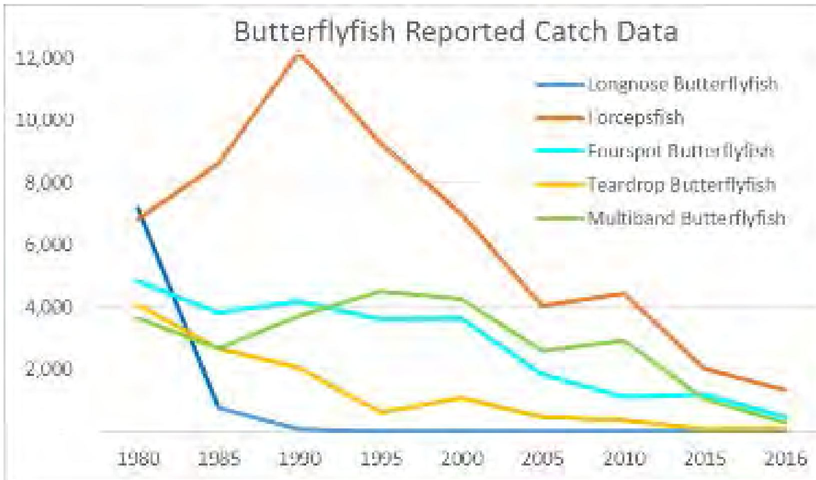

Fig. 6. DLNR reported harvests of the five most heavily targeted butterflyfish species since 1976. Data represents statewide annual average catch over five-year periods.[46]

This sharp decline in reported catch is not an indicator that these species are no longer in demand. Continuing demand is confirmed by several examples:

- These species' inclusion in the West Hawai'i White List.
- Their exclusion from the O'ahu rules.
    - The O'ahu aquarium rule prohibits take of three butterflyfishes, citing their "coral diets" as the need for the restriction.[47] Since 1999 total reported take of those three species was 50 fish.[48]
    - Zero restrictions were provided for three additional coral eating butterflyfishes, with total reported take of over 51,000 individuals since 1999.[49]
- The Fourspot Butterflyfish catch increase that followed the 2014/2015 warming event and unprecedented fish bloom.[50] Subsequently, catch of the Fourspot Butterflyfish declined to an all-time low.[51]

[45] DLNR Aquarium Catch Reports.
[46] DLNR Aquarium Catch Reports.
[47] DLNR (2012).
[48] DLNR Aquarium Catch Reports.
[49] DLNR Aquarium Catch Reports.
[50] Talbot (2014).
[51] DLNR Aquarium Catch Reports.

The scope of the EISs must include a temporal baseline that captures the impacts of the heavy collection pressure on these species over time, before their natural populations were depleted by this activity.

B. Damage to Reef Habitat

In nearly every encounter with commercial aquarium collectors on West Hawai'i reefs, snorkelers and divers have witnessed and documented destructive practices that harm corals, with the most damage coming from vessel anchors and chains. Sticks, buckets, nets, underwater propulsion devices (scooters) are laid in the corals and the fins, knees and legs of collectors often come in contact with the reef—in fact, they are typically described as "crawling across" or "standing" on the corals. The results of these actions include abrasion and coral breakage. Both FEAs refer to a study that determined there was no evidence to indicate the presence of destructive fishing practices (e.g. breaking apart corals to capture hiding fishes).[52] However, the abundance of photographic evidence documenting coral breakage from vessel anchoring and fish capture activities, these impacts cannot be dismissed and must be evaluated in the EISs. Photographs of these practices and their effects can be found at Appendix 2.

Abundant coral reefs—put at risk by the Preferred Alternatives—have a range of beneficial uses. The EISs must adequately address the curtailment of "the range of beneficial uses of the environment."[53]

1. Aesthetic Value

In addition to the impacts to biodiversity, ecosystem function, and other fisheries, aesthetic and other social values are also heavily impacted.[54] Species experiencing the heaviest collection pressure, with a corresponding reduction in natural abundance, are Hawai'i's most beautiful, charismatic and iconic fishes. The diminished aesthetic value from the cumulative and substantial reductions in species such as Yellow Tangs, butterflyfishes and Moorish Idols, which are dominated by vibrant yellows and oranges and striking white and black patterns, cannot be overestimated (see Fig. 7).

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[52] Hawai'i FEA at 89; O'ahu FEA at 68.
[53] Haw. Rev. Stat. § 11-200-12(b)(2).
[54] Walsh, Background on Proposed Hawai'i Administrative Rule 13-60.4 (2013).

Fig. 7. Reefs lacking yellow and orange fishes are greatly diminished in beauty.

These colors are more than aesthetically pleasing, as our eyes are physiologically attuned to them. The frequencies and wavelengths of yellows, oranges and reds allow them to strike our eyes much faster than the other colors.[55]

By removing the species with prominent yellow, orange, red or white coloration and markings, the palette and very essence of what makes a coral reef beautiful to the human eye is diminished and degraded. It is impossible to decrease populations of a coral reef's beautiful wildlife without greatly decreasing the natural beauty of the place. Divers who have frequented these coral reefs, such as some of the Commenters, have noticed decreased abundance of colorful fish in recent years. The EISs must acknowledge and address these cumulative losses and propose proper mitigation measures.

2. Property/Amenity Value

The EISs must acknowledge and address the effects of the trade on the amenity/property values and propose proper mitigation measures. Houses that are within a block or 100 meters of beautiful, clean and healthy coastlines, beaches and coral reefs are more valuable and sell for significantly higher prices than comparable properties elsewhere. The same is true for condos and hotels/hotel rooms which generally command higher room and occupancy rates. Healthy coral reefs are also more likely to prevent beach erosion and, therefore, add value as a form of coastal protection. One and a half percent of the sale price of these properties is attributable to the marine ecosystem. Hawai'i's reef-related property value in 2001 was calculated at $40 million.[56]

3. Recreational Value

The EISs must acknowledge and address the effects of the trade on the recreational value of this marine life and their coral reef homes and propose proper mitigation measures. The annual estimated expenditures related to marine life viewing (i.e. snorkeling and scuba) in Hawai'i is $551

[55] Slembrouck (2011).
[56] Cesar et al. (2002).

million. Reef-adjacent marine tourism expenditures (including hotel rooms) within 30 km of the coastline are an annual $680 million.[57]

These amounts exclude the lost value from declining fish abundance which is captured in willingness to pay surveys and summarized below:

- Healthier reefs lead to substantial economic gains.
    - Recreational users are willing to pay higher rates for a healthier marine environment. [58]
    - Snorkel/dive businesses benefit when there are more fish for their clients to see.[59] One recent study showed divers were willing to pay $93 to $110 more to dive with abundant fish life. [60]
- Without new regulations the potential for increasing losses is real.
    - Inability to stem declining reef fish numbers could cause significant losses to dive tourism industry (i.e. reductions in willingness to pay).[61]
    - These consumer surplus losses could range from $1.2 million to $12.2 million annually.[62]
    - Areas with degraded reefs and low fish populations could also see significant losses from a decrease in their share of the global dive market.[63]
    - Anecdotal reports from long-time residents and visitors point to revenue loss already occurring from reduced abundance of beautiful fishes on Hawai'i reefs.

4. Passive Use Value

The EISs must acknowledge and address the effects of the trade on the substantial non-use values of this marine life and their coral reef homes and propose proper mitigation measures. Intrinsic and social values associated with coral reefs are diminished by reduced fish populations. Concern for the marine environment has increased in recent years and people now place tremendous value on coral reef ecosystems. Many people value beautiful and healthy coral reef ecosystems as part of their legacy and responsibility to ensure future generations are able to experience them. A 2011 report for the National Oceanic and Atmospheric Administration (NOAA) estimated the passive use annual value of Hawai'i's coral reef ecosystems through a willingness to pay survey of U.S.

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[57] Spalding (2017).
[58] Davidson et al. (eds.) (2003); FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[59] Davidson et al. (eds.) (2003).
[60] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[61] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[62] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).
[63] FORCE Management Brief #4 for Caribbean Reef Management (P7/2007-2013).

households. The survey included a visual representation of an overfished and an abundant coral reef (see Fig. 8).

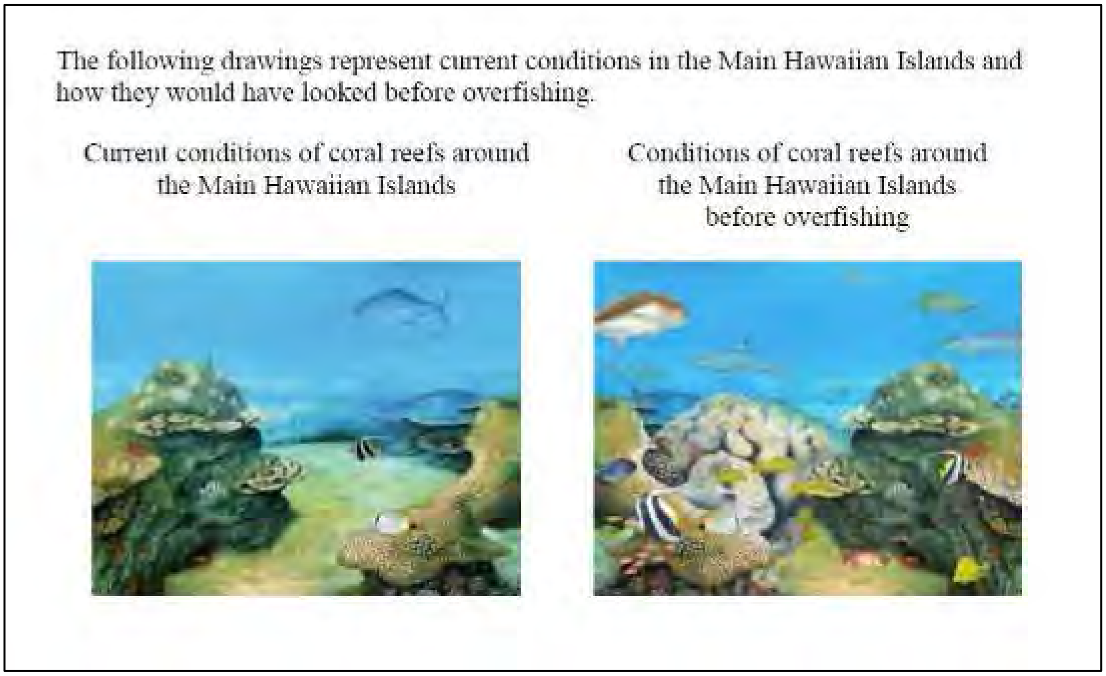

Fig. 8. Survey excerpt: NOAA Economic Value for Protecting and Restoring Hawai'ian Coral Reef Ecosystems.[64]

The project determined that increased protections and restoration of degraded coral reefs in Hawai'i is worth about $288 to the average U.S. household which aggregated over all U.S. households amounts to a $34 billion annual passive use value for Hawai'i's coral reefs.[65] This and other socio-economic values described here provide meaningful insights into the public's concerns and should be addressed in a comprehensive EIS.

C. Impacts to Cultural Resources

As noted earlier and as set forth in HAR §§ 11-200-10 and -16 through -18, a complete analysis and discussion of impacts to cultural resources is required.[66] The EISs must acknowledge and address the direct, indirect, and cumulative impacts on cultural resources. The loss and harm caused by the irrevocable commitment of natural resources equally applies to impacts to cultural resources, as well. The EISs must also acknowledge and address the effects of the trade on Native Hawai'ians traditional reliance on species targeted by the trade for subsistence, such as *pāku'iku'i* (Achilles Tang) and *kole* (Gold Ring Surgeonfish), and propose proper mitigation measures.

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[64] Bishop et al. (2011).

[65] Bishop et al. (2011).

[66] *See also* Office of Environmental Quality and Control, Guidelines for Assessing Cultural Impacts (1997), http://oeqc2.doh.hawaii.gov/OEQC_Guidance/1997-Cultural-Impacts-Guidance.pdf.

The EISs must also acknowledge and address the Native Hawai'ian cultural and spiritual connections to the reef. Examples include consideration of the reef ecosystem and its associated gods and goddesses and their many *kinolau* (divine bodily forms). These gods and goddesses include, but are not limited to, the Goddess *Hina* and her form as *Hina 'Opu Hala Ko'a* who is the goddess of the coral and who gives birth to the reef itself; or, in her moon form which relates to coral spawning events. The Native Hawai'ian ceremonial practices associated with these types of cultural and religious beliefs must be included in the scope of the EISs.

Likewise, many of the particular fish species favored by the aquarium trade also happen to be '*aumakua* (family guardians). The taking of these species obviously adversely impacts Native Hawai'ian cultural and religious beliefs and practices. These aspects must be addressed in the EISs.

"Malama aina involves asking permission prior to fishing, taking only what you need, sharing your catch with your extended '*ohana* or community and having respect for the sacredness of the process. Clearly, harvesting live fish for economic gain and shipping them in a bag for a long, convoluted odyssey, potentially resulting in mortality and waste, violates the very core of these traditional values."[67]

The aforementioned examples were not adequately addressed in the FEAs and serve to highlight that where cultural impacts are concerned, the need for significant analysis remains.

D. Premature Mortality in Captivity and Humaneness Concerns

A major factor that drives the rates of collection is premature mortality rates in captivity. According to a long-time industry insider, most Yellow Tangs die with the first month in a hobbyist tank and fewer than 1% of those captured survive one year in captivity.[68] A 2012 study determined that mistreatment in capture, handling, transport, and holding plays a larger factor in these premature deaths than hobbyist inexperience.[69] Hawai'i's Yellow Tang ranks among the top ten fish sold in the marine aquarium trade.[70] As such, it was prominently featured in the study, in both the consumer survey, as one of the nine fish species featured, and in the supply chain analysis, as one of the eighty-five species analyzed which included eleven other species that are captured both in Hawai'i and elsewhere in the Indo-Pacific.[71] The researchers also determined that each step in the supply chain significantly profits from customer purchases to replace fish that die prematurely, and that profits from replacement fish sales are so high, stores have no incentive to take action to reduce deaths.[72]

A number of practices frequently utilized as cost saving measures by the aquarium trade in Hawai'i are inhumane and significantly contribute to the stressors that accumulate and ultimately lead to premature deaths of captive marine life. They include rapid surfacing and subsequent use of a technique known as "fizzing" to mitigate the resulting barotrauma injury to swim bladders; starving

[67] Tissot (2005).
[68] Fenner, FAQs About Yellow Tangs 4; Fenner. Marine Life Use in the Aquarium Hobby.
[69] Cartwright et al. (2012).
[70] DLNR Aquarium Catch Reports; Rhyne et al. (2015).
[71] Cartwright et al. (2012).
[72] Cartwright et al. (2012).

fish for 2 – 10 days prior to transport and spine cutting. Alternatives to these practices include slow surfacing, transport in larger volumes of water to dilute any waste produced by fishes during transport, and transport in hard plastic containers that cannot be punctured by fish spines.

Every fish that dies early puts extra pressure on natural resources because of the take of replacements. There is a general consensus in many countries that it is not ethical to trade in live animals, unless their health and welfare are ensured. These unnecessary and early deaths have given the trade a poor image. A $20 million, multi-stakeholder reform effort failed, in part, because of trade reluctance to address, and take steps to reduce, mortality rates.

Fifty percent of species among Hawai'i's historical top 20 fish list are either not guaranteed to arrive alive or stay alive longer than 7 – 14 days when purchased from online or "brick and mortar" retailers. Examples are found in Appendix 3.

IV. Area-Specific Impacts Inadequately Analyzed

A. Island of Hawai'i

As mentioned above, reduced populations of reef fishes on Hawai'i Island can seriously impact reef fish abundance in the entire state, as the prevailing currents in Hawai'i mean that Hawai'i Island reefs "seed" the islands to the northwest. There have also been documented impacts of the aquarium trade on the Island of Hawai'i itself.

1. Examples of Impacts Documented in Various Hawai'i Island Regions

Baseline fish population data from the 1970's at Honaunau in West Hawai'i were compared to data gathered in surveys conducted 1998 – 2001. The results indicated that nearly all small bodied surgeonfish, butterflyfish and angelfish (i.e. species targeted by the aquarium trade) declined in abundance. Commercial aquarium collecting was implicated in the decline (see Fig. 9).[73] Similar results were found at Ke'ei where the site had been intermittently surveyed since 1979.[74]

[73] Williams & Walsh (2007).
[74] Williams & Walsh (2007).

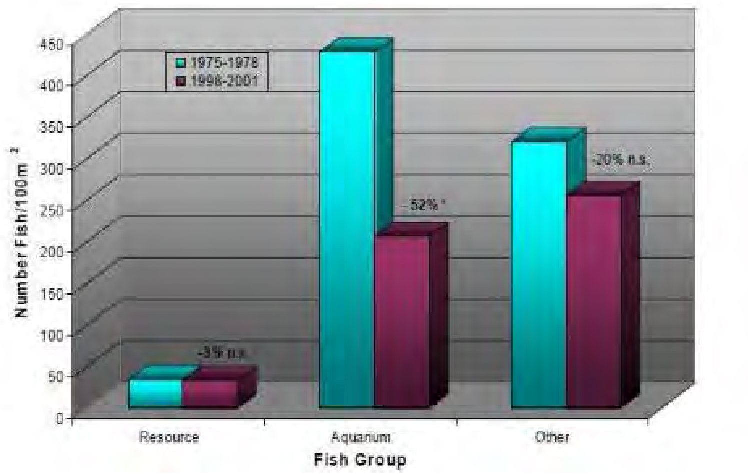

Fig. 9. Comparison of various fish functional groups at Honaunau over two survey periods. *=p<0.05,t-test. [75]

"Of the 20 most collected aquarium species, 18 declined in abundance with the species facing the heaviest fishing pressure typically showing the greatest declines."[76]

In addition to documenting the impact of aquarium collecting in these areas, these studies also document baselines for abundance levels of aquarium targeted and other impacted species. Examinations of reported catch, as documented by DLNR, serve to further highlight the impacts of the trade. [77] The documentation shows that the initial surveys were conducted during a time when the aquarium trade reported taking fewer than 50,000 fish annually from West Hawai'i reefs. In subsequent years, from 1987 to the final surveys in 2001, reported aquarium fish catch in West Hawai'i ranged between 150,000 and 300,000 individuals taken. Since then the annual West Hawai'i aquarium fish catch has ranged between 250,00 and >450,000 fish. Additionally, with the closure of approximately 32% of the reefs in West Hawai'i with the implementation of the FRAs in 2000, this increased fishing pressure was focused in smaller areas with likely intensified results.

Another long-term study looked at reefs in South Kohala and determined that reef fish abundance was in "drastic decline" and reefs were in "dire straits".[78] Populations of all of the top five most abundant fish families had declined since the original surveys conducted in 1979-1981 (see Fig. 10). Thirty-one of the thirty-five most abundant fish species had declined, including 19 species targeted by the aquarium trade. Most of the aquarium targeted species had declined by more than 50% and many were down by more than 80%.[79] The extent to which the massive increase in reported take has contributed to this decline must be studied.

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[75] Williams & Walsh (2007).

[76] Williams & Walsh (2007).

[77] DLNR (2014).

[78] Walsh (2013).

[79] Walsh, unpublished data used as background in South Kohala Reefs in Walsh (2013).

As the Applicant noted in the FEAs' responses to this comment, the "Dire Straits" report concluded that "the widespread declines in families of fish not typically targeted either for food use or for the aquarium fishery suggest that other, more widespread factors are *additionally* contributing to the overall long-term declines in fish abundance."[80][emphasis added] Rather than rebutting the argument that further analysis is needed, this statement only serves to highlight why the EISs must *also* evaluate the potential of cumulative impacts of other factors (e.g. pollution, and sedimentation) on targeted fish species, such as decline of coral coverage, which have been demonstrated to influence reef fish species diversity and abundance.[81]

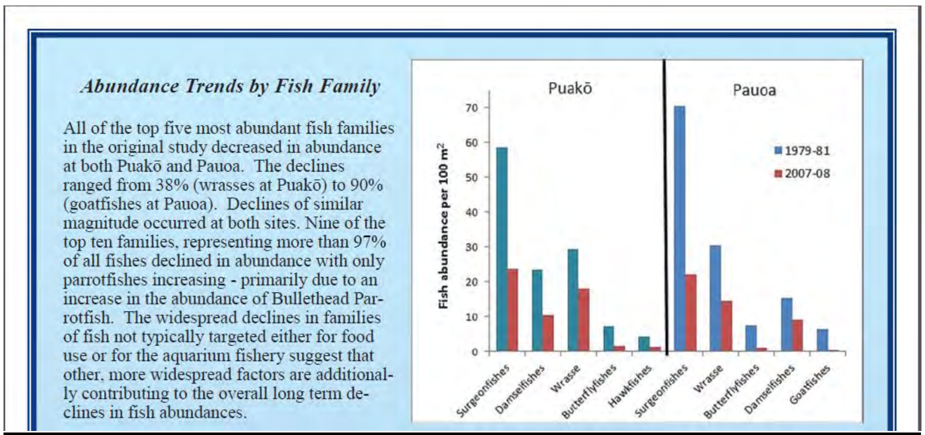

Fig. 10. Drastic declines of the most abundant fish families at two South Kohala Reefs.[82]

The areas south of these reefs are subject to some of the most intense aquarium collecting pressure in the state. Aquarium take between Keahole Point and these reefs in South Kohala, in one year alone, exceeds the aquarium take from the entire Great Barrier Reef in Australia, which has a reef area that is 300 times larger than Hawai'i's. For example, in 2014 aquarium collectors reported taking 191,083 fish from this Hawai'i zone. [83] By comparison, 2014 reported aquarium take from the Great Barrier Reef was 112,000.[84]

Abundant populations of herbivorous fishes are critically important to coral reefs. They keep algae from overgrowing corals or preventing new corals from starting. Important families of herbivorous fishes in Hawai'i include surgeonfishes, damselfishes and parrotfishes. The vast majority of fishes taken by the aquarium trade are surgeonfishes. Yellow Tangs are the dominant herbivore in West Hawaii.[85] They are also the most heavily collected species. The Dire Straits study documented a 90% decline in herbivorous surgeonfish and damselfish populations, while parrotfish populations had actually increased over time.[86]

[80] Hawai'i FEA at Comment No. 833-24
[81] Jones et al. (2004); Friedlander et al. (2018).
[82] Walsh (2013).
[83] DLNR Aquarium Catch Reports.
[84] Queensland Summary Fishery Reports.
[85] Toonen (2011).
[86] Walsh (2013).

This aforementioned 90% decline in herbivores contributed to a 35% reduction in coral cover, a 64% reduction in coral building coralline algae, a 38% increase in algae at one site and a staggering 322% increase in algae at another. DLNR claims that parrotfishes are more important herbivores than surgeonfishes when it comes to keeping algae in check on coral reefs. [87] On these South Kohala reefs, the increased parrotfish populations were not enough to offset the loss of surgeonfishes and damselfishes, and the algae still outcompeted the corals. The notion that surgeonfishes taken by the aquarium trade are not an important component to coral reef health is challenged by this study.

The FEAs attempt to downplay the importance of surgeonfishes and other herbivorous fishes taken by the trade by citing a 2003 study by Tissot and Hallacher (described more in the next section) that found no evidence of increased algal growth in areas of collection versus areas without collection, despite reduced fish abundance in the collected areas.[88] However, the authors concluded that the study may not be a good test of that hypothesis for several reasons and that further investigation is warranted.[89]

Further, a more recent assessment of ecosystem trends in West Hawai'i includes, among other data, the differences in herbivore biomass and coral cover between reefs on the northern portion of the West Hawai'i coast (which encompasses the South Kohala area described above and extends from Keahole Point, northward) and reefs on the southern portion (from Keahole Point, southward).[90] The data shows that herbivore biomass in the north is significantly lower than that found on the south.[91] Additionally, while the northern reefs are now dominated by algae, and coral cover has declined by ~30%, the same not true for the southern reefs.[92] Notably, though the northern area is ~33% smaller than the area to the south, catch reports do not indicate a corresponding reduction in take. In fact, in 2014 take was higher in the north than in the south.[93] The extent to which heavy collection pressure in the north has contributed to this shift must be thoroughly addressed in the Hawai'i EIS.

The FEAs also attempt to downplay the importance of herbivores taken by the trade by claiming that they target the smaller fish which are "the least effective sizes for cropping algae."[94] A comparison of adult Yellow Tang densities in the West Hawai'i long-term protected areas (i.e. MPAs) vs. the Open Areas, shows that collection pressure on small, juvenile, Yellow Tangs has reduced the natural abundance of adults, which are 2 – 4 times larger than juveniles, by an average of 60%.[95]

[87] DLNR (2015); KHON TV (2015).
[88] Hawai'i FEA at 89; O'ahu FEA at 68
[89] Tissot and Hallacher (2003).
[90] Gove et al. (2016).
[91] Gove et al. (2016).
[92] Gove et al. (2016).
[93] DLNR Catch Reports
[94] Hawai'i FEA at 89; O'ahu FEA at 68
[95] Hawai'i FEA at 77 (Table 9).

The fact remains that algae now dominates many West Hawaii reefs, making it essential that the EISs thoroughly evaluate and mitigate any Applicant impacts that occur as a result of reduced herbivory.

2. Examples of Impacts to Species

Two peer reviewed studies documented the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species by the aquarium trade. One, published in 2003 by Tissot and Hallacher, was conducted the two years prior to the establishment of the West Hawai'i Fish Replenishment Areas (i.e. aquarium no-take zones).[96] The next study, by Tissot, et al., was conducted in 2000-2002, three years after those area closures.[97] The results of each study showed that aquarium collectors have a significant effect on the abundance of targeted aquarium fishes (see Fig. 11).

Taxa	This Study	Tissot and Hallacher (2003)
Acanthurus achilles	−56*	−58*
Centropyge potteri	−42*	−46*
Chaetodon multicinctus	−4	−38*
Chaetodon ornatissimus	−7	−39*
Chaetodon quadrimaculatus	−97*	−42*
Ctenochaetus strigosus	−14*	−15
Forcipiger spp.	−55*	−54*
Zanclus cornutus	−49*	−46*
Zebrasoma flavescens	−43*	−47*
Overall	−26*	

Note: Statistical differences in density between reference and FRA sites were tested using a two-sample *t*-test (* = significant at $P < 0.05$). Mean estimates are compared with the study of Tissot and Hallacher (2003), which estimated the effects of aquarium collectors on these species in a previous study in West Hawai'i.

Fig. 11. Effects of aquarium collecting on nine heavily collected aquarium species. Significant declines, ranging from 14% - 97%, were seen in 7 of 9 species.[98]

The U.S. Coral Reef Task Force described these results as follows: "Severe overfishing for aquarium trade occurs even in the United States: Aquarium fishes outside of reserves [in West Hawai'i] experience significant declines – from 14% to 97%."[99]

In a 2010 grant report to NOAA, DLNR documented that "a number of aquarium-targeted species have not responded to the increase in protected areas and have actually decreased in West Hawai'i

[96] Tissot & Hallacher (2003).
[97] Tissot et al. (2004).
[98] Tissot et al. (2004).
[99] U.S. Coral Reef Task Force, Trade Subgroup Report (2005).

since 1999" (see Fig. 12).[100] Per DLNR aquarium catch reports, these species are also among the top 20 most harvested fishes. Nonetheless, all but two species, the Moorish Idol and the Hawai'ian Cleaner Wrasse, were included in the West Hawai'i 40 Species White List adopted in 2014. DLNR therefore calls for the continued harvesting of these species, despite knowing that their populations are in decline.

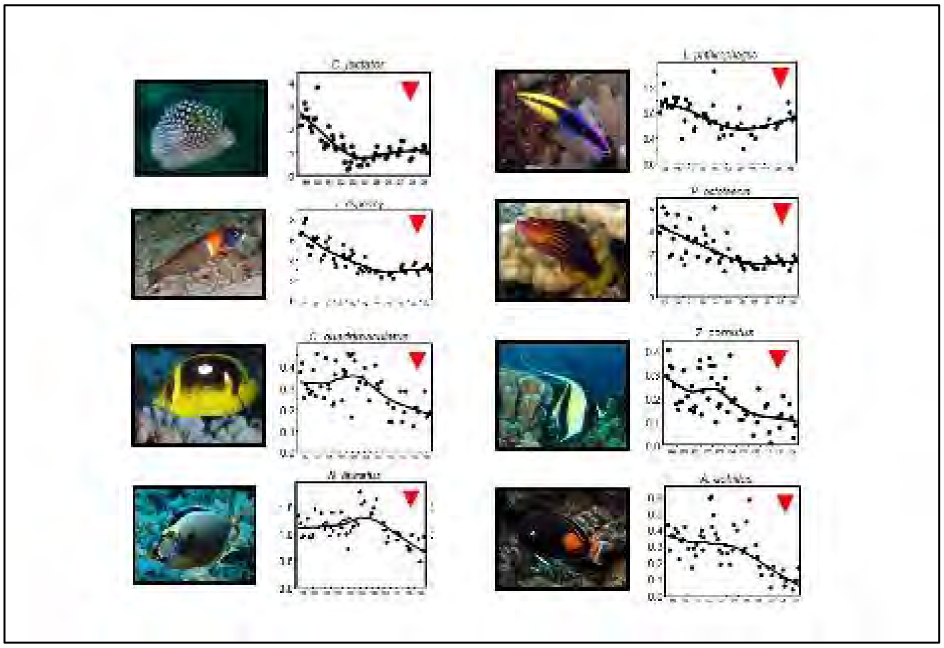

Fig. 12. Example of some targeted aquarium species that failed to respond to FRA's and had decreased along the West Hawai'i coastline from 1999 - 2010 (x-axis = year; y-axis = # 100 sq. meters).[101]

Three species identified in the SWAP, the Bandit Angelfish, Bluestripe Butterflyfish, and Hawai'ian Turkeyfish Figure 4 (in gold outline) were included in a DLNR presentation on West Hawai'i Species of Special Concern (Fig. 3) where two were described as routinely seen in the 1970's and now very rare, and one was described as down by 99% in two different areas.[102]

In West Hawai'i the decline of butterflyfishes has been well-documented in both population surveys and aquarium catch data. A 2008 presentation on West Hawai'i aquarium species of special concern reported declines in butterflyfish abundance and diversity.[103] Two species were particularly hard hit: the Bluestripe Butterflyfish and the Teardrop Butterflyfish, experienced population declines ranging from 89% - 100% in two West Hawai'i areas (see Fig. 13).

[100] Walsh et al. (2013).

[101] Walsh et al. (2013).

[102] Williams & Walsh (2008).

[103] Williams & Walsh (2008).

Fig. 13. Aquarium trade impacts to heavily targeted butterflyfishes and other species in West Hawai'i.

The Bluestripe Butterflyfish is a highly unique, endemic Hawai'ian species that, having no sister species elsewhere in the Indo-Pacific, is also known as a relic (see Fig. 14).[104] Until 1980, this species was among the top twenty fishes collected in West Hawai'i, with an annual average harvest of 347.[105] By 2012, the last year this species appeared on West Hawai'i catch reports, reported harvest had dropped to a total of nine.[106] This species was excluded from the West Hawai'i forty species White List which went into effect in 2014.[107]

Fig. 14. Relic species, Bluestripe Butterflyfish (Photo courtesy of Lynn Allen).

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[104] Randall (1996).

[105] DLNR Aquarium Catch Reports 1976 – 2005.

[106] DLNR Aquarium Catch Report for 2012.

[107] *See* Haw. Code R. § 13-60.4-7.

The 2015 Hawai'i SWAP lists the Bluestripe Butterflyfish among the species of greatest conservation need. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction."[108]

According to DLNR reef surveys and catch data, the Teardrop Butterflyfish has also experienced drastic declines on West Hawai'i reefs (see Fig. 13). This beautiful species is named for the striking upside-down black teardrop located mid-body (see Fig. 4).

Until 1980, the Teardrop Butterflyfish was among the top ten fishes collected in West Hawai'i with an average annual harvest of 1,454 individuals (see Fig. 15).[109] During the following five years, the harvest rate dropped, but it was still among the top twenty species collected (see Fig. 15).[110] Though collection continued until at least 2013, by the late 1990's DLNR considered Teardrop Butterflyfish as no longer targeted by the aquarium trade and excluded them a list of aquarium targeted species provided to researchers, Brian Tissot and Leon Hallacher, who were embarking on a project to document the magnitude of the effect of aquarium collecting on natural populations.[111] They were, however, included in the surveys to test assumptions since they were similar to targeted species.[112] The researchers encountered just one individual Teardrop Butterflyfish during the entire study and so they were excluded from further analysis.[113]

Taxa	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**
Bluestripe Butterflyfish	347	85	269	77	58	12
Teardrop Butterflyfish	1,454	185	508	158	204	185

Fig. 15. Adapted from DLNR Hawai'i Island reported catch data for top 20 aquarium species. Data represents statewide annual average catch over five-year periods.

In 2011 a group of divers encountered an aquarium collector at a popular North Kohala dive site. They watched in horror as the collector scooped up the first Teardrop Butterflyfish they had seen in that area in years along with a number of Yellow Tangs and other fishes (Fig. 16).[114] In 2013, the last year Teardrop Butterflyfish appeared on aquarium catch reports, reported take had dropped to

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108 DLNR, Species of Greatest Conservation Need (2018).

109 DLNR Aquarium Catch Reports 1976 – 2005.

110 DLNR Aquarium Catch Reports 1976 – 2005.

111 Brian Tissot 2010. Email communication with Rene Umberger

112 Tissot & Hallacher (2003).

113 Tissot & Hallacher (2003).

114 Brooke Everett 2011. Pers. Communication with Rene Umberger

a total of ninety, reflecting a 99% drop in annual catch since 1980.[115] This species was excluded from the West Hawai'i forty species White List which went into effect in 2014.

Fig. 16. Teardrop Butterflyfish captured by an aquarium collector on a North Kohala Reef (photo courtesy of Brooke Everett).

The exclusion of any formerly collected species from the White List, such as the Bandit Angelfish, Bluestripe Butterflyfish, Hawai'ian Turkeyfish, Teardrop Butterflyfish, or Thornback Cowfish, is not an exemption for a thorough analysis of their current status within the West Hawai'i Regional Fishery Management Area (WHRFMA) and elsewhere on Hawai'i Island, compared to the baseline (i.e. historic natural abundance), nor does it exempt the need for thorough analysis of impacts from collection efforts elsewhere in the state.

The aquarium fishery in West Hawai'i takes 1.8X more reef fish than recreational and other commercial fishing combined. Most of these fish are Yellow Tangs.[116]

"Overall Yellow Tang abundance in 30'-60' hardbottom habitat in West Hawai'i increased by 355,758 individuals from 1999/2000 to 2010-2012 even though Yellow Tang abundance in the Open areas decreased by 21%. <u>This decrease is attributable largely to an increase in the number of aquarium collectors and collected animals</u> relative to the period when the FRAs were established."[117]

Over sixty percent of West Hawai'i reefs are open to the aquarium trade. On the reefs in those areas, the impact of the aquarium trade on natural populations of Yellow Tangs has been a significant reduction in the abundance.[118] For example, natural populations were reduced by over 75% in

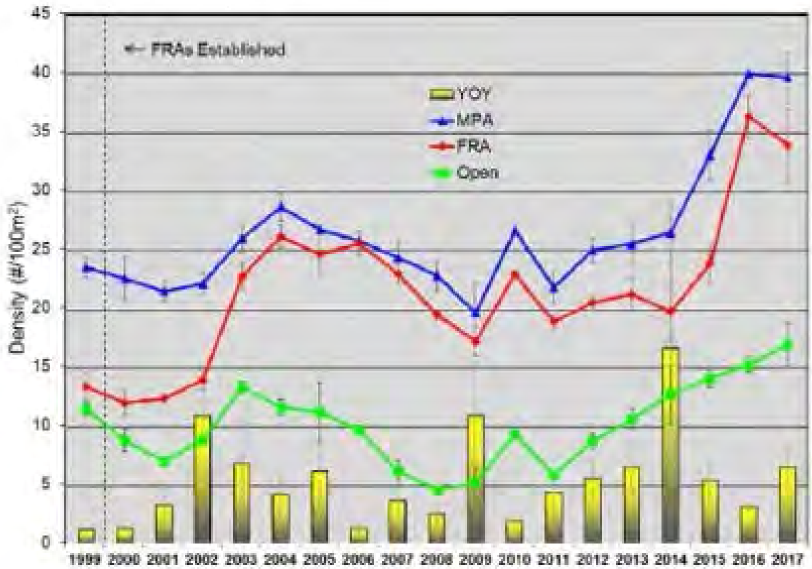
[115] DLNR Aquarium Catch Report for 2013.

[116] DLNR (2014).

[117] Walsh et al. (2013).

[118] Tissot & Hallacher (2003); Tissot et al. (2004); DLNR (2014).

2007-2009 and in recent years, by 60% (see Fig. 17). The increase in FRA Yellow Tang abundance that began in 2002, three years after establishment of these protected areas, is a clear example of the impact of the trade on natural populations: when collection pressure is removed, given enough time, populations may be able to rebound. As noted earlier, the overall increase in Yellow Tang abundance that has occurred since 2014 is due to an anomalous recruitment pulse that coincided with warming waters in 2014.[119] Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines (see Fig. 17).



Overall changes in Yellow Tang density (Mean ± SE) in FRAs, MPAs, and Open Areas, 1999-2017. Yellow vertical bars indicate mean density (MAY-NOV) of Yellow Tang YOY. YOY are not included in trend line data (DAR 2018b).

Fig. 17. Overall changes in Yellow Tang abundance 1999-2017. As shown by the large gap between the green line (areas open to the aquarium trade) and blue line (long term protected areas which serve as a proxy for natural abundance), millions of Yellow Tangs are missing from West Hawai'i reefs.[120]

3. Achilles Tang Conservation Proposed Alternative

We agree with DLNR that the Achilles Tang Conservation Alternative does not provide a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population. Further, in 2014 a bag limit of 10 Achilles Tang per day was imposed on the aquarium trade in an attempt to address declining populations in West Hawai'i. Since 2014, the price has increased, populations have decreased. The FEA proposes to reduce the daily bag limit to 5 per day for commercial aquarium purposes and create a 5 per day bag limit for all consumptive purposes, as well. As with other heavily targeted aquarium species, the natural abundance of Achilles Tangs, as

[119] Gove et al. (2016).

[120] Hawai'i FEA at 79.

indicated by population densities in long-term protected areas such as MPAs, is substantially diminished by aquarium trade collection pressure.[121]

Most importantly, a serious flaw in the DLNR data used by the Applicant to show Achilles Tang catch as a percentage of the Open Area population substantially underestimates the impact of collection pressure. DLNR compared Achilles Tang average reported catch over FY 2013 – 2014 to their CY 2012 – 2013 Achilles Tang Open Area population estimate and determined that catch as a percentage of Open Area population was 32.7%.[122] An examination of catch report data reveals that had they used reported catch from the same time period as the population estimate (i.e. CY 2012 – 2013), Achilles Tang catch as a percentage of Open Area population was substantially higher (see Fig. 18).[123]

Time Period	Achilles Tang Reported Catch	30' – 60' Open Area Population 2012 - 2013	Catch as % of 30' – 60' Open Area Population
FY 2013 - 2014	7,073*	21,627	32.7%
CY 2012	28,649	21,627	132.4%
CY 2013	9,623	21,627	44.5%
CY 2012 - 2013	19,136*	21,627	88.5%

* Averaged

Fig.18. West Hawai'i Open Area population estimate of Achilles Tang based on WHAP and DLNR data and percent of the population taken annually by the aquarium trade at the 30' – 60' depth over CY 2012 – 2013 (adapted from Table 6 in Hawai'i FEA).

This exemplifies the potential for extreme over-collection by the trade; the need for a thorough review of annual reported catch numbers and their relationships to the populations of aquarium targeted species in the areas from which they taken; and, the need for mechanisms for real-time assessments and adjustments to protect these vulnerable species.

B. Island of O'ahu

1. Examples of Impacts Documented in Various O'ahu Regions

Unlike West Hawai'i, no aquarium fish population data was gathered during the early years of aquarium trade operations on O'ahu reefs. More recent data has been gathered in a yet to be published study by Dr. Gail Grabowsky of Chaminade University and is summarized below. Dr. Grabowsky reached the same conclusions reached by Williams and Walsh in a 2007 report documenting declines in populations of certain fishes on two Hawai'i Island reef areas: commercial

[121] Hawai'i FEA at 77 (Table 9).

[122] Hawai'i FEA at 58; DLNR (2014).

[123] Hawai'i FEA at 74, 98, 104; DLNR (2014); DLNR Aquarium Catch Reports.

aquarium collecting is implicated in the declines; and, the greatest declines are seen in the species that have faced the heaviest fishing pressure.[124]

- Using the same methods described in earlier research on Hawai'i Island documenting the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species, Dr. Grabowski and her team quantified the abundance of aquarium collected fish at over 20 sites around O'ahu from 2008- 2010.[125]
- Surveyed species included Yellow Tangs, Forcepsfish, the Hawai'ian "Domino" Damselfish, as well as additional butterflyfishes, surgeonfishes, and other fishes targeted by the aquarium trade.
- The fish population surveys showed that species targeted by the aquarium trade are ten times more abundant at Hanauma Bay, Hawai'i's first marine life conservation district, protected since 1967, than they are on other O'ahu survey sites.[126] As with the Hawai'i Island studies conducted by Tissot and others, uncollected sites were selected as controls and served as a proxy for estimating natural abundance.[127] [128]
- The data also showed that aquarium fish are rare at Pupukea and Coconut Island in Kaneohe Bay, both of which are protected similarly to Hanauma Bay, but unlike Hanauma Bay, are easily accessed by poachers.
- There were no juvenile fish smaller than a silver dollar at Hanauma Bay, which led Dr. Grabowsky to surmise that it may be "that the fish are so depleted on O'ahu that those we see are the "living dead" who cannot effectively maintain a population due to their rarity. This is called the Allee effect and has been documented in other rare species."[129]

In addition to population surveys, catch data can provide an important view into the status of populations of targeted fishes. As explained elsewhere in these comments, using catch data to estimate the proportion of fishing mortality to total population is highly problematic since catch reports are unverified and both underreporting and non-reporting are highly likely. However, where baseline population data are absent, and where consumer demand exists for a particular species or family group, it is highly likely that substantial declines of reported catch reflect reduced abundance of the target sizes—juveniles in most cases—of those species or families Hawai'i's reefs.[130] In fact, historical catch reports have been used to document the collapse of the aquarium fishery on southwest O'ahu reefs after hurricane Iwa hit Hawai'i in 1982 and damaged many

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[124] Williams & Walsh (2007); Grabowsky (2011); Grabowsky (2014).

[125] Grabowsky (2011).

[126] Grabowsky (2014).

[127] Tissot & Hallacher (2003).

[128] Tissot et al. (2004).

[129] Grabowsky (2011).

[130] Walsh et al. (2004).

reefs.[131] Per anecdotal reports from a number of aquarium collectors, the storm destroyed important habitat for Yellow Tangs and other targeted species. This resulted in the migration of many fishes to undamaged coral reef areas. Aquarium collectors then concentrated their efforts on these sites and within a few short years, populations of species targeted by the trade completely collapsed.[132] Referring to these data, researchers noted that since Yellow Tangs are in high demand, these declines reflect the situation on these reefs (i.e. reduced abundance of the small Yellow Tangs targeted by the trade) (Walsh et al. 2004). Catch reports from 2016 confirm that Yellow Tang populations have yet to recover (see Fig. 19, 20).[133]

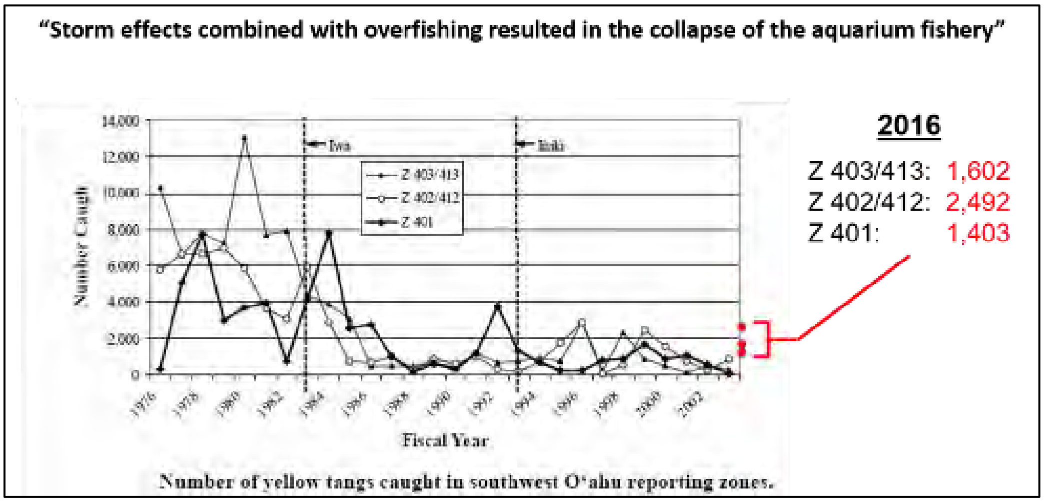

Fig. 19. Catch reports document the collapse of Yellow Tang populations along O'ahu's SW coastline.[134]

131 Walsh et al. (2004).

132 Walsh et al. (2004).

133 DLNR Aquarium Catch Reports 2017.

134 Walsh et al. (2004).

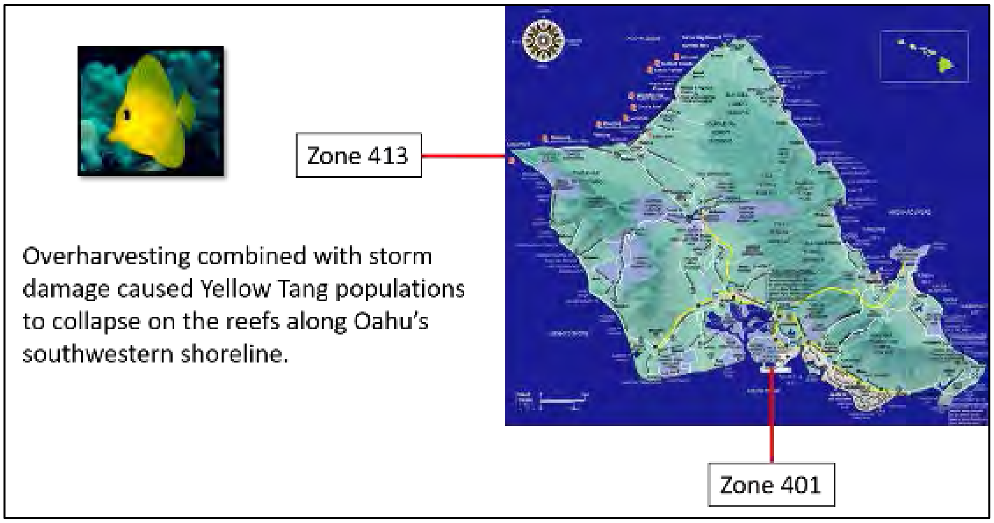

Fig. 20. Map of area encompassed within aquarium catch reporting zones 401 - 413.[135]

2. Examples of Impacts to Species

As previously mentioned, the decline of butterflyfishes on O'ahu has also been documented in the aquarium fish population surveys conducted by Dr. Gail Grabowsky which showed a 90% decline in natural populations of butterflyfishes and other fish species heavily targeted by the aquarium trade.[136]

The Bluestripe Butterflyfish (see Fig. 14) was among the top fifteen aquarium fishes captured on O'ahu through the five-year period that ended in 1995.[137] As of the five-year period that ended in 2015, reported catch had declined by 79% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional 15% (see Fig. 21).[138] As previously noted, the Bluestripe Butterflyfish is listed among the species of greatest conservation need in the 2015 Hawai'i SWAP. Despite this listing and the alarming decline in reported catch, no take limits were placed on this species in the O'ahu Aquarium Rule.

Reported catch of the Teardrop Butterflyfish has also experienced drastic declines on O'ahu reefs (see Fig. 19). During the ten-year period 1976-1985, the Teardrop Butterflyfish was among the top ten fishes collected on O'ahu with an average annual harvest of 2,558 individuals (see Fig. 21).[139] During the following five years, the harvest rate dropped, but it was still among the top twenty species collected.[140] As of the five-year period that ended in 2015, reported catch had declined by

[135] Walsh et al. (2004).

[136] Grabowsky (2014).

[137] DLNR Aquarium Catch Reports.

[138] DLNR Aquarium Catch Reports.

[139] DLNR Aquarium Catch Reports 1976 – 2005.

[140] DLNR Aquarium Catch Reports 1976 – 2005.

94% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional point (see Fig. 21).[141]

The Bandit Angelfish is another beautiful and highly unique, endemic Hawai'ian species with a color pattern unlike that of any other angelfish on Earth (see Fig. 22).[142] The Bandit Angelfish has been among the top twenty aquarium fishes captured on O'ahu on and off since 1976, most recently in 2016.[143] During the five-year period 1976-1980, annual reported catch averaged 1,380 individuals (see Fig. 21). After that, annual reported catch rarely exceeded 600 individuals and from 1996-2005 the average was less than 100.[144] As of the five-year period that ended in 2015, reported catch had declined by 64% from the 1976-1980 high (see Fig. 21).[145]

Average Annual Catch 5 YEAR PERIOD ENDING (except 2016)								
Taxa	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2015**	**2016**
Bluestripe Butterflyfish	2,226	1,886	2,110	1,629	1,079	127	478	124
Teardrop Butterflyfish	2,616	2,499	1,574	485	896	295	160	131
Bandit Angelfish	1,380	541	154	152	77	70	491	559

Fig. 21. O'ahu Reported Aquarium Catch of the Bluestripe and Teardrop Butterflyfish and Bandit Angelfish.[146]

[141] DLNR Aquarium Catch Reports 1976 – 2005.

[142] Hoover (1993).

[143] DLNR Aquarium Catch Reports.

[144] DLNR Aquarium Catch Reports.

[145] DLNR Aquarium Catch Reports.

[146] DLNR Aquarium Catch Reports.

Fig. 22. Bandit Angelfish (By NOAA's National Ocean Service)

Catch reports also indicate increasing consumer demand for this precious species in the landed value data. From 1976-2003 the average landed value for a Bandit Angelfish was $10.[147] By 2004 it had jumped to $54 and in recent years has skyrocketed to $137 each.[148] A similar pattern was noted for Bandit Angelfishes captured in West Hawai'i and prompted University of Hawai'i (UH) and DAR researchers to point out that decreasing catch combined with increasing value signals a real population decline.[149]

Not surprisingly, the Bandit Angelfish is also listed among the species of greatest conservation need in the 2015 Hawai'i SWAP. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction."[150]

The O'ahu aquarium rule established a daily bag limit of two Bandit Angelfishes greater than 5.5 inches in length. Commercial data does not capture fish sizes so the impact of this size limit cannot be determined.

3. O'ahu Aquarium Life Management

Rules governing the take of certain aquarium species on O'ahu were adopted in 2014.[151] The development and adoption of these rules was highly controversial because they were not

[147] Walsh et al. (2004).

[148] DLNR Aquarium Catch Reports.

[149] Williams and Walsh (2008).

[150] DLNR, Species of Greatest Conservation Need (2018).

[151] Haw. Code R. §§ 13-7-1 et seq.

scientifically sound and did not address the concerns of stakeholders outside the aquarium trade.[152] Over 4,000 testimonies were received by DAR, and 98% of the comments preferred that aquarium collecting should end altogether or in the very least should include limits on the number of permits issued, and scientific and community-based limits on species and take levels. Many comments noted that the so-called "limits" allowed take that far exceeded the number of animals historically taken by the trade, and in fact, allowed limitless catch because they included no restrictions on input (i.e. permit limits), and no meaningful restrictions on output (species or take limits).[153]

Among those opposed to the rules was coral reef and marine fisheries biologist, Frazer McGilvray, who was the DAR Administrator at the time. Mr. McGilvray opposed the rules because they were neither based on science, nor were they developed under a multi-stakeholder approach. The written and oral testimony Mr. McGilvray presented to the board governing DLNR included the following:

- "All stakeholders should be consulted and everyone's opinion should be taken into account."
- "There appears to be no scientific basis for the proposed bag limits for each species."
- "The proposed take limits were akin to setting a speed limit at 400 MPH."
- "These rules do not address the take of undersize, sexually immature fish."
- "The majority of Yellow Tang allowed to be taken under this rule are immature and have not contributed to the future of the species."
- "These rules, driven by the demands of the trade, are contrary to good natural resource management."
- "The take of juveniles is generally prohibited" in other fisheries, but not by the aquarium trade.
- "The take of adults is allowed, but only where good management practices govern the take" in other fisheries, but not by the aquarium trade.
- "The taking of 100 immature Yellow Tang per person per day is not consistent with good natural resource management when there are more than 50 licensed aquarium collectors on O'ahu."
- "It is my belief that these rules require further work and are not yet ready for adoption." [154]

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[152] Board of Land and Natural Resources, Minutes (2014); Hawai'i Small Business Regulatory Review Board, Proposed O'ahu Regulations Analysis (2012); Hawai'i Small Business Regulatory Review Board, memo to DLNR (2012).

[153] Hawai'i Small Business Regulatory Review Board, memo to DLNR (2012); Board of Land and Natural Resources, Item F-2 Submittal (2014). October 24, 2014. Item F-2 Submittal.

[154] Board of Land and Natural Resources, Minutes (2014); McGilvray (2014).

The DLNR submittal to the board conceded that the proposed limits were not intended to reduce take, but were, instead, based on animal welfare.[155] This statement does not stand up to scrutiny since no animal welfare experts or groups familiar with the aquarium trade were consulted, and in fact, the concerns of several of these groups were dismissed outright.

The 2014 O'ahu rules also imposed bag limits for certain sizes of three species: a minimum and maximum (i.e. slot) limit for Yellow Tangs and maximum size limits for *kole* (bag limits of two of each size) and Bandit Angelfishes (bag limit of two). While there has been some discussion of the poor survival rates of very small Yellow Tangs, no such discussion was documented for the larger sizes. Finally, because aquarium catch reports do not capture fish sizes, it is impossible to determine or even estimate the impact of a size limit in the aquarium fishery."[156] However, catch reports do show that despite the combined catch, size and vessel limits, Yellow Tang catch in 2015 and 2016 exceeded historical reported catch. This was due to an unprecedented warm water event that bleached and killed many corals, but also brought large numbers of young fishes to Hawai'i's reefs during 2014 and 2015.

4. Other O'ahu Regulated Species and Invertebrates

The O'ahu FEA's discussion of other regulated species describes the Achilles Tang, Bandit Angelfish, and Hawai'ian Cleaner Wrasse as "not collected to the level of the top twenty collected species." [157] However, according to both historical and recent catch data, this is inaccurate. These three species have historically, and recently in one case, been among the top twenty collected species on O'ahu as follows:

- Achilles Tang was among the top twenty during the five-year period that ended in 1985.
- Bandit Angelfish was among the top twenty during the five-year period that ended in 1980 and again in 2014, 2015 and 2016.
- Hawai'ian Cleaner Wrasse among the top twenty during the five-year period that ended in 1980.

Bandit Angelfish have been described earlier, and Achilles Tangs are both a culturally important food source and an important herbivore on the reef. The Hawai'ian Cleaner Wrasse plays a particularly critical role in the reef ecosystem by feeding on parasites, dead tissue and mucus of reef and other fishes (see Fig. 23). In 2008 the West Hawai'i aquarium trade included the Hawai'ian Cleaner Wrasse in its list of Species of Special Concern that should not be captured, citing the key role the play in maintaining the "health of the reef population, as the doctors of the sea".[158] Obviously this species plays a similar role on reefs throughout Hawai'i. This is another clear example of how the dictates of the North American aquarium trade are driving extremely poor management decisions. The cumulative impact of long term sustained heavy collecting pressure on

155 Aila (2014).

156 DLNR, Small Business Impacts Analysis (2012).

157 O'ahu FEA at 41; DLNR catch reports.

158 Walsh, Background on Proposed Hawai'i Administrative Rule 13-60.4 (2013).

these and other species, and its effects on coral reef ecosystems must be fully evaluated and proper mitigation must be proposed in the EISs.

Fig. 23. A pair of Hawai'ian Cleaner Wrasses cleaning a Hawai'ian Hogfish (photo credit: Victoria Martocci).

In addition to fishes, marine invertebrates such as hermit crabs, Feather Duster Worms, sea stars and snails, are taken in very high numbers by commercial aquarium collectors. These invertebrates play a key role in the coral reef environment, and their overharvesting may have serious ecological consequences.[159] The EISs must address the very large numbers of invertebrates that are taken and proper mitigation measures must be proposed.

Concerns expressed by experts about the very high levels of hermit crab collection include:

- "The removal of available shells, a critical resource for hermit crabs, will doom the hermit crab population in any given area; replenishment of shells of all sizes due to natural causes will not be able to keep up with the artificial removal by collectors; hermit crabs are essential to the ecosystem. Not only are they grazers but even more importantly they are detritus feeders and scavengers keeping the ecosystem 'clean'."[160]
- "Collectors do not merely take the crabs, they take also the shells. This amounts to destroying the available habitat for these animals; hermits regularly outgrow their shells and seek new ones, leaving the smaller shells for smaller hermits. When a hermit dies, it leaves its shell for another hermit; taking all the shells will leave no shells for hermits to live in. The population will crash; taking the shells will eventually make shells so uncommon that there are virtually no hermits."[161]

5. Expanded Waikiki MLCD and Flame Wrasse Conservation (Preferred) Alternative

[159] Livengood & Chapman (2007).

[160] Dr. Ernie Reese, UH Professor Emeritus, Biology, Behavioral ecology of coral reef animals. 2008 email communication with Rene Umberger.

[161] John Hoover, Author of Hawai'i's Sea Creatures: A Guide to Hawai'i's Marine Invertebrates. 2008 email communications with Rene Umberger.

The O'ahu FEA proposes to expand the Waikiki Marine Life Conservation District MLCD by 740 acres, and to prohibit only commercial aquarium collection within that expanded area.[162] We concur with the Agency that this alternative is problematic for a number of reasons, including its lack of proper scientific review of the impacts. While it is expected that once collection pressure is removed, there may be a beneficial impact of increasing populations of targeted species, it is also expected that without concurrent reductions in allowable take, populations in the areas open to collection are likely to experience further declines as a result of increased pressure that result from reduced access elsewhere, as has been demonstrated in West Hawai'i.

In addition, the O'ahu FEA proposes a bag limit of 10 Flame Wrasses per day. We concur with the Agency that this proposal lacks a scientific basis for concluding that a bag limit of 10 per day would be sufficient. Not only would the bag limit apply to a limitless number of people, and as such, would neither limit actual take nor would it help to restore or protect populations from increasing collection pressure, it also fails to address the potential for extirpation of Flame Wrasses on coral reefs shallower than 98 feet where collection pressure is the greatest.

As pointed out in the O'ahu FEA, a recent study found zero Flame Wrasses shallower than 98 feet on West Hawai'i reefs.[163] Rather than an indication that Flame Wrasses spend much of their time in deeper waters, an idea forwarded in both FEAs with no reference, the absence of Flame Wrasses in their natural range is more likely an indicator of severe over-collection by the trade in the shallower depths they once inhabited. Flame Wrasses naturally occur at depths over 50 feet. [164] SCUBA divers, including two of the Commenters, have for decades consistently encountered harems of Flame Wrasses at depths ranging from 50 – 90 feet on multiple dive sites, as long as the sites weren't accessed by the aquarium trade. On sites accessed by the trade, Flame Wrasses at those depths have completely disappeared.[165]

Historical catch records indicate that collection pressure on O'ahu populations of Flame Wrasses has dramatically increased: hundreds were annually captured prior to 2008; since then, annual catch has ranged between 1,000 - >4,000.[166] The potential for Flame Wrasses to disappear from shallower reefs around O'ahu, as they have from West Hawai'i, is very real. This increasing collection pressure must be acknowledged and addressed in the EISs.

V. Reliance on Inadequate Science and Data

A. Flawed Threshold for "Sustainable" Collection

The applicant continues to base both FEAs on the premise that fish collection is considered sustainable if only removes less than 5% to 25% of the entire population (annually), but the reasoning behind this threshold is flawed. The FEAs stated that "research suggests that collection

[162] O'ahu FEA at 13.
[163] O'ahu FEA at 35.
[164] Randall (1996); Hoover (2008).
[165] Observations communicated by Rene Umberger, Mike Nakachi, Lynn Allen, Warren Blum, all SCUBA instructors with tens of thousands of dives between them
[166] DLNR catch reports.

between 5% and 25% of a reef fish population is sustainable for various reef fish species in the Philippines that are similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, and triggerfish)" based on a *Reef Check* report by Ochavillo and Hodgson (2006).[167] However, the EISs should not use these thresholds because:

- These thresholds for sustainable ornamental fish collection are species–specific based on estimated natural mortality rates (M) and fishing mortality at maximum sustainable yield (F_{MSY}) or year-per-recruit analysis. Natural mortality rates for reef fishes are based on growth rates and length and thus are also area-specific. Mortality is based on catch data. Yield-per-recruit analysis should be derived from several annual surveys. Thus, these parameters should be specifically calculated for Hawai'ian reef fish targeted by the aquarium industry as highlighted in Ochavillo & Hodgson (2006).

- The 5%-25% threshold indicates "a good rule-of-thumb of collection limit" for coral reef fishes in the Philippines.[168] This does not mean it is a good rule of thumb for collecting reef fishes in Hawai'i.

- Most ornamental fish species in Ochavillo and Hodgson (2006) are species different from those on the White list. Only a few species share the same genus or species (butterflyfish, a couple of wrasses, one angelfish, a couple of damselfish, one tang and one triggerfish). Thus, it is questionable whether this fairly wide threshold (5%-25%) is representative and applicable to Hawai'ian species.

- Finally, this report is not peer-reviewed research, it is a field manual: Marine Aquarium Trade for Coral Reef Monitoring Protocol with a Data Analysis and Interpretation Manual. This field manual was designed in part to: "provide a scientific basis for recommending sustainable levels of collection."[169]

The FEAs continue to assume that current fish abundance for target species is the baseline, and thus 1% to 5% of individuals removed from the population would be considered sustainable. But this is wrong. The FEAs still do not acknowledge that current population abundance of most of these fish species is already depleted due to in part to heavy exploitation by the aquarium trade since at least the 1970's and habitat degradation. The total allowable collection/catch for each species must be calculated based on information on natural mortality rates and the available and limited information on collection/catch records, specific to the geographic areas and locations where they are taken throughout the state.[170]

B. Unrepresentative Data Used

The Coral Reef Ecosystem Program (CREP) data used in the FEAs for the entire Islands of Hawai'i and O'ahu (based on 2010-2016 surveys) continue to not be representative of regional population

[167] Hawai'i FEA at 95; O'ahu FEA at 70.
[168] Ochavillo & Hodgson (2006), at 12.
[169] Ochavillo & Hodgson (2006).
[170] *See* Ochavillo and Hodgson (2006) for step by step guidance on how to do this analysis.

abundance such as in East Hawai'i and the WHRFMA, and should not be used to estimate regional proportions of fish catch.

Population abundance estimates for fish species for the entire island of Hawai'i[171] are not representative of regional fish abundances such as East Hawai'i and WHRFMA. The CREP data collect fish data from 257 stationary point count locations around Hawai'i between depths of 0-98 feet. In contrast, the West Hawai'i Aquarium Project (WHAP) collected data from 25 transect survey sites from WHRFMA area between depths of 30-60 feet.

It is well established that population abundances of reef fish species in Hawai'i, especially relatively small-size species that are targeted by the aquarium industry, are highly variable in space depending on reef complexity, depth and wave exposure, and in time (within and among years) depending on the season, mortality, recruitment to the population, and environmental factors.[172] The relative proportion abundance of fish species taken annually by the aquarium industry should be based on regional total abundances and regional catch records (e.g., aligned with the aquarium fish trip report zones). Allowable levels of take should be determined in conjunction with the wishes of Hawai'i residents and visitors who strongly desire that fish populations are restored to their naturally occurring (i.e. unfished) levels of abundance on the majority of Hawai'i reefs.

The FEAs continue to assume that current island-wide and regional targeted fish population estimates are healthy and not impacted and this represents a shifting in baselines. Population abundance of most of these fish species has declined over the past decades due to overexploitation and habitat degradation and thus they cannot be considered baselines. Strong scientific evidence shows that coral reefs of the main Hawai'ian Islands, especially near higher human population densities (where exploitation pressure is the highest), have significantly less abundance and biomass of reef fish species than more isolated islands due to overfishing.[173]

The allowable number of individuals that could be collected from aquarium fish populations must be substantially less than those stated by the FEAs because most of these species are already depleted. Fishing effort has substantially increased for aquarium fish species on the Island of Hawai'i as well as for certain species, such as Flame Wrasses, on O'ahu.[174] Prime-targeted species on both islands have significantly declined due to overharvesting.[175] For example, population abundance of one of the most heavily exploited species, Yellow Tang (*Zebrasoma flavescens*), on the west coast of the Big Island of Hawai'i (West Hawai'i) declined 45% due to exploitation in areas open to fishing/collection from 1999 to 2007.[176] Yellow Tang abundance is closely tied to annual levels of recruitment, and after good recruitment levels from 2008 – 2013, Yellow Tang abundance in the Open Areas improved, but was still 4.7% lower than the 1999 – 2000 Open Area baseline.[177]

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[171] CREP (2018).
[172] Friedlander & Parrish (1998a, 1998b).
[173] Friedlander & DeMartini (2002); Williams et al. (2008); Nadon et al. (2015); Nadon (2017); Friedlander et al. (2018).
[174] DLNR Catch Reports.
[175] Williams et al. (2009); Walsh et al. (2004).
[176] Williams et al. (2009).
[177] 2015 Report to the Legislature.

As noted earlier, an anomalous recruitment pulse in 2014 is likely behind the increase in abundance seen since then.[178]

Even when including marine managed areas (MMAs) such as fish replenishment areas (FRA), where collection is prohibited and abundances are five times higher than in open areas, the population abundance of Yellow Tangs on West Hawai'i is substantially less than historical levels.[179] The established networks of MMAs have definitely worked to increase Yellow Tangs and some other fish species in the West Hawai'i FRAs,[180] but not all species have responded positively, and some have actually decreased overall since the FRAs were established. The extent to which collection pressure—whether in the Open Areas or due to poaching—is driving the decline of heavily targeted aquarium species in the areas closed to the trade must be studied. While the FEA attempts to minimize the impacts of collection pressure by proposing that "factors other than aquarium collecting [are] also affecting their populations," it remains highly likely that the main cause is collection pressure [181] An example of the effect of collection pressure on populations in MMA's is found in the significant decline of Yellow Tangs in those areas from 2004-2009 which coincided with Yellow Tang reported catch during that period that was substantially higher (e.g. in 2004 and 2006 it was more than double that reported in 2002).

Given the relative long life-span of Yellow Tangs (>40 yrs.) and increasing fishing intensity, these MMAs are just becoming sources for the aquarium fishing industry. The recovery of this species to past levels is unlikely if fishing/collection intensity continues or increases in the future.

The commercial aquarium fishery in the Island of Hawai'i has grown over the last three decades, particularly after the O'ahu aquarium fishery substantially declined in the early 1990s due to hurricanes and localized overfishing.[182] It is thought that the expansion of the Island of Hawai'i aquarium fishery was due to new collectors and relocation of collectors from O'ahu.[183] Scientific evidence shows that collecting activities substantially affect targeted species in Hawai'i[184] and fishing intensity remains high even when stocks are depleted or recruitment is weak.[185]

Therefore, the current estimates of population abundance of fish species for the entire Island of Hawai'i (from 2010 to 2016)[186] should not be used as regional/local reference abundances (e.g., East Hawai'i, WHRFMA) to estimate minimum and maximum percentage of fish taken per year.[187] This is because these calculations underestimate the proportion of fish collected by region (East and West Hawai'i) and assumes fish populations of the entire Island of Hawai'i are distinct or discrete. A more accurate calculation of allowable catch would be based on regional population

[178] Gove et al. (2016).
[179] Williams et al. (2009).
[180] Tissot et al. (2004); Williams et al. (2009).
[181] Hawai'i FEA at 60, 99, 101.
[182] Walsh et al. (2004); Friedlander et al. (2008).
[183] Friedlander et al. (2008).
[184] Tissot & Hallacher (2003).
[185] Stevenson et al. (2011).
[186] CREP (2018).
[187] Hawai'i FEA, Tables 10, 11, 12, 13, 14, 15.

abundance, using the aquarium trip report zones, and by using the WHAP data estimates obtained from the depth ranges where the fishes are captured, rather than by regions.

Finally, sustainable fishable abundance for target species must take into consideration the fact that most target species are depleted in comparison with historical levels. The EISs must take into account these depletions to determine the number of individuals that could be taken from the populations. The EISs must analyze the impact of collection/fishing on current population abundance and consider that these populations are far below the historical baselines.

C. Catch Is Grossly Underreported

As mentioned above, there is no requirement for recreational aquarium collectors to report catch. For commercial collectors, while reports are required, catch report compliance is substantially low on the Islands of Hawai'i and O'ahu and thus catch records grossly underestimate the real impact of the aquarium fishery.

The number of permits reporting catch in the islands of Hawai'i and O'ahu was approximately half of the number of commercial aquarium permits issued annually from 2000 to 2017. On average, 47% (40 out 85) of commercial aquarium permit holders reported their catch between 2000 and 2017 in O'ahu.[188] Similarly, on average, 56% (33 out 59) of commercial permit holders in the Island of Hawai'i (WFRFMA and East Hawai'i combined) reported their catch during the past 18 years (see Table 3 in the DEA of Island of Hawai'i). Although commercial aquarium fishers are required to report their monthly catch on an aquarium fish catch report, the compliance is clearly significantly low. This is a systemic problem that undermines the evaluation of the real impact that the aquarium fishery has on target species, the coral reef ecosystem, and the people that depend on them in Hawai'i. As such the impact of the aquarium fishing industry is likely larger than is reported, which has been discussed in the scientific literature.[189]

As a former DLNR employee succinctly wrote regarding aquarium catch reports: "The reliability of the data depends upon the sincerity of the permittees."[190] There is no verification system, such as that provided by independent observers, to ensure the accuracy of self-reported data. One additional major impediment to accurate data stems from the lack of a license requirement for marine dealers and/or exporters. Currently there is a requirement for dealers (i.e. those who buy directly from aquarium collectors) to report their purchases. According to DLNR, the effect is that "dealer reporting is essentially on a voluntary basis and a few dealers are not reporting in whole or in part.[191] DLNR cannot know whether a "few" or a dozen dealers are not reporting, but without a requirement for these businesses to have licenses, these businesses operate beneath the radar and serve as a conduit for moving unreported catch out of the state.

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[188] *See* O'ahu DEA, Table 2.

[189] Friedlander et al. (2008).

[190] Katekaru (1978).

[191] DLNR (2014).

Establishing a marine dealer/exporter license has long been a priority for those within DLNR concerned about Hawai'i's marine resources, because it would enable the department to verify catch reports, identify unlicensed collectors (and all commercial fishers), identify dealers and helped with generating economic data about the fisheries. Without this information DLNR/DAR has no accurate data on health of fish populations. According to a former DAR Commercial Fisheries manager, Karl Brookins, the process of establishing the license was abandoned due to lack of funding.[192]

In addition, the combined average of total fish and invertebrates collected under aquarium permits from East Hawai'i and the WHRFMA annually from 2000-2017 should not be used as reference for future annual collections. The lack of collection data for East Hawai'i from 2001 to 2004 lowers the calculated average and underestimates the number of fish collected.[193] A more accurate estimation is to use data collected after 2005 when collection data from East Hawai'i resumed. As such the combined average fish and invertebrates collected under Aquarium Permits from East Hawai'i and the WHRFMA annually from 2005-2017 was 392,006 individuals instead of 355,381 (see Fig. 24). This updated estimate, which accounts for 36,625 more individuals, along with a value representing underreporting, should be used as the reference point for the Hawai'i EIS to calculate proportion of the population that is being taken by the fishery island wide. We note that Table 8 in the Hawai'i FEA has *not* "been updated to exclude any years without data in the averaging for East Hawai'i data," as stated in the Applicant's response.[194]

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[192] Clark & Gulko (1999); Brookins, K., DAR commercial fisheries manager, personal communication to author R. Umberger (October 7, 2008).

[193] See Hawai'i DEA, Table 8.

[194] Hawai'i FEA at Comment No. 833-49.

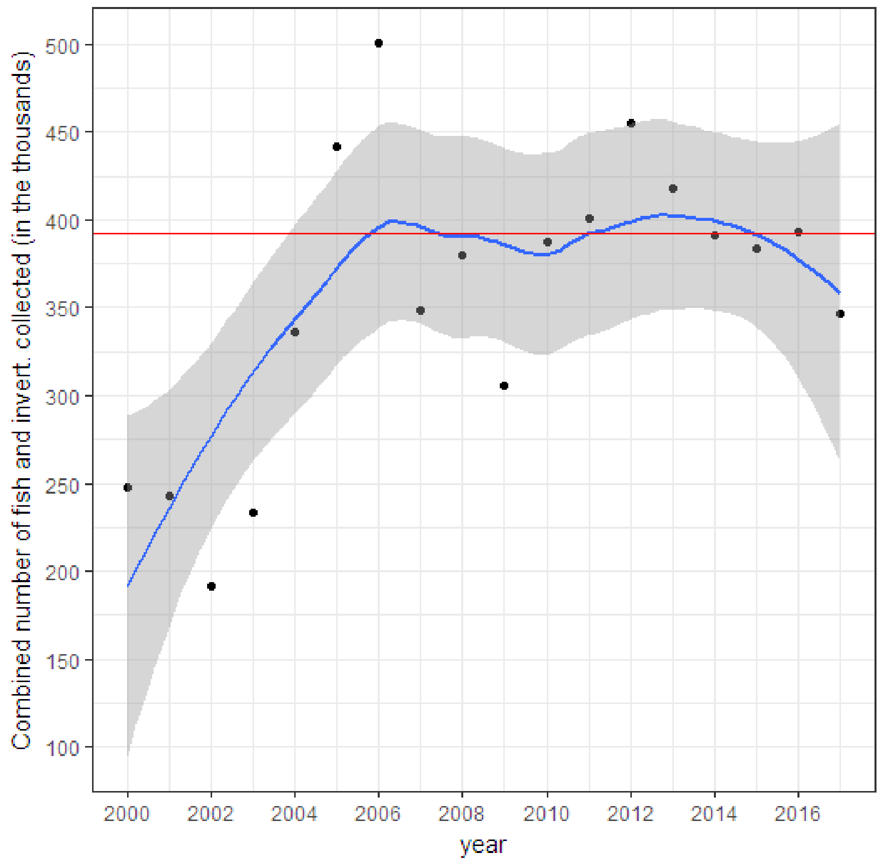

Fig. 24. Combined number of fish and invertebrates collected under Aquarium permits from East Hawai'i and the WHRFMA annually from 2000-2017. Blue line is a loess trend with span of 0.8 and 95% confidence interval (grey area). Red horizontal line is the average between 2005 and 2017. Note that the data before 2005 is missing records from East Hawai'i. Data extracted from Hawai'i FEA, Table 8.

D. Further Data is Needed for an EIS

As discussed above, there is no reliable data on how many fish and other species are actually taken pursuant to aquarium permits in any given year. The FEAs repeatedly referred to a lack of data for numerous species. For example:

- "Because specific species of hermit crabs are not reported on aquarium permits reporting forms, it is not possible to know which species are collected, with the exception of zebra hermit crabs."[195]
- "Due to this underestimation, it is not possible to know the exact proportion of Flame Wrasse population that would be collected. . . ."[196]

[195] Hawai'i FEA at 51.

[196] O'ahu FEA at 70.

- For Psychedelic (Redtail) Wrasse, Tinker's Butterflyfish, Longfin Anthias, Flame Wrasse, Fisher's Angelfish, and Eyestripe Surgeonfish (Palani), open area populations and catch as a percent of the open area populations are not available, because species "occur[] in habitats not adequately surveyed by transects."[197]

This data is necessary in order for the EISs to properly assess impacts. Furthermore, the Agency must conduct stock assessments of species before it is able to determine a sustainable rate of take. Clearly the Agency has not done so, as DLNR personnel have stated that to do so would take over a decade for just 40 fish species, out of the more than 287 fish and invertebrate species the Agency identifies as targeted by the trade (found at Appendix 4).[198] Without such data, the Agency cannot meaningfully assess the environmental impacts of commercial aquarium collection. Such assessments must be completed prior to the issuance of the EISs, and in the face of any uncertainty, the EISs' analyses must err on the side of caution to protect these vulnerable species.

VI. <u>Additional Deficiencies</u>

The FEAs continue to contain additional deficiencies that must be remedied for the Agency to conduct a thorough review of environmental impacts.

A. Lack of Meaningful Alternatives Analyses

Neither FEA considers any alternatives other than the Preferred Alternative, Status Quo Alternative, and a No Action Alternative. HEPA requires EAs to identify and summarize reasonable alternatives.[199] The new Preferred Alternatives ignore the vast majority of comments submitted on the DEAs and instead focus on just two species, Achilles Tangs on Hawai'i Island and Flame Wrasses on O'ahu. They also ignore the many comments naming locations where the impacts of collecting pressure are of concern, and instead arbitrarily name Waikiki as an area where no commercial collection would occur in the future.

The Agency's letter of determination stated that "because the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish, [the Agency] is interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes."[200] We dispute the value of any self-regulation measure. Meaningful change must be binding on the industry, and a meaningful alternatives analysis requires the Applicant to propose binding measures.

A reasonable alternative would require the Agency to first determine:

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[197] Hawai'i FEA at 59, Table 6.

[198] DLNR (2017); Eagle (2017); Aquarium Fishing Trip Report.

[199] *See* Haw. Code R. § 11-200-10(7).

[200] DLNR HRS Chapter 343, Final Environmental Assessment, Notice of Determination for Hawai'i at 3 and for O 'ahu at 3.

1) the life history, spawning grounds and offspring/recruitment patterns for each species to be collected for aquarium purposes (see DLNR list of aquarium species at Appendix 4);[201]
2) natural abundance (i.e. unfished) levels and complete stock assessments, for each island as a whole in addition to each collection zone, for those same species (see DLNR map of aquarium fish zones at Appendix 5);[202]
3) a definition for "sustainable" as it relates to the natural abundance of coral reef species taken for aquarium purposes; and
4) annual total allowable catch, by species, designed to restore and then sustain natural abundance levels, with negligible impacts as defined in the Queensland Ecological Risk Assessment of the Marine Aquarium Fish Fishery, for each species to be taken for aquarium purposes, in each zone.[203]

After making these necessary threshold determinations, the Agency should issue limited numbers of Aquarium Permits, by zone and by species with corresponding total allowable catch limits, per the above parameters. Additionally, the Agency should require Aquarium Collection Permits, for all take for aquarium purposes, regardless of the method of collection.

B. Lack of Mitigation Measures

HEPA also requires an EIS to consider mitigation measures.[204] With minor exceptions, such a discussion is plainly absent from both FEAs. Decades of Applicant actions have directly impacted more than 200 species and indirectly impacted an unknown number of additional vertebrate and invertebrate species found in Hawai'i's coral reefs, one of the most complex ecosystems on Earth, where the fate of each species is determined by the existence, abundance and diverse actions of a multitude of other species that inhabit or otherwise rely upon these unique places. Yet, the FEAs claim there are no significant impacts whatsoever, and therefore, propose no mitigation measures outside of those found in the Preferred Alternatives, related to just two species and one area, which were designed to mitigate potential impacts to cultural resources only.[205] In addition to proposing mitigation measures to address biological and related impacts to the various socio-economic values described herein, the EISs must also propose mitigation for impacts to cultural resources and for the ethical concerns and harm done to the animals, themselves, also described herein.

C. Lack of Early Consultations

PIJAC additionally failed to conduct the required early consultations prior to submitting its DEAs/FEAs. HEPA requires that the application must "at the earliest practicable time, . . . consult with . . . those citizen groups and individuals which the approving agency reasonably believes to be affected."[206] In this case, it is clear from the long history of litigation that Commenters, at the very

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[201] See DLNR Aquarium Fish Trip Report
[202] See DLNR Aquarium Fish Trip Report
[203] *See* Roelofs (2008) for a useful guide for describing the range of impacts to populations of target species in marine aquarium fisheries.
[204] Haw. Code R. § 11-200-10(7).
[205] Hawai'i FEA at 74; O'ahu FEA at 59.
[206] Haw. Code R. § 11-200-9(b)(1).

least, should have been consulted. PIJAC should also have consulted Native Hawai'ian groups and experts such as Gail Grabowsky. As a result of this failure to abide by HEPA's mandate of early consultation, the FEAs fail to analyze all impacts, and are skewed toward a favorable result for industry.

VII. <u>Conclusion</u>

For the reasons explained above, the Hawai'i FEA and O'ahu FEA are patently insufficient to analyze the impacts of commercial aquarium collection permits. Moreover, as numerous significance criteria are met, we concur with the Agency that EISs are required to fully analyze the impacts of issuing these permits prior to issuing any in the future.

A serious overhaul of aquarium fish permitting in Hawai'i is needed.

Because currently there are not restrictions on the number of collection permits or the amount of take per species under a fine mesh net (i.e. aquarium) permit or commercial fishing license, the impact that collection may have on target species must be evaluated before issuing permits. As such, each aquarium collection permit must show the total allowable catch, per species and ideally per zone that permit holders must follow to prevent unsustainable fishing. Catch limits per species and per zone should be calculated in conjunction with input from all stakeholders and based on the stock assessment for each target species in the specific areas where they will be allowed to be taken under a permit.

The legislature has decreed it the "policy of the State" that DNLR and other agencies must "[c]onserve natural resources . . . by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics . . . ."[207] The Agency must also "[e]ncourage management practices which conserve . . . all natural resources," and encourage all individuals "to fulfill the responsibility as trustees of the environment for the present and succeeding generations."[208] In enacting HEPA, the State legislature found "that the quality of humanity's environment is critical to humanity's well-being, [and] that humanity's activities have broad and profound effects upon the interrelations of all components of the environment . . . ."[209] The Agency simply cannot meet these mandates by continuing to allow unlimited aquarium collection, in light of the serious environmental consequences of those permits.

Respectfully submitted,

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[207] Haw. Rev. Stat. § 344-3(1).
[208] Haw. Rev. Stat. § 344-4(2)(A), (10)(A).
[209] Haw. Rev. Stat. § 343-1.

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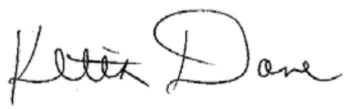

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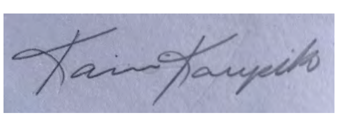

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Appendix 1

Linear model results showing a significant increase on the number of commercial aquarium permits issued annually for the Island of Hawai'i (WHRFMA and East Hawai'i combined) and O'ahu. Data from O'ahu DEA (Table 2, p16) and Hawai'i DEA (Table 2, p20).

Island of Hawai'i

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -3316.8903  1157.5586  -2.865   0.0112 *
year            1.6801     0.5763   2.915   0.0101 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 12.69 on 16 degrees of freedom
Multiple R-squared:  0.3469,	Adjusted R-squared:  0.3061
F-statistic: 8.498 on 1 and 16 DF,  p-value: 0.01012
```

O'ahu

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -3157.1228  1260.2195  -2.505   0.0234 *
year            1.6140     0.6274   2.572   0.0205 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 13.81 on 16 degrees of freedom
Multiple R-squared:  0.2926,	Adjusted R-squared:  0.2484
F-statistic: 6.617 on 1 and 16 DF,  p-value: 0.02045
```

Appendix 2

All photos courtesy of Paul Cox.

Aquarium Collecting Vessel Anchored off Black Rock Caves, North Kohala 2011

Aquarium Collecting Vessel Anchored off Papa Bay, Milolii, February 2014: prior coral damage apparent in trench adjacent to current anchor location; newly broken coral indicated by bright white pieces.

Aquarium Collecting Vessel Anchored off Papa Bay, Milolii, March 2014 (same vessel as in images for Feb. 2014).

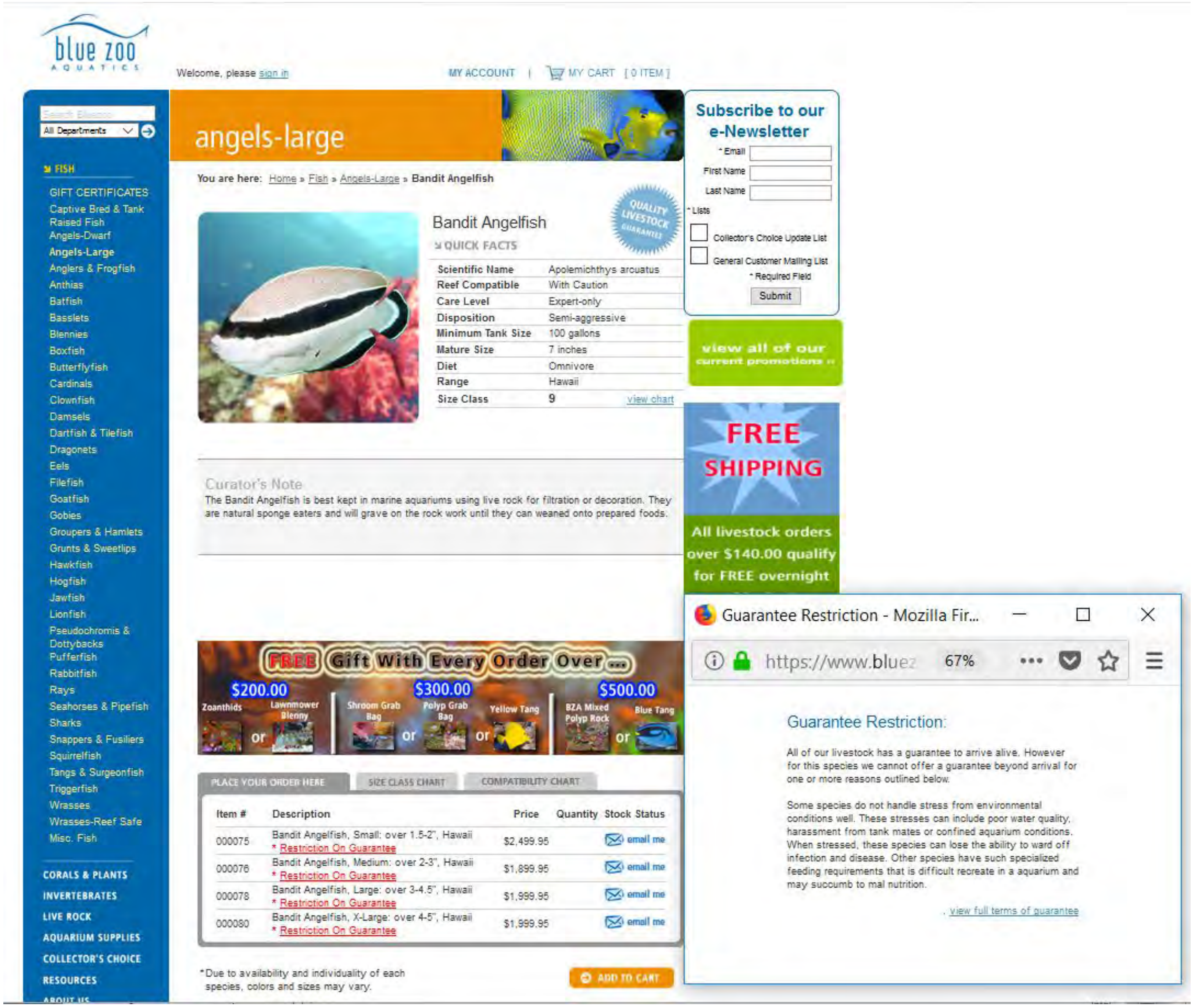
Aquarium Collecting Vessel Anchored off Papa Bay, Milolii, September 2014: (different vessel from Feb/March photos).

Aquarium collectors crawling through coral wearing knee pads. Note: none of these divers are wearing buoyancy control devices—used to maintain neutral buoyancy above the coral—which are standard equipment for recreational scuba divers. Instead they use a backpack designed to contribute to negative buoyancy, along with weight belts.

Fins, sticks, nets, buckets in the coral

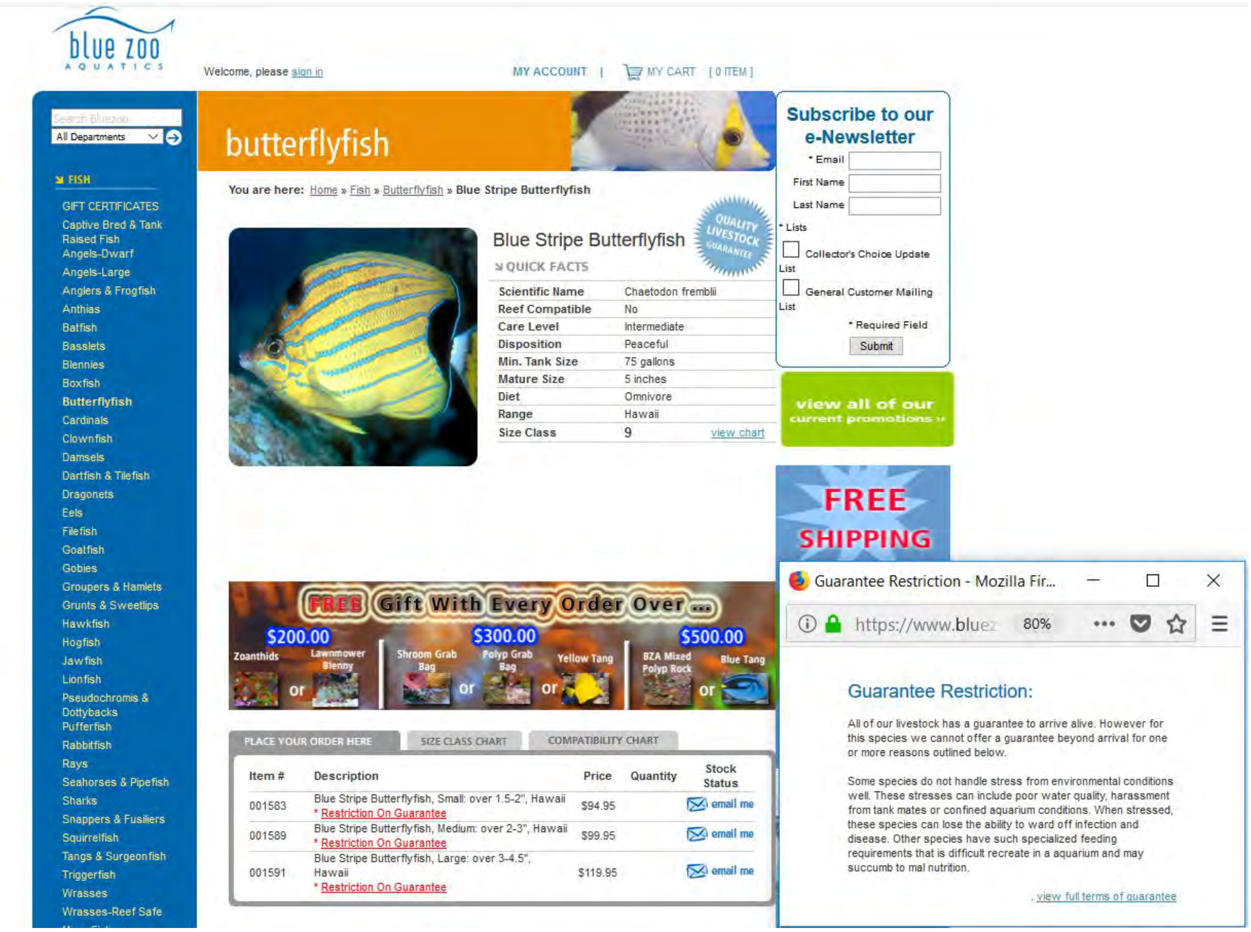
Appendix 3

Live Arrive/Stay Alive Restrictions on Guarantees



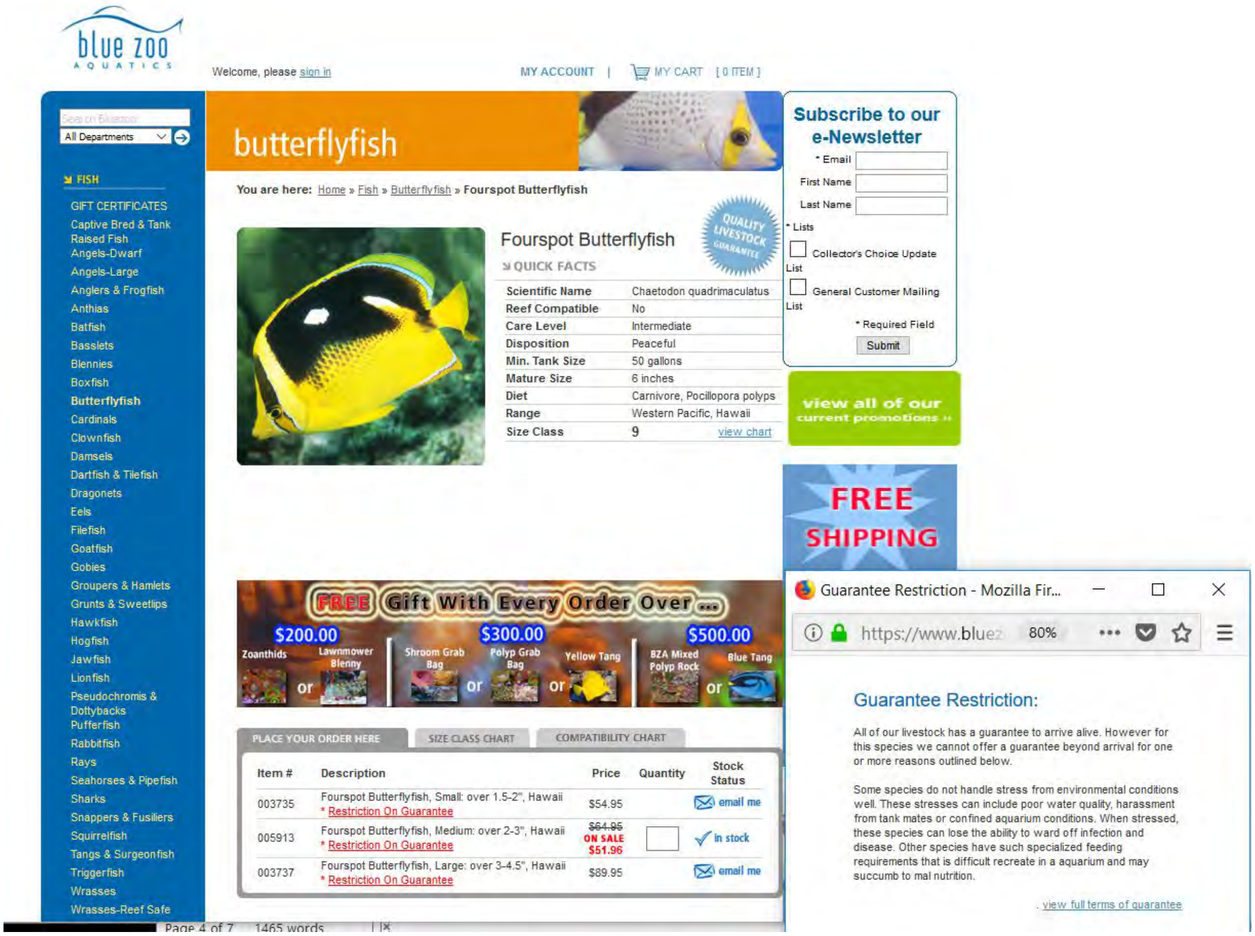
Available at: https://www.bluezooaquatics.com/productdetail.asp?cid=8&pid=145&did=1

Guarantee Restriction: https://www.bluezooaquatics.com/guarantee_restriction.htm



Available at: https://www.bluezooaquatics.com/productdetail.asp?cid=26&pid=558&did=1

Guarantee Restriction: https://www.bluezooaquatics.com/guarantee_restriction.htm



Available at: https://www.bluezooaquatics.com/productdetail.asp?cid=26&pid=617&did=1

Guarantee Restriction: https://www.bluezooaquatics.com/guarantee_restriction.htm

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Appendix 4: DLNR Commercial Aquarium Species List (available in DLNR Aquarium Fish Trip Report Booklet)

rev. 9/30/2011

Commercial Aquarium Species List

	Angelfishes	**(Pomacanthidae)**
219	Bandit	*(Desmoholocanthus arcuatus)*
223	Fisher's	*(Centropyge fisheri)*
221	Flame	*(Centropyge loricula)*
225	Masked	*(Genicanthus personatus)*
220	Potter's	*(Centropyge potteri)*
	Anthias & Groupers	**(Serranidae)**
663	Bicolor Anthias	*(Pseudanthias bicolor)*
675	Grammistidae	
650	Groupers, Basslets and Anthias	
661	Hapu'u Grouper	*(Epinephelus quernus)*
664	Hawaiian Longfin Anthias	*(Pseudanthias hawaiiensis)*
667	Redblotch perchlet	*(Plectranthias winniensis)*
660	Roi - Bluespot Grouper	*(Cephalopholus argus)*
600	Soapfishes	
662	Thompson's Anthias	*(Pseudanthias thompsoni)*
665	Yellow Anthias	*(Holanthias fuscipinnis)*
	Blennies	**(Blenniidae)**
440	Blenny	(Blenniidae)
449	Biting	*(Plagiotremus goslinei)*
448	Blue-striped	*(Plagiotremus rhinorhyncus)*
447	Hump-Head	*(Blenniella gibbifrons)*
445	Istiblennius spp.	*(Istiblennius* spp.)
444	Marbled	*(Entomacrodus marmoratus)*
441	Red Sailfin	*(Exallias brevis)*
443	Red Speckled	*(Cirripectes variolosus)*
442	White speckled	*(Cirripectes obscurus)*
446	Zebra Rockskipper	*(Istiblennius zebra)*
	Boxfishes - Trunkfishes	**(Ostraciidae)**
323	Spiny Cowfish	*(Lactoria diaphana)*
320	Spotted Boxfish	*(Ostracion meleagris)*
322	Thornback Cowfish	*(Lactoria fornasini)*
319	Trunkfishes	(Ostraciidae)
321	Whitley's Trunkfish	*(Ostracion whitleyi)*
199	**Butterflyfishes**	**(Chaetodontidae)**
207	Blacklip (Kleini, Coral)	*(Chaetodon kleinii)*
205	Bluestripe	*(Chaetodon fremblii)*
218	Chevron	*(Chaetodon trifascialis)*
214	Fourspot	*(Chaetodon quadrimaculatus)*
228	Golden Banded	*(Prognathodes roa excelsa)*
216	Lemon (Citron)	*(Chaetodon citrinellus)*
222	Lined	*(Chaetodon lineolatus)*
200	Longnose	*(Forcipiger flavissimus)*
217	Milletseed	*(Chaetodon miliaris)*
227	Orange Margin	*(Prognathodes basabe)*
213	Ornate (Clown)	*(Chaetodon ornatissimus)*
212	Oval	*(Chaetodon lunulatus)*
215	Pebbled	*(Chaetodon multicinctus)*
202	Pennantfish	*(Heniochus diphreutes)*
204	Pyramid (Zoster)	*(Hemitaurichthys polylepis)*
211	Raccoon	*(Chaetodon lunula)*
201	Rare Longnose	*(Forcipiger longirostris)*
	Butterflyfishes (cont)	**(Chaetodontidae)**
206	Reticulated	*(Chaetodon reticulatus)*
208	Saddleback	*(Chaetodon ephippium)*
210	Teardrop	*(Chaetodon unimaculatus)*
203	Thompson's	*(Hemitaurichthys thompsoni)*
209	Threadfin (Cross-stripe)	*(Chaetodon auriga)*
224	Tinker's	*(Chaetodon tinkeri)*
390	**Cardinalfishes**	**(Apogonidae)**
394	Bandfin	*(Apogon menesemus)*
395	Bay	*(Foa brachygramma)*
393	Iridescent	*(Apogon kallopterus)*
392	Red	*(Apogon erythrinus)*
391	Spotted	*(Apogon maculiferus)*
195	**Damselfishes**	**(Pomacentridae)**
192	Agile Chromis	*(Chromis agilis)*
187	Backfin Chromis	*(Chromis vanderbilti)*
181	Blackspot Sergeant	*(Abudefduf sordidus)*
185	Blue-eye Damsel	*(Plectroglyphidodon johnstonianus)*
183	Brighteye Damsel	*(Plectroglyphidodon imparipennis)*
191	Chocolate-Dip Chromis	*(Chromis hanui)*
180	Hawaiian Domino	*(Dascyllus albisella)*
182	Hawaiian Sergeant Major	*(Abudefduf abdominalis)*
193	Indo-Pacific Sergeant Major	*(Abudefduf vaigiensis)*
188	Oval Chromis	*(Chromis ovalis)*
184	Rock Damsel	*(Plectroglyphidodon sindonis)*
190	Threespot Chromis	*(Chromis verator)*
189	Whitetail Chromis	*(Chromis leucurus)*
186	Yellow-eye Damsel	*(Stegastes fasciolatus)*
	Eels	**Moray & Others**
423	Brown Moray	*(Gymnothorax steindachneri)*
422	Common Moray	*(Gymnothorax eurostus)*
414	Dark-banded Moray	*(Echidna polyzona)*
417	Dragon Moray	*(Enchelycore pardalis)*
411	Dwarf Moray Eel	*(Gymnothorax melatremus)*
410	Moray	(Muraenidae)
426	Mustache Conger	*(Conger cinereus)*
413	Snowflake Moray	*(Echidna nebulosa)*
429	Tiger Moray	*(Scuticaria tigrina)*
425	Undulated Moray	*(Gymnothorax undulatus)*
416	Uropterygius knighti	*(Uropterygius knightii)*
415	Uropterygius spp.	*(Uropterygius* spp.)
421	Whitemouth Moray	*(Gymnothorax meleagris)*
424	Yellowhead	*(Gymnothorax rueppelliae)*
420	Yellowmargin Moray	*(Gymnothorax flavimarginatus)*
419	Yellowmouth Moray	*(Gymnothorax nudivomer)*
412	Zebra Moray	*(Gymnothorax zebra)*
428	Magnificent Snake Eel	*(Myrichthys magnificus)*
427	Snake Eels and Worm Eels	(Ophichthidae)
310	**Filefishes**	**(Monacanthidae)**
313	Orange-fin	*(Cantherhines dumerilii)*
312	Redtail	*(Pervagor spilosoma)*
311	Scribbled	*(Aluterus scriptus)*

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Commercial Aquarium Species List

	Filefishes (cont)	**(Monacanthidae)**
314	Squaretail	(*Cantherhines sandwichiensis*)
315	Yellowtail	(*Pervagor aspricaudus*)
169	**Goatfishes**	**(Mullidae)**
170	Bandtail	(*Upeneus taeniopterus*)
176	Kumu - Whitesaddle*	(*Parupeneus porphyreus*)
175	Moana kali - Blue	(*Parupeneus cyclostomus*)
177	Moano - Manybar*	(*Parupeneus multifasciatus*)
178	Munu - Doublebar	(*Parupeneus bifasciatus*)
172	Red Weke - Yellowfin*	(*Mulloidicthys vanicolensis*)
174	Sidespot	(*Parupeneus pleurostigma*)
171	White Weke - Yellowstripe*	(*Mulloidicthys flavolineatus*)
330	**Hawkfishes**	**(Cirrhitidae)**
331	Arc-eye	(*Paracirrhites arcatus*)
332	Blackside (Freckled, Forster's)	(*Paracirrhites forsteri*)
336	Longnose	(*Oxycirrhites typus*)
335	Redbar	(*Cirrhitops fasciatus*)
333	Stocky	(*Cirrhitus pinnulatus*)
334	Twospot	(*Amblycirrhitus bimacula*)
	Pipefishes	**(Syngnathidae)**
504	Fantail	(*Doryhamphus exisus*)
565	Pipefishes	
505	Redstripe	(*Doryrhamphus baldwini*)
566	Seahorses	
567	Spotted Seahorse	(*Hippocampus kuda*)
349	**Porcupinefishes**	**(Diodontidae)**
350	Porcupinefish	(*Diodon hystrix*)
351	Spiny Balloonfish	(*Diodon holocanthus*)
290	**Pufferfishes**	**(Tetraodontidae)**
293	Amboy Toby	(*Canthigaster amboiensis*)
291	Crown Toby	(*Canthigaster coronata*)
294	Maze Toby	(*Canthigaster rivulata*)
341	Spotted Puffer	(*Arothron meleagris*)
342	Stripebelly Puffer	(*Arothron hispidus*)
292	White-spot Toby	(*Canthigaster jactator*)
295	Yellowtail Toby	(*Canthigaster epilamera*)
400	**Scorpionfishes**	**(Scorpaenidae)**
405	Devil Scorpionfish	(*Scorpaenopsis diabolus*)
403	Green Lionfish	(*Dendrochirus barberi*)
402	Hawaiian Turkeyfish	(*Pterois sphex*)
401	Leaf Scorpion	(*Taenianotus triacanthus*)
407	Speckled Scorpionfish	(*Sebastapistes coniorta*)
406	Titan Scorpionfish	(*Scorpaenopsis cacopsis*)
	Squirrelfishes & Soldierfishes	**(Holocentridae)**
376	Bigscale Soldier	(*Myripristis berndti*)
377	Brick Soldier	(*Myripristis amaena*)
374	Crown Squirrel	(*Sargocentron diadema*)
375	Hawaiian Squirrel	(*Sargocentron xantherythrum*)
378	Shoulder-bar Soldier	(*Myripristis kuntee*)
370	Squirrelfish	(Holocentridae)
373	Whitespot Squirrel	(*Sargocentron punctatissimum*)

	Surgeonfishes	**(Acanthuridae)**
103	Achilles Tang	(*Acanthurus achilles*)
107	Bluelined Surgeon	(*Acanthurus nigroris*)
114	Chevron Tang	(*Ctenochaetus hawaiiensis*)
104	Goldrim Surgeon	(*Acanthurus nigricans*)
113	Kole - Goldring	(*Ctenochaetus strigosus*)
106	Lavender Tang (Forktail)	(*Acanthurus nigrofuscus*)
120	Long bodied Surgeon	(*Naso brevirostris*)
101	Manini - Convict Tang*	(*Acanthurus triostegus*)
118	Naso Tang	(*Naso lituratus*)
109	Orange-shoulder Surgeon	(*Acanthurus olivaceus*)
110	Palani - Eyestripe	(*Acanthurus dussumieri*)
111	Pualu - Yellowfin	(*Acanthurus xanthopterus*)
112	Ringtail Surgeonfish	(*Acanthurus blochii*)
116	Sailfin Tang	(*Acanthurus veliferum*)
119	Sleek Unicorn*	(*Naso hexacanthus*)
102	Spotted Tang	(*Acanthurus guttatus*)
100	Surgeonfishes	(Acanthuridae)
108	Thompson's Surgeon	(*Acanthurus thompsoni*)
121	Unicorn*	(*Naso unicornis*)
117	Unicornfishes	
105	Whitebar Surgeon	(*Acanthurus leucopareius*)
115	Yellow Tang	(*Zebrasoma flavescens*)
122	Moorish Idol	(*Zanclus cornutus*)
307	**Triggerfishes**	**(Balistidae)**
303	Black	(*Melichthys niger*)
300	Blue-throat	(*Xanthichthys auromarginatus*)
299	Crosshatch	(*Xanthichthys mento*)
302	Lagoon	(*Rhinecanthus aculeatus*)
301	Picasso	(*Rhinecanthus rectangulus*)
304	Pinktail	(*Melichthys vidua*)
305	Whiteline, Lei	(*Sufflamen bursa*)
130	**Wrasses**	**(Labridae)**
157	Belted (Orange-bar)	(*Stethojulis balteata*)
151	Bird	(*Gomphosus varius*)
150	Blacktail	(*Thalassoma ballieui*)
146	Christmas	(*Thalassoma trilobatum*)
131	Cigar (Alligator)	(*Cheilio inermis*)
134	Cleaner	(*Labroides phthirophagus*)
144	Dragon	(*Novaculichthys taeniourus*)
139	Eightline	(*Pseudocheilinus octotaenia*)
153	Elegant Coris	(*Coris venusta*)
160	Flag	(*Anampses cuvier*)
162	Flame	(*Cirrhilabrus jordani*)
140	Fourline	(*Pseudocheilinus tetrataenia*)
133	Hogfish	(*Bodianus bilunulatus*)
155	Lined Coris	(*Coris ballieui*)
165	Moon (Lyretail)	(*Thalassoma lunare*)
161	Ornate (Pinkface)	(*Halichoeres ornatissimus*)
143	Peacock Razorfish	(*Xyrichtys pavo*)
156	Pencil	(*Pseudojuloides cerasinus*)
158	Potter's	(*Macropharyngodon geoffroy*)

Commercial Aquarium Species List

Code	Name	Scientific name / Family
	Wrasses (cont)	**(Labridae)**
145	Razorfish	(*Xyrichtys umbrilatus*)
159	Red-tail (Psychedelic)	(*Anampses chrysocephalus*)
136	Ringtail	(*Oxycheilinus unifasciatus*)
148	Saddle	(*Thalassoma dupperey*)
138	Scarlett	(*Pseudocheilinus evanidus*)
142	Sharp-headed	(*Cymalutes lecluse*)
132	Sunrise Wrasse	(*Bodianus sanguines*)
147	Sunset	(*Thalassoma lutescens*)
149	Surge	(*Thalassoma purpureum*)
137	Twospot	(*Oxycheilinus bimaculatus*)
152	Yellowstriped Coris	(*Coris flavovittata*)
154	Yellowtail Coris	(*Coris gaimard*)
	Other Fish	
280	Aholehole - Hawaiian Flagtail*	(*Kuhlia sandvicensis*)
360	Aweoweo - Bigeyes	(Priacanthidae)
780	Baitfish	
630	Bat fish	(Onocephalidae)
570	Boarfish	(Histioopteridae)
500	Cornetfish	(*Fistularia commersonii*)
465	Dartfish	(Microdesmidae)
680	Dwarf rockfish	(*Canthidermis maculatus*)
610	Frogfish	(Antennnariidae)
460	Gobies	(Gobiidae)
560	Hawaiian Morwong	(*Cheilodactylus vittatus*)
670	Helmet Gurnard	(*Dactyloptena orientalis*)
470	Lefteye Flounders	(Bothidae)
480	Lizardfishes	(Synodontidae)
790	Mollies	(Poecilidae)
530	Moi - Threadfin*	(*Polydactylus sexfilis*)
700	Mu - Bigeye Emperor	(*Monotaxis grandoculis*)
270	Nenue	(*Kyphosus bigibbus*)
250	Papio - Jacks*	(Carangidae)
715	Redspotted Sandperch	(*Parapercis schauinslandii*)
475	Righteye Flounders	(Pleuronectidae)
620	Saltwater cats	(Brotulidae)
690	Sand Tilefish	(*Malacanthus brevirostris*)
240	Scaridae	(Scaridae)
795	Sharks	
522	Sharp-jaw Mullet	(*Neomyxus leuciscus*)
520	Striped Mullet*	(*Mugil cephalus*)
510	Stripey	(*Microcanthus strigatus*)
267	Ta'ape - Blueline Snapper	(*Lutjanus kasmira*)
642	Toau - Blacktail Snapper	(*Lutjanus fulvus*)
490	Trumpetfish	(*Aulostomus chinensis*)
230	Uhu - Parrotfishes*	(Scaridae)
398	Velvetfish	(Caracanthidae)
	Algae (Limu - Seaweed)	
801	Grape Calerpa	(*Caulerpa racemosa*)
804	Halimeda	(*Halimeda* spp.)
802	Letucce Cauerpa	(*Caulerpa* spp.)
970	Other Algae	

Code	Name	Scientific name / Family
	Algae (Limu - Seaweed) (cont)	
803	Red Kelp	(*Halymenia* spp.)
805	Sea Lettuce	(*Ulva* spp.)
	Invertebrates	
926	**Anemones**	
811	Mann's Anemone	(*Cladactella manni*)
812	Seabae Anemone	(*Heteractis malu*)
931	**Crustaceans: Crabs**	
863	Aama	(*Grapsus tenuicrustatus*)
933	Anemone Hermit (Orange-leg)	(*Dardanus gemmatus*)
860	Black Zanthid	
861	Flat Rock (Sally Lightfoot)	(*Percnon planissimum*)
862	Pom-Pom	(Lybia)
932	Yellow Hairy Hermit	(*Aniculus maximus*)
937	Halloween Hermit Crab	(*Calcinus elegans*)
934	Hermits (small & misc.)	(Diogenidae)
938	Zebra Hermit Crab	(*Clibanarius zebra*)
854	Arrow	(Majidae)
865	Strawberry	(Xanthidae)
800	**Crustaceans: Crayfish**	
909	**Crustaceans: Lobsters**	
936	Hawaiian Red Lobster	(Enoplometiopidae)
910	Spiny Lobster*	(Palinuridae)
912	Slipper Lobster*	(Scyllaridae)
949	**Crustaceans: Shrimp**	
945	Cleaner	(*Lysmata amboinensis*)
948	Coral-banded	(*Stenopus hispidus*)
943	Ghost	(*Stenopus pyrsonotus*)
944	Green	(Hippolytidae)
946	Harlequin	(*Hymenocera picta*)
866	Opae ula - Red Pond	(*Halocaridina rubra*)
947	Red-Stripe	(*Saron marmoratus*)
880	**Echinoderms: Brittlestars**	**(Ophiuroidea)**
952	Echinoderms	
953	**Echinoderms: Sea Cucumbers**	**(Holothuroidea)**
876	Black	(*Holothuria atra*)
877	Strawberry or Pink	(*Holothuria edulis*)
878	Stubborn	(*Holothuria pervicax*)
955	**Echinoderms: Seastars**	**(Asteroidea)**
881	Blue Linckia	(*Linckia guildingi*)
882	Common Linckia	(*Linckia multifora*)
954	Crown-of-Thorns	(*Acanthaster planci*)
883	Cushion Star	(*Culcita novaeguinae*)
884	Orange Knob	(*Pentaceraster cumingi*)
957	**Echinoderms: Urchins**	**(Echinodea)**
891	Longspine	(Echinothrix or Diadema spp.)
892	Pincushion	(*Tripneustes gratilla*)
893	Shortspine	(*Echinometra* spp.)
956	Slate urchin	(*Heterocentrotus mammilatus*)
928	**Jellyfishes**	

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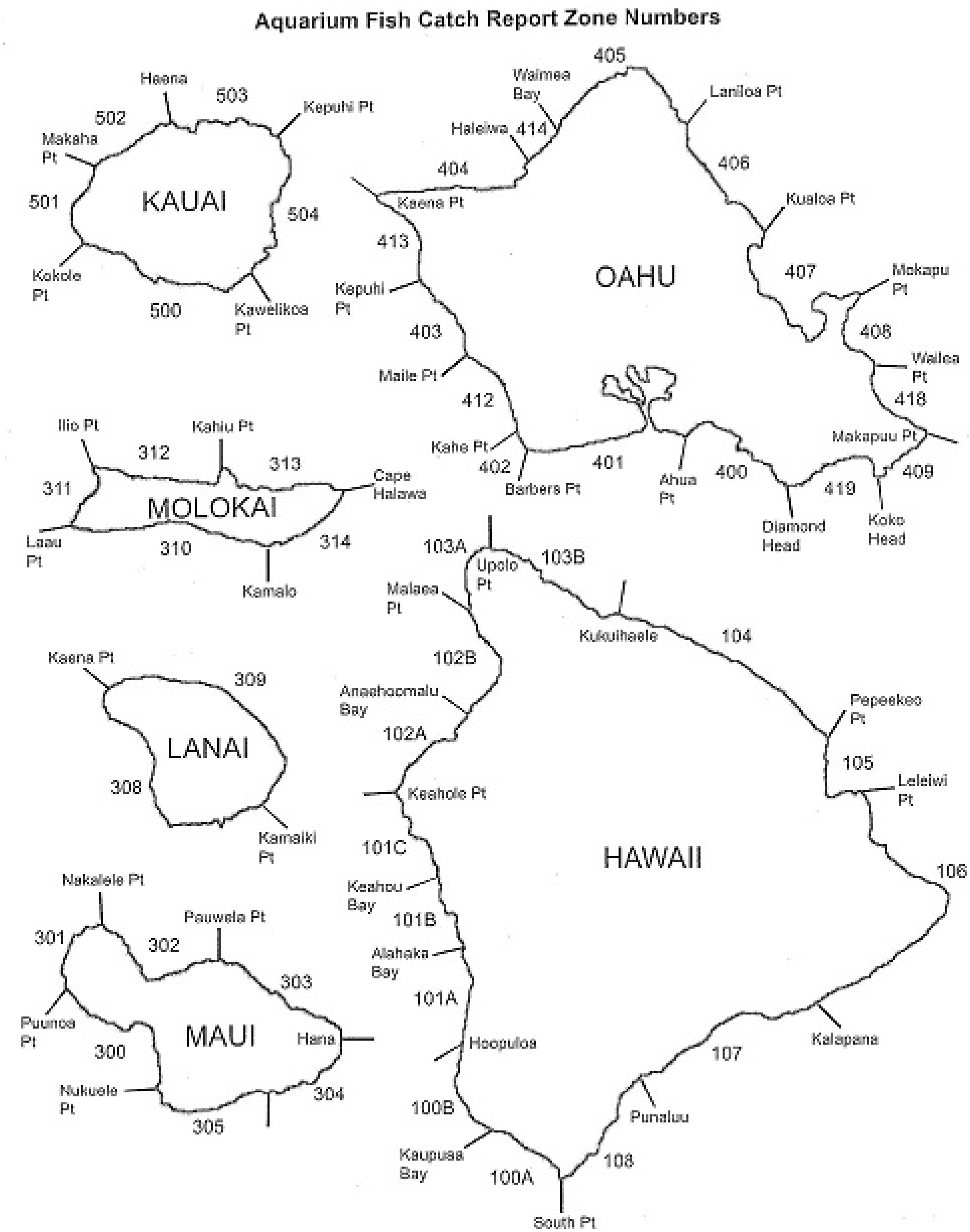
958	**Molluscs**	
858	Bobtail Squid	(*Euprymna scolopes*)
963	Bubble Shells	(order Cephalaspidea)
961	Nudibranchs	(order Nudibranchia)
900	Octopus*	(Octopus spp.)
859	Oval Squid	(*Sepioteuthis lessoniana*)
962	Sea Hares	(order Anaspidea)
964	Spanish Dancer	(*Hexabranchus sanguineus*)
959	Cones	(Conidae)
960	Cowries	(Cypraeidae)
852	Reticulated Cowries	(*Cyrpaea reticulata*)
851	Tiger Cowries	(*Cypraea tigris*)
929	**Soft Corals**	
818	Snowflake Coral	(*Carijoa riisei*)
965	**Sponges**	
922	**Worms**	
921	Featherduster	(*Sabellastarte sanctijosephi*)
923	Medusa Worms	(*Loimia medusa*)
825	**Zoanthids**	

999 Misc. (For any Invert or Fish: please describe specimen)

Appendix 5

DLNR Aquarium Fish Catch Report Zones (available in DLNR Aquarium Fish Trip Report Booklet)



Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
We concur with DLNR's findings that the significance criteria in HAR § 11-200-12 have been met, and that the preparation of EISs is required to fully analyze the environmental impacts of commercial aquarium collection on both the islands of Hawai'i and O'ahu.	Comment noted. A DEIS has been prepared.
To this end, we expect the Applicant endeavor to develop fully acceptable EISs prior to the time the EISs is filed with the office, through a full and complete consultation process, and that the Applicant shall not rely solely upon the review process to expose environmental concerns. We are also requesting to be parties to any public scoping meeting(s) convened to receive comments on the FEA-EISPNs and setting forth the scope of the draft EISs. Further, we expect our substantive comments on the FEAs, discussed below, to be responded to in writing and incorporated into the draft EIS by the Applicant prior to the filing of the draft EISs with DLNR. We also expect that the responses shall not be merely self-serving recitations of benefits and/or rationalizations of the proposed actions. In addition, we expect the EIS's to disclose any and all adverse effects on cultural resources and traditional cultural practices, which are set forth in HAR § 11-200-10 and discussed in more detail below. Finally we also expect the Draft EIS to include discussion and disclosure of climate change impacts, as envisioned by the proposed HAR § 11-200.1-13 Significance Criteria, Criterion 11 (based on the December 2017 Climate Change Mitigation and Adaptation Commission report) to address concerns related to climate change adaptation, such as impacts from increased hurricane frequency and/or intensity, potential endangered species migration, impacts on areas likely to experience wave inundation, increased exposure to hurricanes, or flooding, and further impacts discussed below.	Comment noted. A DEIS has been prepared, and the commenter was included as a consulted party. No public scoping meeting was held. Cultural impacts are analyzed in depth in the Cultural Impact Assessment (Appendix A of the DEIS). The DEIS includes an analysis of the cumulative impacts of climate change (Section 5.4.3.5 of the DEIS).
The FEAs are entirely inadequate under the HEPA and its implementing regulations. The environmental impact statements now required by DLNR must adequately address these and other notable flaws remaining in the FEAs fail to analyze the impacts of collection beyond one year; fail to analyze the cumulative impacts of unlimited collection of aquatic life; fail to analyze the cumulative impacts of commercial collection on the islands of Hawai'i and O'ahu along with collection in other parts of the State; fail to analyze the cumulative impacts of commercial collection along with recreational collection; fail to analyze impacts on cultural resources; fail to analyze reasonable alternatives; fail to analyze the impacts of harmful collection practices; rely on inaccurate, misleading, and incomplete data; fail to analyze mitigation measure; fail to incorporate input of Native Hawai'ian groups, experts, and affected citizens.	Comment noted. The DEIS expanded the analysis to a 5-year period, and also addresses the cumulative impact of past, present, and foreseeable aquarium collection in future years in Section 5.4.3.3. Cumulative impacts of recreational collection is discussed in Section 5.4.3.1. Impacts to cultural resources are analyzed in Section 5.3, and also included in the Cultural Impact Assessment (Appendix A of the DEIS). Two additional alternatives have been added in the DEIS that addresses concerns with Achilles Tang and the number of permits that would be issued. Specifically, one alternative proposes restricting permits to the WHRFMA, and the other alternative includes issuance of only 14 permits, as well as reducing the Achilles Tang bag limit form 10/day to 5 per day for commercial aquarium collection in the WHRFMA. The Cultural Impact Assessment (Appendix A of the DEIS) included consultation with Native Hawaiian groups and affected citizens. The best available scientific data has been included in the DEIS.
The Applicant unlawfully limited its analyses to the time period of a single year. PIJAC's reasoning for this is that each permit only lasts one year, and therefore a new EA would need to be completed on an annual basis. However, while Commenters agree that it is critical for the Agency to continue to monitor the impacts that aquarium collection is having over time, the relatively short time period of the activity itself does not nullify HEPA's clear requirement for considering the long-term effects of that activity (example given).	Comment noted. As noted in the DEIS, the analysis period has been expanded to five years. However, under HRS 188-31, the DLNR may issue an Aquarium Permit not longer than one year in duration.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	**Response**
Additionally, a 12-month timeframe that analyzes impacts is inadequate because the impact of fish removal will accumulate over time. Studies show that catch numbers from the commercial aquarium fishery in Hawai'i have significantly increased over the last few decades and are likely to increase even more	Comment noted. As noted in the DEIS, the analysis period has been expanded to five years. However, under HRS 188-31, the DLNR may issue an Aquarium Permit not longer than one year in duration. While it is correct that individuals are removed from the population annually, it is also true that new individuals are added during that period, and therefore it is not certain losses will accumulate over time. As noted in Section 5.4.1.2 of the Hawai'i DIES, reef fish have high fecundity and are long lived, and as such produce a large number of young each year over many years. In addition, as noted throughout the DEIS, commercial aquarium collection targets juvenile fish leaving behind the adult broodstock. Section 5.4.3.3 of the DEIS addresses the cumulative impacts of multiple years of commercial aquarium collection.
The number of commercial aquarium permits issued per year has significantly increased over the last 18 years for the Island of Hawai'i (at ~35% per year, p=0.01) and for O'ahu (at ~29% per year, p=0.02) (see Fig. 1, see Appendix 1 for linear model results). In fact these trends have been observed since the early 1980s. It is likely that the number of commercial aquarium permits issued on the Islands of Hawai'i and O'ahu will continue to increase in the coming years due to the high demand for aquarium reef fish and their increasing market value. In response to this comment, the Applicant claims that the number of permits issued is "[not] necessarily indicative of the number of fish collected," however DLNR data shows a strong correlation between the number of permits issued and the level of catch (Fig. 2). Furthermore, the Hawai'i Supreme Court has made clear that the proper inquiry under HEPA is "the outer limits of what the permits allow . . . ." The relationship between the number of participants in a fishery and impacts to fish populations is well-established in the literature. The importance of restricting access to fisheries has been acknowledged and used for thousands of years to conserve and help sustain fish populations.	Comment noted. The DEIS has been updated, and the new Preferred Alternative limits the number of permits to be issued to 14 fishers.
The FEAs failed to take into account how increasing demand and increasing market value will affect already depleted targeted reef fish species in the coming years, thus result in significant environmental impact. For example, the market value of tropical reef fish (e.g., yellow tang) has increased and thus collection/fishing pressure is likely to increase in the near future. The commercial aquarium fishery in Hawai'i reports annual landings of over 579,000 organisms (fish and invertebrates combined. The number of aquarium fish caught on the island of Hawai'i since 1976 has substantially increased by 645%. Similarly, the adjusted value of the Hawai'i Island aquarium fishery increased by over 280% between 1976 and 2003. This relationship must be analyzed in the FEAs and permitting must be adjusted accordingly to account for populations declines. The FEAs' claim that the high fecundity and long lifespans of reef fishes combined with the limited targeting of adult brood-stock by the trade removes the certainty that the losses will accumulate over time is false. Studies show that populations of heavily targeted species, such as Yellow Tangs, are neither annually replenished, nor restored over time to their natural levels of abundance. On the contrary, they have been severely depleted over time, especially in the areas where they are collected. While the Hawai'i FEA noted that for Yellow Tang and kole, which represent two of the top three collected species, population trends are stable or increasing, it failed to acknowledge that the increase in fish abundance is due to an anomalous recruitment pulse that coincided with warming waters in 2014. Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines	Comment noted. As discussed in the DEIS, population trends for Yellow Tang and Kole continue to increase. Two alternatives in the DEIS address concerns with Achilles Tang, specifically by reducing the bag limit from 10/day to 5/day for commercial aquarium collection in the WHRFMA. For the remaining species, the data analysis in the DEIS were limited to collection data from 2000-2017 due to changes in regulations that occurred in or after 1999 (i.e., creation of FRAs, bag limits, etc.). The Preferred Alternative further limits commercial aquarium collection by limiting the number of permits to 14. The analysis looks at both average and maximum collection rates from recent years (2000-2017) to estimate collection over the 5-year analysis period.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
The FEAs also fail to consider other cumulative impacts. The Hawai'i FEA states that it only analyzes impacts that the aquarium permits issued for the island of Hawai'i will have; similarly, the O'ahu FEA states that it only analyzes the impacts that aquarium permits issued for O'ahu will have. Neither FEA considers the cumulative impacts that permits issued for either island will have cumulatively with permits issued for the other island with a FEA—let alone cumulatively with permits issued for islands for which PIJAC conducted no FEA (e.g., Kauai and the islands that make up the County of Maui). Coral reefs in Hawai'i are connected by ocean currents. Carried within these currents are the larvae of Hawai'i's reef fishes which typically settle downstream of the reefs where they originated. Most fishes on Hawai'i's reefs are the result of other fishes upstream of that reef. Fish removed from a reef can re-populate as long as the capacity of the upstream larval reservoir isn't exceeded. For example, the prevailing currents in Hawai'i mean that Hawai'i Island reefs "seed" the islands to the northwest—marine life spreads from the Hawai'i Island to the islands of Maui County and beyond. Reduced populations of reef fishes on Hawai'i Island can seriously impact reef fish abundance in the entire state.	Comment noted. As noted in Section 4.4 of the DEIS, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, include a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI).
Additionally, the FEAs fail to even properly address the true nature of what the Applicant is requesting in its Preferred Alternative. Under the Preferred Alternatives for both EAs, "DLNR would issue Aquarium Permits for the island of Hawai'i under existing regulation set forth in HRS 188-31," and "DLNR would issue Aquarium Permits for the island of O'ahu under existing regulation set forth in HRS 188-31." In other words, PIJAC's Preferred Alternative is collection of an unlimited number of fish and other coral reef inhabitants—the limits of what regulation allows. Additional bag limits, proposed only for Achille Tangs in the Hawai'i FEA and Flame Wrasses in the O'ahu FEA, fail to limit total catch because these daily catch limits apply to a limitless number of people. Yet, the FEAs consider only very limited collection. HEPA requires that an EA assess the potential cumulative impacts of what State regulations allow, not just what some permittees may claim they intend to do with their permits. As the Hawai'i Supreme Court clearly stated, "the properly defined activity for the purposes of the HEPA analysis must encompass the outer limits of what the permits allow and not only the most restrictive hypothetical manner in which the permits may be used." The EISs must address this. Likewise, although the FEAs purport to analyze impacts cumulatively with those of recreational collection permits, the FEAs do not account for the fact that the Agency issues a permit for every application that is submitted, and therefore the take under recreational permits is potentially unlimited as well. And the FEAs admit that, as there is no required reporting for recreational permits, it is currently impossible to know how many of each species are taken under those permits, and therefore, the impact of collection under these permits on species collected under thes permits cannot be quantified. This lack of data must be addressed in the EISs.	Comment noted. The DEIS has been updated, and the new Preferred Alternative limits the number of permits to be issued to 14 fishers. The DEIS used the best available data to evaluate the cumulative impacts from recreational permits.
The analysis of cumulative impacts must include the impact of the commercial aquarium fishery, regardless of the gear used to capture the marine life, combined with non-aquarium commercial and recreational fisheries and other activities that impact population abundance. Commercial and recreational fishing combined with the aquarium fishery have a substantial impact on targeted species. The FEAs should determine cumulative impact of all fishing on target species. In addition, the FEAs must analyze indirect impacts from collection such as vessel traffic and accumulated reef damage due to vessel anchoring and collection practices. As noted earlier, the EISs must also evaluate the potential of cumulative impacts of climate change (warming, coral bleaching, and ocean acidification) on targeted fish species such as decline of coral coverage which have been demonstrated to influence reef fish species diversity and abundance. The FEAs recognize that climate change poses serious threats to Hawai'i's coral reefs and the species targeted by the Applicant, yet ironically claim that climate change impacts coupled with the impacts of implementing the three proposed alternatives are expected to be less than significant. These statements completely deny the research and data that demonstrate what is stated, that climate change impacts, specifically ocean warming, acidification and coral bleaching events will continue, thus further analysis of impacts and exacerbation of impacts due to climate change is required.	Comment noted. The issues mentioned in the comment are addressed in various sections of the DEIS, including the Cumulative Impacts section (5.4.3), direct impacts, and Section 5.4.1.2 of the DEIS which notes that two studies have concluded that the aquarium fishery has no significant impact on coral or the reef ecosystem. As noted in Section 5.4.3.6 of the DEIS, cumulative impacts to the 12 White List Species which have significantly declined between 1999 and 2017 would be significant. However, as noted in Section 5.4.3, the DAR (2019) found that declines were occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating the aquarium collection is not driving the decline. While commercial aquarium collection does contribute to the cumulative impact, it is a less than significant factor in the observed declines. Additionally, measures included in the Preferred Alternative (e.g., limited permit issuance, reduced Achilles Tang bag limit) may mitigate potential impacts by limiting the number of aquarium permits issued as well as the number of Achilles Tang that can be collected by commercial aquarium collectors each day.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
It is clear from an analysis of cumulative impacts that many of HEPA's "significance criteria" apply. Most directly, the proposed actions willl likely have a significant effect on the environment due to at least: the loss or destruction of natural and cultural resources; curtailing the range of beneficial uses of the environment; substantial degradation of environmental quality; cumulative effects on the environment; and potentially substantially affecting rare, threatened or endangered species, or its habitat. The scope of the EISs must address these effects. The scope must include a temporal baseline that captures the impacts of collection pressure over time, before the natural populations of targeted species were depleted by this activity. Proper examination of the magnitude of the effect of aquarium collecting on natural populations and the coral reef ecosystem over time requires a look-back period that in the very least begins in 1953 when the aquarium permits were authorized by the state.	Comment noted. The DEIS evaluates the HEPA significance criteria in Section 5.6. The scope of the DEIS evaluates each of the five alternatives based on their impact to the current baseline conditions, because that is the environment which would be impacted by each of the five alternatives.
Environmental impacts from aquarium trade activities have been documented for over forty years. Under the Preferred Alternative, every fish and marine creature, other than corals and those associated with live rock, could be removed from one, or all, of the State of Hawai'i's reefs—with catastrophic effects. This is not speculation: there is currently no law, regulation or enforcement capability that would prevent this from occurring. The potential for unlimited collection is a fact that encompasses the outer limits of what the aquarium permits allow, as was explained earlier. Collecting individual species in high numbers poses a significant threat to coral reef health. As explained herein, herbivorous species, such as Yellow Tangs and Goldring Surgeonfishes, are the most heavily targeted. Herbivorous fish are essential to avoid algal overgrowth of corals and concomitant degradation of the reef. Hermit crabs are also collected in large numbers despite being essential to ecosystem health. Other important functional groups include: planktivores (e.g. Hawai'ian Dascyllus), corallivores (e.g. Fourspot Butterflyfish, Multiband Butterflyfish), fish predators (e.g. Hawkfishes, Hawai'ian Lionfish) and cleaner fishes (e.g. Hawai'ian Cleaner Wrasse). The collection of large numbers of invertebrates including hermit crabs and shrimps that are grazers, scavengers, or cleaners, could potentially have serious ecosystem impacts including reduced resiliency to other threats.	Comment noted. The concept of "unlimited" collection is still speculative and not reasonably foreseeable. Analyzing extreme possibilities is not helpful (and not what the law requires). The law requires an assessment of the "expected consequences" of a proposed action. The Preferred Alternative in the DEIS limits the number of permits to be issued to 14 permits, and limits the permits to the WHRFMA. The DEIS uses the best available data (past commercial aquarium collection) to predict the reasonable outcome of issuance of permits for five additional years. The analysis in the DEIS is limited to the island of Hawai'i. As noted in Section 4.4 of the DEIS, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, include a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI). It is understood that coral reefs are a complicated ecosystem made up of many species that each serve a function. However, given the conclusions in the DEIS that commercial aquarium collection is not significantly impacting the populations of any of the White List Species on the island of Hawai'i , the species are anticipated to continue to serve their functions in the ecosystem. In addition, as noted in Section 5.4.1.2 of the DEIS, Tissot and Hallacher (2003) found no evidence that algal growth was higher in areas of collection versus areas without collection, despite differences in fish abundance. Additionally, the DAR (2019) reported that herbivore biomass has not changed since 2003 in the open areas or FRAs and has increased by 30.8% in the MPAs. While there has been no significant change in Open Areas or FRAs, there has still been an increasing trend, with a 14.4% increase in herbivore biomass in FRAs and a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (Gove et al. 2019). This occurred even with the pressures from commercial aquarium collection, which was occurring during this time.

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The reduction of natural populations of species taken by the aquarium trade in any area (e.g. specific site, zone, coastline, island or statewide), and by any amount, whether one or one hundred percent, indicates an irrevocable commitment and loss of a natural and cultural resource. This very loss curtails the range of beneficial uses that would otherwise be provided by the natural abundance of these populations. As has been long recognized, "The impact of commercial aquarium fish collecting is a complicated issue. The fish community members are highly dependent on one another. There is a constant interaction between predators and competitors, as well as other members of the food web. There is a lot of variability in the system, even when it is not disturbed by man. Reefs seem to undergo natural cycles. At times they may be very abundant. There is also natural variation in the fish community at different locations." The EISs and any discussion of "sustainable" must include the high aesthetic value of this beautiful marine life as well as impacts to the complex relationships inherent in coral reef ecosystems and impacts to overall coral reef health. "Animal communities" are included in the rule definition for "environment," however the FEAs exclude any mention of the impact to fish and invertebrate communities.	Comment noted. This is not an irrevocable action, as commercial aquarium permits may be suspended pursuant to HAR 13-74-3(1) if the department determines that it is necessary for the protection and conservation of aquatic life. In addition, fish will continue to reproduce. The DEIS concludes that there will be no significant reduction in the natural populations of species collected by the aquarium trade. In addition, regarding the aesthetic values of fish, the DEIS concludes that the percent of each population collected would be imperceptible to observers.
The Hawai'i State Wildlife Action Plan (SWAP) states that "Excessive extractive use constitutes a threat to wildlife. Certain reef fishes are harvested for sale in the aquarium trade . . . . These activities are not sustainable on a large scale and impact native wildlife."	Comment noted. The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).
The list of species of greatest conservation need includes at least 18 native fish species that are threatened by the aquarium trade and in need of conservation actions to reduce the risk of extinction (see Fig. 2).	Comment noted. The Preferred Alternative in the DEIS includes limited permit issuance for the WHRFMA only, which limits collection to the 40 White List Species, of which three are SGCN, which are discussed in Section 5.4.1.2 of the DEIS. The DEIS concludes no significant impact to these three species.
Butterflyfishes are heavily targeted by the aquarium trade (Fourspot Butterflyfish, Longnose Butterflyfish, Teardrop Butterflyfish, Forcepsfish, Multiband/Copperband). Reported aquarium harvest of those same five species has since plummeted (see Fig. 5). The same is true for other heavily targeted butterflyfish species that have been among the top twenty aquarium fishes collected by the trade since 1976. This sharp decline in reported catch is not an indicator that these species are no longer in demand. Continuing demand is confirmed by several examples: • These species' inclusion in the West Hawai'i White List. • Their exclusion from the O'ahu rules (The O'ahu aquarium rule prohibits take of three butterflyfishes, citing their "coral diets" as the need for the restriction. Since 1999 total reported take of those three species was 50 fish. Zero restrictions were provided for three additional coral eating butterflyfishes, with total reported take of over 51,000 individuals since 1999.) • The Fourspot Butterflyfish catch increase that followed the 2014/2015 warming event and unprecedented fish bloom. Subsequently, catch of the Fourspot Butterflyfish declined to an all-time low. The scope of the EISs must include a temporal baseline that captures the impacts of the heavy collection pressure on these species over time, before their natural populations were depleted by this activity.	Comment noted. Of the five butterflyfish species mentioned specifically in the comment, the DEIS concludes that commercial aquarium collection is anticipated to take 1% or less of the population of the fourspot butterflyfish, forcepsfish, and multiband/copperband butterflyfish (see Table 5-14 in the DEIS). The longnose butterflyfish and teardrop butterflyfish are no longer able to be collected in West Hawai'i. The scope of the DEIS evaluates each of the five alternatives based on their impact to the current baseline conditions, because that is the environment which would be impacted by each of the five alternatives.

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In nearly every encounter with commercial aquarium collectors on West Hawai'i reefs, snorkelers and divers have witnessed and documented destructive practices that harm corals, with the most damage coming from vessel anchors and chains. Sticks, buckets, nets, underwater propulsion devices (scooters) are laid in the corals and the fins, knees and legs of collectors often come in contact with the reef—in fact, they are typically described as "crawling across" or "standing" on the corals. The results of these actions include abrasion and coral breakage. Both FEAs refer to a study that determined there was no evidence to indicate the presence of destructive fishing practices (e.g. breaking apart corals to capture hiding fishes).However, the abundance of photographic evidence documenting coral breakage from vessel anchoring and fish capture activities, these impacts cannot be dismissed and must be evaluated in the EISs. Photographs of these practices and their effects can be found at Appendix 2	Comment noted. Section 5.4.1.2 of the DEIS notes that two studies have concluded that the aquarium fishery and aquarium fish collection practices have no significant impact on coral or the reef ecosystem. The Applicant is not aware of any scientific studies documenting damage to coral reefs as a result of commercial aquarium collection in Hawai'i.
In addition to the impacts to biodiversity, ecosystem function, and other fisheries, aesthetic and other social values are also heavily impacted. Species experiencing the heaviest collection pressure, with a corresponding reduction in natural abundance, are Hawai'i's most beautiful, charismatic and iconic fishes. The diminished aesthetic value from the cumulative and substantial reductions in species such as Yellow Tangs, butterflyfishes and Moorish Idols, which are dominated by vibrant yellows and oranges and striking white and black patterns, cannot be overestimated (see Fig. 6). These colors are more than aesthetically pleasing, as our eyes are physiologically attuned to them. The frequencies and wavelengths of yellows, oranges and reds allow them to strike our eyes much faster than the other colors. By removing the species with prominent yellow, orange, red or white coloration and markings, the palette and very essence of what makes a coral reef beautiful to the human eye is diminished and degraded. It is impossible to decrease populations of a coral reef's beautiful wildlife without greatly decreasing the natural beauty of the place.	Comment noted. The DEIS concludes that there will be no significant reduction in the natural populations of species taken by the aquarium trade. In addition, regarding the aesthetic values of fish, the DEIS concludes that the percent of each population collected would be imperceptible to observers. As noted in Section 5.2.2.2 of the DEIS, available data do not suggest that commercial aquarium collection has impacted the tourism industry in Hawai'i. Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories.
The EISs must acknowledge and address the effects of the trade on the amenity/property values and propose proper mitigation measures. Houses that are within a block or 100 meters of beautiful, clean and healthy coastlines, beaches and coral reefs are more valuable and sell for significantly higher prices than comparable properties elsewhere. The same is true for condos and hotels/hotel rooms which generally command higher room and occupancy rates. Healthy coral reefs are also more likely to prevent beach erosion and, therefore, add value as a form of coastal protection. One and a half percent of the sale price of these properties is attributable to the marine ecosystem. Hawai'i's reef-related property value in 2001 was calculated at $40 million.	Comment noted. The DEIS addresses socioeconomic impacts in Section 5.2. The average sale price of homes in 2014 was $594,440, which was 26.4 percent higher than the average sale price in 2011. In 2015, the total number of home sales increased by 9.3 percent (HDBEDT 2016). The DEIS does not conclude that there are any impacts to housing values; therefore, no mitigation is proposed or required.
The EISs must acknowledge and address the effects of the trade on the recreational value of this marine life and their coral reef homes and propose proper mitigation measures. The annual estimated expenditures related to marine life viewing (i.e. snorkeling and scuba) in Hawai'i is $551 million. Reef-adjacent marine tourism expenditures (including hotel rooms) within 30 km of the coastline are an annual $680 million. These amounts exclude the lost value from declining fish abundance which is captured in willingness to pay surveys and summarized below: Healthier reefs lead to substantial economic gains; Recreational users are willing to pay higher rates for a healthier marine environment; Snorkel/dive businesses benefit when there are more fish for their clients to see; One recent study showed divers were willing to pay $93 to $110 more to dive with abundant fish life; Without new regulations the potential for increasing losses is real; Inability to stem declining reef fish numbers could cause significant losses to dive tourism industry (i.e. reductions in willingness to pay); These consumer surplus losses could range from $1.2 million to $12.2 million annually; Areas with degraded reefs and low fish populations could also see significant losses from a decrease in their share of the global dive market; Anecdotal reports from long-time residents and visitors point to revenue loss already occurring from reduced abundance of beautiful fishes on Hawai'i reefs.	Comment noted. The DEIS addresses socioeconomic impacts in Section 5.2. As noted in Section 5.2.2.2 of the DEIS, available data do not suggest that commercial aquarium collection has impacted the tourism industry in Hawai'i. Hawai'i's tourism industry achieved new records in total visitor spending and visitor arrivals in 2017, marking the sixth consecutive year of record growth in both categories. The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). Additionally, Section 5.4.1.2 of the DEIS notes that two studies have concluded that the aquarium fishery and aquarium fish collection practices have no significant impact on coral or the reef ecosystem. Therefore, the DEIS concludes that coral and reef fish viewing opportunities would not be significantly impacted under the Preferred Alternative. The DEIS addresses the cumulative impact of tourism, including damage to coral reef habitat in associatiojn with tourism (thorugh coastal development, point source pollution, and recreational activities) in Section 5.4.3.4.

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The EIS must acknowledge and address the effects of the trade on the substantial non-use values of this marine life and their coral reef homes and propose proper mitigation measures. Intrinsic and social values associated with coral reefs are diminished by reduced fish populations. Concern for the marine environment has increased in recent years and people now place tremendous value on coral reef ecosystems. Many people value beautiful and healthy coral reef ecosystems as part of their legacy and responsibility to ensure future generations are able to experience them. A 2011 report for the National Oceanic and Atmospheric Administration (NOAA) estimated the passive use annual value of Hawai'i's coral reef ecosystems through a willingness to pay survey of U.S. households. The survey included a visual representation of an overfished and an abundant coral reef (see Fig. 7). The project determined that increased protections and restoration of degraded coral reefs in Hawai'i is worth about $288 to the average U.S. household which aggregated over all U.S. households amounts to a $34 billion annual passive use value for Hawai'i's coral reefs.58 This and other socio-economic values described here provide meaningful insights into the public's concerns and should be addressed in a comprehensive EIS.	Comment noted. The DEIS addresses socioeconomic impacts in Section 5.2, and addresses cultural impacts in Section 5.3 (as well as in the Cultural Impact Assessment, which is Appendix A of the DEIS). The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).
As noted earlier and as set forth in HAR §§ 11-200-10 and -16 through -18, a complete analysis and discussion of impacts to cultural resources is required. The EISs must acknowledge and address the direct, indirect, and cumulative impacts on cultural resources. The loss and harm caused by the irrevocable commitment of natural resources equally applies to impacts to cultural resources, as well. The EISs must also acknowledge and address the effects of the trade on Native Hawai'ians traditional reliance on species targeted by the trade for subsistence, such as pāku'iku'i (Achilles Tang) and kole (Gold Ring Surgeonfish), and propose proper mitigation measures.	Comment noted. The DEIS addresses the cultural significance of each of the 40 White List Species in Section 4.4.1. A Cultural Impact Assessment has been included as Appendix A of the DEIS, and cultural impacts are addressed there and within Section 5.3 of the DEIS.
The EISs must also acknowledge and address the Native Hawai'ian cultural and spiritual connections to the reef. Examples include consideration of the reef ecosystem and its associated gods and goddesses and their many kinolau (divine bodily forms). These gods and goddesses include, but are not limited to, the Goddess Hina and her form as Hina 'Opu Hala Ko'a who is the goddess of the coral and who gives birth to the reef itself; or, in her moon form which relates to coral spawning events. The Native Hawai'ian ceremonial practices associated with these types of cultural and religious beliefs must be included in the scope of the EISs. Likewise, many of the particular fish species favored by the aquarium trade also happen to be 'aumakua (family guardians). The taking of these species obviously adversely impacts Native Hawai'ian cultural and religious beliefs and practices. These aspects must be addressed in the EISs. "Malama aina involves asking permission prior to fishing, taking only what you need, sharing your catch with your extended 'ohana or community and having respect for the sacredness of the process. Clearly, harvesting live fish for economic gain and shipping them in a bag for a long, convoluted odyssey, potentially resulting in mortality and waste, violates the very core of these traditional values."67 The aforementioned examples were not adequately addressed in the FEAs and serve to highlight that where cultural impacts are concerned, the need for significant analysis remains.	Comment noted. The DEIS addresses the cultural significance of each of the 40 White List Species in Section 4.4.1. A Cultural Impact Assessment has been included as Appendix A of the DEIS, and cultural impacts are addressed there and within Section 5.3 of the DEIS.

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A major factor that drives the rates of collection is premature mortality rates in captivity. According to a long-time industry insider, most yellow tangs die with the first month in a hobbyist tank and fewer than 1% of those captured survive one year in captivity. A 2012 study determined that mistreatment in capture, handling, transport, and holding plays a larger factor in these premature deaths than hobbyist inexperience. Hawai'i's Yellow Tang ranks among the top ten fish sold in the marine aquarium trade. As such, it was prominently featured in the study, in both the consumer survey, as one of the nine fish species featured, and in the supply chain analysis, as one of the eighty-five species analyzed which included eleven other species that are captured both in Hawai'i and elsewhere in the Indo-Pacific. The researchers also determined that each step in the supply chain significantly profits from customer purchases to replace fish that die prematurely, and that profits from replacement fish sales are so high, stores have no incentive to take action to reduce deaths.	Comment noted. As stated in Section 2.5 of the DEIS, the DEIS focuses primarily on the effects of aquarium fishing on wild populations of White List Species, as it is at the population level that DAR measures changes in White List Species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population. In addition, the paper referenced here (Cartwright et al. 2012) is focused on marine ornamentals from the "Coral Triangle" (Philippines, east Malaysia, Indonesia, Timor-Leste, Papua New Guinea, and the Solomon Islands), where they commonly use harmful chemicals such as cyanide and dynamite to catch fish, which then leads to extremely high mortality rates in the supply chain. These practices are not used in Hawai'i.
A number of practices frequently utilized as cost saving measures by the aquarium trade in Hawai'i are inhumane and significantly contribute to the stressors that accumulate and ultimately lead to premature deaths of captive marine life. They include rapid surfacing and subsequent use of a technique known as "fizzing" to mitigate the resulting barotrauma injury to swim bladders; starving fish for 2 – 10 days prior to transport and spine cutting. Alternatives to these practices include slow surfacing, transport in larger volumes of water to dilute any waste produced by fishes during transport, and transport in hard plastic containers that cannot be punctured by fish spines. Every fish that dies early puts extra pressure on natural resources because of the take of replacements. There is a general consensus in many countries that it is not ethical to trade in live animals, unless their health and welfare are ensured. These unnecessary and early deaths have given the trade a poor image. A $20 million, multi-stakeholder reform effort failed, in part, because of trade reluctance to address, and take steps to reduce, mortality rates. Fifty percent of species among Hawai'i's historical top 20 fish list are either not guaranteed to arrive alive or stay alive longer than 7 – 14 days when purchased from online or "brick and mortar" retailers. Examples are found in Appendix 3.	Comment noted. As stated in Section 2.5 of the DEIS, the DEIS focuses primarily on the effects of aquarium fishing on wild populations of White List Species, as it is at the population level that DAR measures changes in White List Species and makes management decisions (e.g., issuance of harvest permits, implementation of bag limits). Therefore, because population effects have already occurred once an individual fish has been removed from the ocean, it is beyond the scope of this analysis to evaluate effects on individual fish once they are removed from the population.

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Baseline fish population data from the 1970's at Honaunau in West Hawai'i were compared to data gathered in surveys conducted 1998 – 2001. The results indicated that nearly all small bodied surgeonfish, butterflyfish and angelfish (i.e. species targeted by the aquarium trade) declined in abundance. Commercial aquarium collecting was implicated in the decline (see Fig. 8). Similar results were found at Ke'ei where the site had been intermittently surveyed since 1979. "Of the 20 most collected aquarium species, 18 declined in abundance with the species facing the heaviest fishing pressure typically showing the greatest declines." In addition to documenting the impact of aquarium collecting in these areas, these studies also document baselines for abundance levels of aquarium targeted and other impacted species. Examinations of reported catch, as documented by DLNR, serve to further highlight the impacts of the trade. The documentation shows that the initial surveys were conducted during a time when the aquarium trade reported taking fewer than 50,000 fish annually from West Hawai'i reefs. In subsequent years, from 1987 to the final surveys in 2001, reported aquarium fish catch in West Hawai'i ranged between 150,000 and 300,000 individuals taken. Since then the annual West Hawai'i aquarium fish catch has ranged between 250,00 and >450,000 fish. Additionally, with the closure of approximately 32% of the reefs in West Hawai'i with the implementation of the FRAs in 2000, this increased fishing pressure was focused in smaller areas with likely intensified results.	Comment noted. The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). As discussed in the DEIS, population trends for the two top collected species (Yellow Tang and Kole) show significantly increasing population trends. For the next eight most commonly collected species, six species have had long-term population increases. For the two species with long term declines, these declines were in both FRAs (where commercial aquarium collection is not allowed) and in Open Areas, with larger declines seen in FRAs than in Open Area, suggesting that some factor other than commercial aquarium collection is driving the decline. For one of these species, the Achilles Tang, a reduced bag limit is proposed in the Preferred Alternative to reduce impacts to this species. The commenter also noted a concern of increased fishing pressure in open areas due to the closure of approximatly 32% of the reefs. As stated in Section 4.4 of the DEIS, there is connectivity around the island of Hawai'i, with fish from protected FRAs being documented to seed unprotected areas, highlighting the effectiveness of protected areas (Christie et al. 2010). And as discussed above, population trends for many of the species have increased since establishment of this network of FRAs. Lastly, the paper referenced in the comment was Williams and Walsh (2007). This study was conducted in 1998-2001, which coincides with the beginning of the FRAs, and as stated above, population trends for eight of the top ten collected species since implementation of more regulations in 1999 have been stable or increasing. The evidence suggests that the conservation measures put in place in 1999 and 2014 are working, and the Preferred Alternative adds additional conservation measures. Williams and Walsh (2007) also found declines in food fishes (17 of the 29 species) and other species (26 of the 47 species), but these were determined to be non-significant because it wasn't as large of a proportion of the group as aquarium fish (18 of the 20 species). However, of the ten aquarium fish species that they evaluate in the text, half of the species are not on the White List, and are thus no longer collected in West Hawaii.

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Another long-term study looked at reefs in South Kohala and determined that reef fish abundance was in "drastic decline" and reefs were in "dire straits". Populations of all of the top five most abundant fish families had declined since the original surveys conducted in 1979-1981 (see Fig. 9). Thirty-one of the thirty-five most abundant fish species had declined, including 19 species targeted by the aquarium trade. Most of the aquarium targeted species had declined by more than 50% and many were down by more than 80%. The extent to which the massive increase in reported take has contributed to this decline must be studied. As the Applicant noted in the FEAs' responses to this comment, the "Dire Straits" report concluded that "the widespread declines in families of fish not typically targeted either for food use or for the aquarium fishery suggest that other, more widespread factors are additionally contributing to the overall long-term declines in fish abundance."[emphasis added] Rather than rebutting the argument that further analysis is needed, this statement only serves to highlight why the EISs must also evaluate the potential of cumulative impacts of other factors (e.g. pollution, and sedimentation) on targeted fish species, such as decline of coral coverage, which have been demonstrated to influence reef fish species diversity and abundance.	Comment noted. The Applicant used the best available science to develop the DEIS, including recent population estimates (CREP 2018). The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). Furthermore, more recent data than that provided by the commenter has been included in the DEIS. DAR (2019) reported that total abundance of nearshore fishes has had a significant positive trend in all management areas (open areas, FRAs and MPAs) since 2003. As discussed in the DEIS, population trends for the two top collected species (Yellow Tang and Kole) show significantly increasing population trends. For the next eight most commonly collected species, six species have had long-term population increases. For the two species with long term declines, these declines were in both FRAs (where commercial aquarium collection is not allowed) and in Open Areas, with larger declines seen in FRAs than in Open Area, suggesting that some factor other than commercial aquarium collection is driving the decline. For one of these species, the Achilles Tang, a reduced bag limit is proposed in the Preferred Alternative to reduce impacts to this species. Lastly, the DEIS evaluated the cumulative impacts in Section 5.4.3. As noted in Section 5.4.3.6 of the DEIS, cumulative impacts to the 12 White List Species which have significantly declined between 1999 and 2017 would be significant. However, as noted in Section 5.4.3, the DAR (2019) found that declines were occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating the aquarium collection is not driving the decline. While commercial aquarium collection does contribute to the cumulative impact, it is a less than significant factor in the observed declines. Additionally, measures included in the Preferred Alternative (e.g., limited permit issuance, reduced Achilles Tang bag limit) may mitigate potential impacts by limiting the number of aquarium permits issued as well as the number of Achilles Tang that can be collected by commercial aquarium collectors each day.
The areas south of these reefs are subject to some of the most intense aquarium collecting pressure in the state. Aquarium take between Keahole Point and these reefs in South Kohala, in one year alone, exceeds the aquarium take from the entire Great Barrier Reef in Australia, which has a reef area that is 300 times larger than Hawai'i's. For example, in 2014 aquarium collectors reported taking 191,083 fish from this Hawai'i zone. By comparison, 2014 reported aquarium take from the Great Barrier Reef was 112,000.	Comment noted. The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006).

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Abundant populations of herbivorous fishes are critically important to coral reefs. They keep algae from overgrowing corals or preventing new corals from starting. Important families of herbivorous fishes in Hawai'i include surgeonfishes, damselfishes and parrotfishes. The vast majority of fishes taken by the aquarium trade are surgeonfishes. Yellow Tangs are the dominant herbivore in West Hawaii. They are also the most heavily collected species. The Dire Straits study documented a 90% decline in herbivorous surgeonfish and damselfish populations, while parrotfish populations had actually increased over time. This aforementioned 90% decline in herbivores contributed to a 35% reduction in coral cover, a 64% reduction in coral building coralline algae, a 38% increase in algae at one site and a staggering 322% increase in algae at another. DLNR claims that parrotfishes are more important herbivores than surgeonfishes when it comes to keeping algae in check on coral reefs. On these South Kohala reefs, the increased parrotfish populations were not enough to offset the loss of surgeonfishes and damselfishes, and the algae still outcompeted the corals. The notion that surgeonfishes taken by the aquarium trade are not an important component to coral reef health is challenged by this study. The FEAs attempt to downplay the importance of surgeonfishes and other herbivorous fishes taken by the trade by citing a 2003 study by Tissot and Hallacher (described more in the next section) that found no evidence of increased algal growth in areas of collection versus areas without collection, despite reduced fish abundance in the collected areas. However, the authors concluded that the study may not be a good test of that hypothesis for several reasons and that further investigation is warranted. Further, a more recent assessment of ecosystem trends in West Hawai'i includes, among other data, the differences in herbivore biomass and coral cover between reefs on the northern portion of the West Hawai'i coast (which encompasses the South Kohala area described above and extends from Keahole Point, northward) and reefs on the southern portion (from Keahole Point, southward). The data shows that herbivore biomass in the north is significantly lower than that found on the south. Additionally, while the northern reefs are now dominated by algae, and coral cover has declined by ~30%, the same not true for the southern reefs. Notably, though the northern area is~33% smaller than the area to the south, catch reports do not indicate a corresponding reduction in take. In fact, in 2014 take was higher in the north than in the south. The extent to which heavy collection pressure in the north has contributed to this shift must be thoroughly addressed in the Hawai'i EIS. The FEAs also attempt to downplay the importance of herbivores taken by the trade by claiming that they target the smaller fish which are "the least effective sizes for cropping algae." A comparison of adult Yellow Tang densities in the West Hawai'i long-term protected areas (i.e.MPAs) vs. the Open Areas, shows that collection pressure on small, juvenile, Yellow Tangs has reduced the natural abundance of adults, which are 2 – 4 times larger than juveniles, by an average of 60%. The fact remains that algae now dominates many West Hawaii reefs, making it essential that the EISs thoroughly evaluate and mitigate any Applicant impacts that occur as a result of reduced herbivory.	Comment noted. As noted throughout the DEIS, the DAR (2019) reported that herbivore biomass has not changed since 2003 in the open areas or FRAs and has increased by 30.8% in the MPAs. While there has been no significant change in Open Areas or FRAs, there has still been an increasing trend, with a 14.4% increase in herbivore biomass in FRAs and a 26.0% increase in herbivore biomass in Open Areas between 2003 and 2017 (DAR 2019, Gove et al. 2019). This occurred even with the pressures from commercial aquarium collection, which was occurring during this time. Since establishment of the FRAs, the population of Yellow Tang has increased 150% (over 3.4 million fish) between 1999/2000 and 2017/2018, to a current population of approximately 5.7 million fish (DAR 2019). While they are the most heavily collected species, they have increased even in Open Areas, doubling in population size since 1999. The role of herbivores, and the impact of aquarium collection on these species, is included in Section 5.4 of the DEIS.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
Two peer reviewed studies documented the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species by the aquarium trade. One, published in 2003 by Tissot and Hallacher, was conducted the two years prior to the establishment of the West Hawai'i Fish Replenishment Areas (i.e. aquarium no-take zones). The next study, by Tissot, et al., was conducted in 2000-2002, three years after those area closures. The results of each study showed that aquarium collectors have a significant effect on the abundance of targeted aquarium fishes (see Fig. 11). The U.S. Coral Reef Task Force described these results as follows: "Severe overfishing for aquarium trade occurs even in the United States: Aquarium fishes outside of reserves [in West Hawai'i] experience significant declines – from 14% to 97%." In a 2010 grant report to NOAA, DLNR documented that "a number of aquarium-targeted species have not responded to the increase in protected areas and have actually decreased in West Hawai'i since 1999" (see Fig. 11). Per DLNR aquarium catch reports, these species are also among the top 20 most harvested fishes. Nonetheless, all but two species, the Moorish Idol and the Hawai'ian Cleaner Wrasse, were included in the West Hawai'i 40 Species White List adopted in 2014. DLNR therefore calls for the continued harvesting of these species, despite knowing that their populations are in decline.	Comment noted. The FEAs use the best available data regarding species abundance, including more recent data on the effectiveness of the WHRFMA and existing restrictions than the citations provided by the commenter. DAR (2019) reported that total abundance of nearshore fishes has had a significant positive trend in all management areas (open areas, FRAs and MPAs) since 2003. For the 12 White List Species which had significant declines, as noted in Section 5.4.3, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines.
Three species identified in the SWAP, the Bandit Angelfish, Bluestripe Butterflyfish, and Hawai'ian Turkeyfish Figure 4 (in gold outline) were included in a DLNR presentation on West Hawai'i Species of Special Concern (Fig. 2) where two were described as routinely seen in the 1970's and now very rare, and one was described as down by 99% in two different areas.	Comment noted. Collection of these three species is not allowed in the WHRFMA, as none of these species are on the White List.
In West Hawai'i the decline of butterflyfishes has been well-documented in both population surveys and aquarium catch data. A 2008 presentation on West Hawai'i aquarium species of special concern reported declines in butterflyfish abundance and diversity. Two species were particularly hard hit: the Bluestripe Butterflyfish and the Teardrop Butterflyfish, experienced population declines ranging from 89% - 100% in two West Hawai'i areas (see Fig. 12).	Comment noted. Collection of these two species is not allowed in the WHRFMA, as the Bluestripe Butterflyfish and the Teardrop Butterflyfish are not on the White List.
The Bluestripe Butterflyfish is a highly unique, endemic Hawai'ian species that, having no sister species elsewhere in the Indo-Pacific, is also known as a relic (see Fig. 13). Until 1980, this species was among the top twenty fishes collected in West Hawai'i, with an annual average harvest of 347. By 2012, the last year this species appeared on West Hawai'i catch reports, reported harvest had dropped to a total of nine. This species was excluded from the West Hawai'i forty species White List which went into effect in 2014. 2015 Hawai'i SWAP lists the Bluestripe Butterflyfish among the species of greatest conservation need in the 2015 Hawai'i State Wildlife Action Plan. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction."	Comment noted. Collection of the Bluestripe Butterflyfish not allowed in the WHRFMA, as the species is not on the White List.

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Comment	**Response**
According to DLNR reef surveys and catch data, the Teardrop Butterflyfish has also experienced drastic declines on West Hawai'i reefs (see Fig. 12). This beautiful species is named for the striking upside down black teardrop located mid-body (see Fig. 3). Until 1980, the Teardrop Butterflyfish was among the top ten fishes collected in West Hawai'i with an average annual harvest of 1,454 individuals (see Fig. 14). During the following five years, the harvest rate dropped, but it was still among the top twenty species collected (see Fig. 14). Though collection continued until at least 2013, by the late 1990's DLNR considered Teardrop Butterflyfish as no longer targeted by the aquarium trade and excluded them a list of aquarium targeted species provided to researchers, Brian Tissot and Leon Hallacher, who were embarking on a project to document the magnitude of the effect of aquarium collecting on natural populations. They were, however, included in the surveys to test assumptions since they were similar to targeted species. The researchers encountered just one individual Teardrop Butterflyfish during the entire study and so they were excluded from further analysis. In 2011 a group of divers encountered an aquarium collector at a popular North Kohala dive site. They watched in horror as the collector scooped up the first Teardrop Butterflyfish they had seen in that area in years along with a number of yellow tangs and other fishes (Fig. 15).92 In 2013, the last year Teardrop Butterflyfish appeared on aquarium catch reports, reported take had dropped to a total of ninety, reflecting a 99% drop in annual catch since 1980.93 This species was excluded from the West Hawai'i forty species White List which went into effect in 2014. The exclusion of any formerly collected species from the White List, such as the Bandit Angelfish, Bluestripe Butterflyfish, Hawai'ian Turkeyfish, Teardrop Butterflyfish, or Thornback Cowfish, is not an exemption for a thorough analysis of their current status within the West Hawai'i Regional Fishery Management Area (WHRFMA) and elsewhere on Hawai'i Island, compared to the baseline (i.e. historic natural abundance), nor does it exempt the need for thorough analysis of impacts from collection efforts elsewhere in the state.	Comment noted. Collection of the Teardrop Butterflyfish is not allowed in the WHRFMA, as the species is not on the White List. Because these species cannot be collected, implementation of the Preferred Alternative would not impact their populations. Impacts to the reef ecosystem as a whole are analyzed in Section 5.4 of the DEIS. The scope of the DEIS is limited to the island of Hawai'i, and the Preferred Action limits permit issuance to the WHRFMA, where only the White List Species can be collected.
The aquarium fishery in West Hawai'i takes 1.8X more reef fish than recreational and other commercial fishing combined. Most of these fish are yellow tangs.	Comment noted. The statement in the comment is included in the DEIS from the DAR 2019 report. As noted in Section 5.4.3.2 of the DEIS, the DAR report also stated if Yellow Tang, which is primarily collected at small sizes and generally not targeted by other fishers, is excluded, on average the recreational and commercial fisheries combine to take 3 times the number of reef fishes (194,674/year) caught annually by aquarium collectors (64,815/year).
"Overall Yellow Tang abundance in 30'-60' hardbottom habitat in West Hawai'i increased by 355,758 individuals from 1999/2000 to 2010-2012 even though Yellow Tang abundance in the Open areas decreased by 21%. This decrease is attributable largely to an increase in the number of aquarium collectors and collected animals relative to the period when the FRAs were established." Over sixty percent of West Hawai'i reefs are open to the aquarium trade. On the reefs in those areas, the impact of the aquarium trade on natural populations of yellow tangs has been a significant reduction in the abundance. For example, natural populations were reduced by over 75% in 2007-2009 and in recent years, by 60% (see Fig. 16). The increase in FRA Yellow Tang abundance that began in 2002, three years after establishment of these protected areas, is a clear example of the impact of the trade on natural populations: when collection pressure is removed, given enough time, populations may be able to rebound. As noted earlier, the overall increase in Yellow Tang abundance that has occurred since 2014 is due to an anomalous recruitment pulse that coincided with warming waters in 2014. Typical recruitment pulses, such as those that occurred in 2002 and 2009, have resulted in short-lived increases in fish populations that were followed by prolonged or short and steep population declines	Comment noted. Section 5.4.1.2.1 of the DEIS includes more recent data than that referenced in the comment, which shows an increase in Yellow Tang populations between 1999-2000 and 2017-2018 in all areas, including a 101% increase in Open Areas.

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Comment	Response
We agree with DLNR that the Achilles Tang Conservation Alternative does not provide a scientific basis for concluding that the proposed reduction would be sufficient to sustain the population. Further, in 2014 a bag limit of 10 Achilles Tang per day was imposed on the aquarium trade in an attempt to address declining populations in West Hawai'i. Since 2014, the price has increased, populations have decreased. The FEA proposes to reduce the daily bag limit to 5 per day for commercial aquarium purposes and create a 5 per day bag limit for all consumptive purposes, as well. As with other heavily targeted aquarium species, the natural abundance of Achilles Tangs, as indicated by population densities in long-term protected areas such as MPAs, is substantially diminished by aquarium trade collection pressure. Most importantly, a serious flaw in the DLNR data used by the Applicant to show Achilles Tang catch as a percentage of the Open Area population substantially underestimates the impact of collection pressure. DLNR compared Achilles Tang average reported catch over FY 2013 – 2014 to their CY 2012 – 2013 Achilles Tang Open Area population estimate and determined that catch as a percentage of Open Area population was 32.7%. An examination of catch report data reveals that had they used reported catch from the same time period as the population estimate (i.e. CY 2012 – 2013), Achilles Tang catch as a percentage of Open Area population was substantially higher (see Fig. 18). This exemplifies the potential for extreme over-collection by the trade; the need for a thorough review of annual reported catch numbers and their relationships to the populations of aquarium targeted species in the areas from which they taken; and, the need for mechanisms for real-time assessments and adjustments to protect these vulnerable species.	Comment noted. Impacts to Achilles Tang are addressed in detail in Section 5.4.1.2. As noted in this Section, while the most recent DAR report suggests there should be concern for the sustained abundance of Achilles Tang in the WHRFMA, the report concedes that WHAP transects are not located in prime habitat for adult Achilles Tang (i.e., high energy shallower surge zones), and therefore the bulk of the Achilles Tang population is not adequately surveyed by WHAP monitoring (DAR 2019). Additionally, unlike the Yellow Tang and Kole, Achilles Tang have generally been more abundant over the past decade in Open Areas compared to the protected FRAs, which may reflect habitat differences or differential non-aquarium fishing pressure in various areas (DAR 2019). It should be noted that even in the absence of collection by commercial aquarium collectors, harvest by other fishing groups would continue. The Applicant cannot independently confirm the Achilles Tang reported catch numbers presented in Table 18 of the comment, as they do not align with the collection numbers provided by the DLNR.
Unlike West Hawai'i, no aquarium fish population data was gathered during the early years of aquarium trade operations on O'ahu reefs. More recent data has been gathered in a yet to be published study by Dr. Gail Grabowsky of Chaminade University and is summarized below. Dr. Grabowsky reached the same conclusions reached by Williams and Walsh in a 2007 report documenting declines in populations of certain fishes on two Hawai'i Island reef areas: commercial aquarium collecting is implicated in the declines; and, the greatest declines are seen in the species that have faced the heaviest fishing pressure. Using the same methods described in earlier research on Hawai'i Island documenting the magnitude of the effect of aquarium collecting on natural populations of heavily targeted species, Dr. Grabowski and her team quantified the abundance of aquarium collected fish at over 20 sites around O'ahu from 2008- 2010. Surveyed species included Yellow tangs, Forcepsfish, the Hawai'ian "Domino" Damselfish, as well as additional butterflyfishes, surgeonfishes, and other fishes targeted by the aquarium trade. The fish population surveys showed that species targeted by the aquarium trade are ten times more abundant at Hanauma Bay, Hawai'i's first marine life conservation district, protected since 1967, than they are on other O'ahu survey sites.	Comment noted. The best available scientific data has been included in the DEIS, which is limited to the island of Hawai'i. Unpublished data from Dr. Grabowski was not available for analysis in the DEIS.
As with the Hawai'i Island studies conducted by Tissot and others, uncollected sites were selected as controls and served as a proxy for estimating natural abundance. The data also showed that aquarium fish are rare at Pupukea and Coconut Island in Kaneohe Bay, both of which are protected similarly to Hanauma Bay, but unlike Hanauma Bay, are easily accessed by poachers. There were no juvenile fish smaller than a silver dollar at Hanauma Bay, which led Dr. Grabowsky to surmise that it may be "that the fish are so depleted on O'ahu that those we see are the "living dead" who cannot effectively maintain a population due to their rarity. This is called the Allee effect and has been documented in other rare species."	Comment noted. The best available scientific data has been included in the DEIS, which is limited to the island of Hawai'i. Unpublished data from Dr. Grabowski was not available for analysis in the DEIS. As noted in Section 4.4.7.1 of the DEIS, the DAR (2019) concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors.
In addition to population surveys, catch data can provide an important view into the status of populations of targeted fishes. As explained elsewhere in these comments, using catch data to estimate the proportion of fishing mortality to total population is highly problematic since catch reports are unverified and both underreporting and non-reporting are highly likely .	Comment noted. As stated in Section 4.4.7.1 of the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors.

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Comment	Response
However, where baseline population data are absent, and where consumer demand exists for a particular species or family group, it is highly likely that substantial declines of reported catch reflect reduced abundance of the target sizes—juveniles in most cases—of those species or families Hawai'i's reefs. In fact, historical catch reports have been used to document the collapse of the aquarium fishery on southwest O'ahu reefs after hurricane Iwa hit Hawai'i in 1982 and damaged many reefs. Per anecdotal reports from a number of aquarium collectors, the storm destroyed important habitat for yellow tangs and other targeted species. This resulted in the migration of many fishes to undamaged coral reef areas. Aquarium collectors then concentrated their efforts on these sites and within a few short years, populations of species targeted by the trade completely collapsed. Referring to these data, researchers noted that since yellow tangs are in high demand, these declines reflect the situation on these reefs (i.e. reduced abundance of the small yellow tangs targeted by the trade) (Walsh et al. 2004). Catch reports from 2016 confirm that yellow tang populations have yet to recover (see Fig. 17, 18).	Comment noted. The DEIS includes the best available science, including updated population data on the Yellow Tang. The DAR (2019) concluded that there were no significant differences in the abundance of adult Yellow Tang in open vs. closed areas in shallow water (10-20-foot depths).
The Bluestripe Butterflyfish (see Fig. 13) was among the top fifteen aquarium fishes captured on O'ahu through the five-year period that ended in 1995. As of the five-year period that ended in 2015, reported catch had declined by 79% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional 15% (see Fig. 19). As previously noted, the Bluestripe Butterflyfish is listed among the species of greatest conservation need in the 2015 Hawai'i SWAP. Despite this listing and the alarming decline in reported catch, no take limits were placed on this species in the O'ahu Aquarium Rule.	Comment noted. The DEIS is limited to the island of Hawai'i. The Bluestripe Butterflyfish is not on the White List, and cannot be collected in the WHRFMA.
Reported catch of the Teardrop Butterflyfish has also experienced drastic declines on O'ahu reefs (see Fig. 19). During the ten-year period 1976-1985, the Teardrop Butterflyfish was among the top ten fishes collected on O'ahu with an average annual harvest of 2,558 individuals (see Fig. 19). During the following five years, the harvest rate dropped, but it was still among the top twenty species collected. As of the five-year period that ended in 2015, reported catch had declined by 94% from the five-year period that ended in 1980. In 2016, reported catch dropped an additional point (see Fig. 19).	Comment noted. The DEIS is limited to the island of Hawai'i. The Teardrop Butterflyfish is not on the White List, and cannot be collected in the WHRFMA.
The Bandit Angelfish is another beautiful and highly unique, endemic Hawai'ian species with a color pattern unlike that of any other angelfish on Earth (see Fig. 20). The Bandit Angelfish has been among the top twenty aquarium fishes captured on O'ahu on and off since 1976, most recently in During the five-year period 1976-1980, annual reported catch averaged 1,380 individuals (see Fig. 19). After that, annual reported catch rarely exceeded 600 individuals and from 1996-2005 the average was less than 100. As of the five-year period that ended in 2015, reported catch had declined by 64% from the 1976-1980 high (see Fig. 19).	Comment noted. The DEIS is limited to the island of Hawai'i. The Bandit Angelfish is not on the White List, and cannot be collected in the WHRFMA.
Catch reports also indicate increasing consumer demand for this precious species in the landed value data. From 1976-2003 the average landed value for a Bandit Angelfish was $10. By 2004 it had jumped to $54 and in recent years has skyrocketed to $137 each. A similar pattern was noted for Bandit Angelfishes captured in West Hawai'i and prompted University of Hawai'i (UH) and DAR researchers to point out that decreasing catch combined with increasing value signals a real population decline. Not surprisingly, the Bandit Angelfish is also listed among the species of greatest conservation need in the 2015 Hawai'i State Wildlife Action Plan. Threatened by the aquarium trade, conservation actions include to "protect current populations, but also to establish further populations to reduce the risk of extinction." The O'ahu aquarium rule established a daily bag limit of two Bandit Angelfishes greater than 5.5 inches in length. Commercial data does not capture fish sizes so the impact of this size limit cannot be determined.	Comment noted. The DEIS is limited to the island of Hawai'i. The Bandit Angelfish is not on the White List, and cannot be collected in the WHRFMA.

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Comment	Response
Rules governing the take of certain aquarium species on O'ahu were adopted in 2014. The development and adoption of these rules was highly controversial because they were not scientifically sound and did not address the concerns of stakeholders outside the aquarium trade. Over 4,000 testimonies were received by DAR, and 98% of the comments preferred that aquarium collecting should end altogether or in the very least should include limits on the number of permits issued, and scientific and community- based limits on species and take levels. Many comments noted that the so-called "limits" allowed take that far exceeded the number of animals historically taken by the trade, and in fact, allowed limitless catch because they included no restrictions on input (i.e. permit limits), and no meaningful restrictions on output (species or take limits). Among those opposed to the rules was coral reef and marine fisheries biologist, Frazer McGilvray, who was the DAR Administrator at the time. Mr. McGilvray opposed the rules because they were neither based on science, nor were they developed under a multi-stakeholder approach. The written and oral testimony Mr. McGilvray presented to the board governing DLNR included the following: "All stakeholders should be consulted and everyone's opinion should be taken into account. There appears to be no scientific basis for the proposed bag limits for each species. The proposed take limits were akin to setting a speed limit at 400 MPH. These rules do not address the take of undersize, sexually immature fish. The majority of yellow tang allowed to be taken under this rule are immature and have not contributed to the future of the species. These rules, driven by the demands of the trade, are contrary to good natural resource management.	Comment noted. The DEIS is limited to the island of Hawai'i.
The take of juveniles is generally prohibited in other fisheries, but not by the aquarium trade. The take of adults is allowed, but only where good management practices govern the take in other fisheries, but not by the aquarium trade. The taking of 100 immature yellow tang per person per day is not consistent with good natural resource management when there are more than 50 licensed aquarium collectors on O'ahu. It is my belief that these rules require further work and are not yet ready for adoption." The DLNR submittal to the board conceded that the proposed limits were not intended to reduce take, but were, instead, based on animal welfare. This statement does not stand up to scrutiny since no animal welfare experts or groups familiar with the aquarium trade were consulted, and in fact, the concerns of several of these groups were dismissed outright. The 2014 O'ahu rules also imposed bag limits for certain sizes of three species were also imposed: a minimum and maximum (i.e. slot) limit for yellow tangs and maximum size limits for kole (bag limits of two of each size) and Bandit Angelfishes (bag limit of two). While there has been some discussion of the poor survival rates of very small yellow tangs, no such discussion was documented for the larger sizes. Finally, because aquarium catch reports do not capture fish sizes, it is impossible to determine or even estimate the impact of a size limit in the aquarium fishery." However, catch reports do show that despite the combined catch, size and vessel limits, yellow tang catch in 2015 and 2016 exceeded historical reported catch. This was due to an unprecedented warm water event that bleached and killed many corals, but also brought large numbers of young fishes to Hawai'i's reefs during 2014 and 2015.	Comment noted. The DEIS is limited to the island of Hawai'i, and the Preferred Alternative limits the issuance of permits to 14. Additionally, there are bag limits on Yellow Tang in the WHRFMA.

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Comment	Response
The O'ahu FEA's discussion of other regulated species describes the Achilles Tang, Bandit Angelfish, and Hawai'ian Cleaner Wrasse as "not collected to the level of the top twenty collected species." However, according to both historical and recent catch data, this is inaccurate. These three species have historically, and recently in one case, been among the top twenty collected species on O'ahu as follows: Achilles Tang was among the top twenty during the five-year period that ended in 1985; Bandit Angelfish was among the top twenty during the five-year period that ended in 1980 and again in 2014, 2015 and 2016; Hawai'ian Cleaner Wrasse among the top twenty during the five-year period that ended in 1980. Bandit Angelfish have been described earlier, and Achilles Tangs are both a culturally important food source and an important herbivore on the reef. The Hawai'ian Cleaner Wrasse plays a particularly critical role in the reef ecosystem by feeding on parasites, dead tissue and mucus of reef and other fishes (see Fig. 21). In 2008 the West Hawai'i aquarium trade included the Hawai'ian Cleaner Wrasse in its list of Species of Special Concern that should not be captured, citing the key role the play in maintaining the "health of the reef population, as the doctors of the sea". Obviously this species plays a similar role on reefs throughout Hawai'i. This is another clear example of how the dictates of the North American aquarium trade are driving extremely poor management decisions. The cumulative impact of long term sustained heavy collecting pressure on these and other species, and its effects on coral reef ecosystems must be fully evaluated and proper mitigation must be proposed in the EISs.	Comment noted. The DEIS is limited to the island of Hawai'i.
In addition to fishes, marine invertebrates such as hermit crabs, Feather Duster Worms, sea stars and snails, are taken in very high numbers by commercial aquarium collectors. These invertebrates play a key role in the coral reef environment, and their overharvesting may have serious ecological consequences. The EISs must address the very large numbers of invertebrates that are taken and proper mitigation measures must be proposed.	Comment noted. The DEIS is limited to the island of Hawai'i. On the island of Hawai'i, invertebrates are only collected in East Hawai'i, and those impacts are discussed in Section 5.4.1.2 of the DEIS. However, collection of invertebrates is not a part of the Proposed Action, and a commercial aquarium permit is not required for their collection.
The O'ahu FEA proposes to expand the Waikiki Marine Life Conservation District MLCD by 740 acres, and to prohibit only commercial aquarium collection within that expanded area. We concur with the Agency that this alternative is problematic for a number of reasons, including its lack of proper scientific review of the impacts. While it is expected that once collection pressure is removed, there may be a beneficial impact of increasing populations of targeted species, it is also expected that without concurrent reductions in allowable take, populations in the areas open to collection are likely to experience further declines as a result of increased pressure that result from reduced access elsewhere, as has been demonstrated in West Hawai'i.	Comment noted. The DEIS is limited to the island of Hawai'i.

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Comment	**Response**
In addition, the O'ahu FEA proposes a bag limit of 10 Flame Wrasses per day. We concur with the Agency that this proposal lacks a scientific basis for concluding that a bag limit of 10 per day would be sufficient. Not only would the bag limit apply to a limitless number of people, and as such, would neither limit actual take nor would it help to restore or protect populations from increasing collection pressure, it also fails to address the potential for extirpation of Flame Wrasses on coral reefs shallower than 98 feet where collection pressure is the greatest. As pointed out in the O'ahu FEA, a recent study found zero Flame Wrasses shallower than 98 feet on West Hawai'i reefs.163 Rather than an indication that Flame Wrasses spend much of their time in deeper waters, an idea forwarded in both FEAs with no reference, the absence of Flame Wrasses in their natural range is more likely an indicator of severe over-collection by the trade in the shallower depths they once inhabited. Flame Wrasses naturally occur at depths over 50 feet. SCUBA divers, including two of the Commenters, have for decades consistently encountered harems of Flame Wrasses at depths ranging from 50 – 90 feet on multiple dive sites, as long as the sites weren't accessed by the aquarium trade. On sites accessed by the trade, Flame Wrasses at those depths have completely disappeared. Historical catch records indicate that collection pressure on O'ahu populations of Flame Wrasses has dramatically increased: hundreds were annually captured prior to 2008; since then, annual catch has ranged between 1,000 - >4,000.166 The potential for Flame Wrasses to disappear from shallower reefs around O'ahu, as they have from West Hawai'i, is very real. This increasing collection pressure must be acknowledged and addressed in the EISs.	Comment noted. The DEIS is limited to the island of Hawai'i.
The applicant continues to base both FEAs on the premise that fish collection is considered sustainable if only removes less than 5% to 25% of the entire population (annually), but the reasoning behind this threshold is flawed. The FEAs stated that "research suggests that collection between 5% and 25% of a reef fish population is sustainable for various reef fish species in the Philippines that are similar to those on the White List (e.g., tang, wrasse, butterflyfish, angelfish, and triggerfish)" based on a Reef Check report by Ochavillo and Hodgson (2006). However, the EISs should not use these thresholds because: These thresholds for sustainable ornamental fish collection are species–specific based on estimated natural mortality rates (M) and fishing mortality at maximum sustainable yield (FMSY) or year-per-recruit analysis. Natural mortality rates for reef fishes are based on growth rates and length and thus are also area-specific. Mortality is based on catch data. Yield-per-recruit analysis should be derived from several annual surveys. Thus, these parameters should be specifically calculated for Hawai'ian reef fish targeted by the aquarium industry as highlighted in Ochavillo & Hodgson (2006); The 5%-25% threshold indicates "a good rule-of-thumb of collection limit" for coral reef fishes in the Philippines. This does not mean it is a good rule of thumb for collecting reef fishes in Hawai'i; Most ornamental fish species in the Ochavillo and Hodgson (2006) are species different from those on the White list.	Comment noted. The DEIS uses the best available science in the analysis, and there are currently no Hawai'i-specific thresholds. However, the Ochavillo and Hodgson (2006) thresholds were established using data from fish from the same families and guilds as those collected in Hawai'i.
Only a few species share the same genus or species (butterflyfish, a couple of wrasses, one angelfish, a couple of damselfish, one tan and one triggerfish). Thus, it is questionable whether this fairly wide threshold (5%-25%) is representative and applicable to Hawai'ian species; Finally, this report is not peer-reviewed research, it is a field manual: Marine Aquarium Trade for Coral Reef Monitoring Protocol with a Data Analysis and Interpretation Manual. This field manual was designed in part to: "provide a scientific basis for recommending sustainable levels of collection." The FEAs continue to assume that current fish abundance for target species is the baseline, and thus 1% to 5% of individuals remove from the population would be considered sustainable. But this is wrong. The FEAs still do not acknowledge that current population abundance of most of these fish species is already depleted due to in part to heavy exploitation by the aquarium trade since at least the 1970's and habitat degradation. The total allowable collection/catch for each species must be calculated based on information on natural mortality rates and the available and limited information on collection/catch records, specific to the geographic areas and locations where they are taken throughout the state.	Comment noted. The DEIS uses the best available science in the analysis. Under the Preferred Alternative, all collection would be below 4% of current population estimates for the 40 White List Species.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
The Coral Reef Ecosystem Program (CREP) data used in the FEAs for the entire Islands of Hawai'i and O'ahu (based on 2010-2016 surveys) continue to not be representative of regional population abundance such as in East Hawai'i and the West Hawai'i Regional Fishery Management Area (WHRFMA), and should not be used to estimate regional proportions of fish catch. Population abundance estimates for fish species for the entire island of Hawai'i are not representative of regional fish abundances such as East Hawai'i and WHRFMA. The CREP data collect fish data from 257 stationary point count locations around Hawai'i between depths of 0-98 feet. In contrast, the West Hawai'i Aquarium Project (WHAP) collected data from 25 transect survey sites from WHRFMA area between depths of 30-60 feet. It is well established that population abundances of reef fish species in Hawai'i, especially relatively small-size species that are targeted by the aquarium industry, are highly variable in space depending on reef complexity, depth and wave exposure, and in time (within and among years) depending on the season, mortality, recruitment to the population, and environmental factors. The relative proportion abundance of fish species taken annually by the aquarium industry should be based on regional total abundances and regional catch records (e.g., aligned with the aquarium fish trip report zones; or, as in Hawai'i DEA, Table 6). Allowable levels of take should be determined in conjunction with the wishes of Hawai'i residents and visitors who strongly desire that fish populations are restored to their naturally occurring (i.e. unfished) levels of abundance on the majority of Hawai'i reefs.	Comment noted. As stated in Section 4.4 of the DEIS, there is connectivity around the island of Hawai'i, with fish from protected FRAs being documented to seed unprotected areas, highlighting the effectiveness of protected areas (Christie et al. 2010). Therefore, using island-wide population estimates to analyze impacts is appropriate. WHAP data (which are specific to the WHRFMA) are also included in the analysis, but no comparable data are available for East Hawai'i.
The Hawai'i FEA continue to assume that current island-wide and regional targeted fish population estimates are healthy and not impacted and this represents a shifting in baselines. Population abundance of most of these fish species has declined over the past decades due to overexploitation and habitat degradation and thus they cannot be considered baselines. Strong scientific evidence shows that coral reefs of the main Hawai'ian Islands, especially near higher human population densities (where exploitation pressure is the highest), have significantly less abundance and biomass of reef fish species than more isolated islands due to overfishing.	Comment noted. The most recent population data are used as the baseline, because that is the environment which would be impacted by each of the five alternatives. The DEIS does not assume that the White List Species populations are not impacted (see Cumulative Impacts in Section 5.4.3 of the DEIS) and because these populations have been impacted by past and present activities, using the most recent population data provides the best baseline against which to analyze impacts. As stated in Section 4.4 of the DEIS, there is connectivity around the island of Hawai'i, with fish from protected FRAs being documented to seed unprotected areas, highlighting the effectiveness of protected areas (Christie et al. 2010). Therefore, using island-wide population estimates to analyze impacts is appropriate. Additionally, as noted in Section 5.4.1.2, a comparison of West Hawai'i with Maui using 2002-2010 WHAP data and CREP data found that for the 10 most collected species in the WHRFMA, all were more abundant within the Open Areas of the WHRFMA (where aquarium collection occurs) than in the Maui MPA closed areas, and five of the species were significantly more abundant (DAR 2019). Additionally, as noted in Section 5.4.3.6 and throughout the DEIS, the DAR (2019) has reported that populations of 24 of the 40 White List Species are either stable or increasing. For the 12 species with documented declines, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. In addition, for the 12 species that have shown a significant decline in population size in one or more management area since establishment of the WHRFMA in 1999, commercial aquarium collection under any of the five alternatives would collect less than 1% of the island-wide population estimates for 10 of the species. For the remaining two species, Achilles Tang and the Pyramid Butterflyfish, commercial aquarium collection would collect less than 4% of the island-wide population.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
The allowable number of individuals that could be collected from aquarium fish populations must be substantially less than those stated by the FEA because most of these species are already depleted. Fishing effort has substantially increased for aquarium fish species on the Island of Hawai'i as well as for certain species, such as Flame Wrasses on O'ahu. Prime-targeted species on both islands have significantly declined due to overharvesting. For example, population abundance of one of the most heavily exploited species, yellow tang (Zebrasoma flavescens), on the west coast of the Big Island of Hawai'i (West Hawai'i) declined 45% due to exploitation in areas open to fishing/collection from 1999 to 2007. Yellow Tang abundance is closely tied to annual levels of recruitment, and after good recruitment levels from 2008 – 2013, Yellow Tang abundance in the Open Areas improved, but was still 4.7% lower than the 1999 – 2000 Open Area baseline. As noted earlier, an anomalous recruitment pulse in 2014 is likely behind the increase in abundance seen since then. Even when including marine managed areas (MMAs) such as fish replenishment areas (FRA), where collection is prohibited and abundances are five times higher than in open areas, the population abundance of yellow tangs on West Hawai'i is substantially less than historical levels. The established networks of MMAs have definitely worked to increase yellow tangs and some other fish species in the West Hawai'i FRAs, but not all species have responded positively, and some have actually decreased overall since the FRAs were established. The extent to which collection pressure—whether in the Open Areas or due to poaching—is driving the decline of heavily targeted aquarium species in the areas closed to the trade must be studied. While the FEA attempts to minimize the impacts of collection pressure by proposing that "factors other than aquarium collecting [are] also affecting their populations," it remains highly likely that the main cause is collection pressure. An example of the effect of collection pressure on populations in MMA's is found in the significant decline of Yellow Tangs in those areas from 2004-2009 which coincided with Yellow Tang reported catch during that period that was substantially higher (e.g. in 2004 and 2006 it was more than double that reported in 2002). Given the relative long life-span of yellow tangs (>40 yrs) and increasing fishing intensity, these MMAs are just becoming sources for the aquarium fishing industry. The recovery of this species to past levels is unlikely if fishing/collection intensity continues or increases in the future.	Comment noted. As stated in Section 5.4.1.2 of the DEIS, the Yellow Tang population has increased over 150% (over 3.4 million fish) from 1999/2000 to 2017/2018 to a population of approximately 5.7 million fish, and there were no significant differences in the abundance of adult Yellow Tang in open vs closed areas in shallow water (DAR 2019). Even with the targeting the smaller fish by the commercial aquarium collectors, juvenile Yellow Tang densities have significantly increased by 60.8% within Open Areas between 2003 and 2017 (Gove et al. 2019). Additionally, as noted in Section 5.4.3.6 and throughout the DEIS, the DAR (2019) has reported that populations of 24 of the 40 White List Species are either stable or increasing. For the 12 species with documented declines, these declines are occurring in both areas open and closed to commercial aquarium fishing for all but one species, indicating that aquarium collection is not driving the decline (DAR 2019). Because these declines are occurring in FRAs and/or MPAs as well (i.e., areas not open to commercial aquarium collection) it is reasonable to assume that banning commercial aquarium collection would not halt the declines. In addition, for the 12 species that have shown a significant decline in population size in one or more management area since establishment of the WHRFMA in 1999, commercial aquarium collection under any of the five alternatives would collect less than 1% of the island-wide population estimates for 10 of the species. For the remaining two species, Achilles Tang and the Pyramid Butterflyfish, commercial aquarium collection would collect less than 4% of the island-wide population.
As mentioned above, there is no requirement for recreational aquarium collectors to report catch. For commercial collectors, while reports are required, catch report compliance is substantially low on the Islands of Hawai'i and O'ahu and thus catch records grossly underestimate the real impact of the aquarium fishery. The number of permits reporting catch in the islands of Hawai'i and O'ahu was approximately half of the number of commercial aquarium permits issue annually from 2000 to 2017. On average, 47% (40 out 85) of commercial aquarium permit holders reported their catch between 2000 and 2017 in O'ahu. Similarly, on average, 56% (33 out 59) of commercial permit holders in the Island of Hawai'i (WFRFMA and East Hawai'i combined) reported their catch during the past 18 years (see Table 3 in the DEA of Island of Hawai'i). Although commercial aquarium fishers are required to report their monthly catch on an aquarium fish catch report, the compliance is clearly significantly low.	Comment noted. As stated in Section 4.4.7.1 of the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. While the commenter points to differences between the number of permits issued and the number reporting, a difference in these values is not indicative of underreporting. Rather, as stated in Section 5.2.1 of the DEIS, to avoid duplicate fish catch reporting, only a principal diver is required to report the catch and effort for the dive team (DAR, pers. comm., 2018). This process ensures that reported catch data are not duplicated in the State's system. However, this reporting mechanism can lead to confusion by outside observers, as the total number of permit holders is higher than the number of permit holders reporting data, giving the appearance of under reporting. Analysis by the DAR (2019) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
This is a systemic problem that undermines the evaluation of the real impact that the aquarium fishery has on target species, the coral reef ecosystem, and the people that depend on them in Hawai'i. As such the impact of the aquarium fishing industry is likely larger than is reported, which has been discussed in the scientific literature. As a former DLNR employee succinctly wrote regarding aquarium catch reports: "The reliability of the data depends upon the sincerity of the permittees." There is no verification system, such as that provided by independent observers, to ensure the accuracy of self-reported data. One additional major impediment to accurate data stems from the lack of a license requirement for marine dealers and/or exporters. Currently there is a requirement for dealers (i.e. those who buy directly from aquarium collectors) to report their purchases. According to DLNR, the effect is that "dealer reporting is essentially on a voluntary basis and a few dealers are not reporting in whole or in part. DLNR cannot know whether a "few" or a dozen dealers are not reporting, but without a requirement for these businesses to have licenses, many operate beneath the radar and serve as a conduit for moving unreported catch out of the state. Establishing a marine dealer/exporter license has long been a priority for those within DLNR concerned about Hawai'i's marine resources, because it would enable the department to verify catch reports, identify unlicensed collectors (and all commercial fishers), identify dealers and helped with generating economic data about the fisheries. Without this information DLNR/DAR has no accurate data on health of fish populations. According to a former DAR Commercial Fisheries manager, Karl Brookins, the process of establishing the license was abandoned due to lack of funding.	Comment noted. As stated in Section 4.4.7.1 of the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. While the commenter points to differences between the number of permits issued and the number reporting, a difference in these values is not indicative of underreporting. Rather, as stated in Section 5.2.1 of the DEIS, to avoid duplicate fish catch reporting, only a principal diver is required to report the catch and effort for the dive team (DAR, pers. comm., 2018). This process ensures that reported catch data are not duplicated in the State's system. However, this reporting mechanism can lead to confusion by outside observers, as the total number of permit holders is higher than the number of permit holders reporting data, giving the appearance of under reporting. Analysis by the DAR (2019) has shown that actual underreporting of catch is small, with a 3.5% difference between the number of animals reported caught and sold in 2010 and a 0.4% difference in 2014, which likely represent live releases and mortality.
In addition, the combined average of total fish and invertebrates collected under aquarium permits from East Hawai'i and the WHRFMA annually from 2000-2017 should not be used as reference for future annual collections. The lack of collection data for East Hawai'i from 2001 to 2004 lowers the calculated average and underestimates the number of fish collected. A more accurate estimation is to use data collected after 2005 when collection data from East Hawai'i resumed. As such the combined average fish and invertebrates collected under Aquarium Permits from East Hawai'i and the WHRFMA annually from 2005-2017 was 392,006 individuals instead of 355,381 (see Fig. 22). This updated estimate, which accounts for 36,625 more individuals, along with a value representing underreporting, should be used as the reference point for the Hawai'i EIS to calculate proportion of the population that is being taken by the fishery island wide. We note that Table 8 in the Hawai'i FEA has not "been updated to exclude any years without data in the averaging for East Hawai'i data," as stated in the Applicant's response.	Comment noted. The DEIS does not include data from years without data in the East Hawai'i averages, however, those years are included for the island averages since they did have data from the WHRFMA. However, impacts to the fish species are analyzed using both the average and maximum values from 2000 to 2017, eliminating any bias that including those years may introduce. As stated in Section 4.4.7.1 of the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. Therefore, no adjustments to the values were made for "underreporting".
As discussed above, there is no reliable data on how many fish and other species are actually taken pursuant to aquarium permits in any given year. The FEAs repeatedly referred to a lack of data for numerous species. For example: "Because specific species of hermit crabs are not reported on aquarium permits reporting forms, it is not possible to know which species are collected, with the exception of zebra hermit crabs"; "Due to this underestimation, it is not possible to know the exact proportion of Flame Wrasse population that would be collected. . . ."; For Psychadelic (Redtail) Wrasse, Tinker's Butterflyfish, Longfin Anthias, Flame Wrasse, Fisher's Angelfish, and Eyestripe Surgeonfish (Palani), open area populations and catch as a percent of the open area populations are not available, because species "occur[] in habitats not adequately surveyed by transects." This data is necessary in order for the EISs to properly assess impacts. Furthermore, the Agency must conduct stock assessments of species before it is able to determine a sustainable rate of take. Clearly the Agency has not done so, as DLNR personnel have stated that to do so would take over a decade for just 40 fish species, out of the more than 287 fish and invertebrate species the Agency identifies as targeted by the trade (found at Appendix 4). Without such data, the Agency cannot meaningfully assess the environmental impacts of commercial aquarium collection. Such assessments must be completed prior to the issuance of the EISs, and in the face of any uncertainty, the EISs' analyses must err on the side of caution to protect these vulnerable species.	Comment noted. As stated in Section 4.4.7.1 of the DEIS, the DAR concluded that the 2010 and 2014 Hawai'i Island aquarium catch report validation did not indicate substantial underreporting of catch by aquarium collectors. The DEIS uses the best available data for analysis. This includes CREP (2018) population estimates for 38 of the 40 White List Species. The two species without population estimates are the Flame Wrasse and the Longfin Anthias, both of which have a maximum collection of less than 275 individuals in any given year.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
HEPA also requires EAs to consider mitigation measures. Such a discussion is plainly absent from both DEAs. The new Preferred Alternatives ignore the vast majority of comments submitted on the DEAs and instead focus on just two species, Achilles Tangs on Hawai'i Island and Flame Wrasses on O'ahu. They also ignore the many comments naming locations where the impacts of collecting pressure are of concern, and instead arbitrarily name Waikiki as an area where no commercial collection would occur in the future.	Comment noted. The DEIS states in Section 5.6 that no significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Sections 5.2.4, 5.3.3 and 5.4.4 specifically address mitigation for socioeconomics, cultural resources and biological resources. It should be noted that the DEIS does include a limited permit issuance alternative as the Preferred Alternative, as well as a reduced bag limit for the Achilles Tang. Public comments on the DEA and FEA were fully considered during the development of the DEIS. Individuals and groups who requested to be consulted parties for the DEIS are listed in Section 6.0, and comments and responses are included in Appendix B of the DEIS. A Cultural Impact Assessment (CIA) was prepared that includes additional consulted parties, and is included as Appendix A of the DEIS.
The Agency's letter of determination stated that "because the applicant can propose but not ensure regulations aimed at protecting and restoring populations of aquarium fish, [the Agency] is interested in proposals for self-regulation by aquarium permit holders which could be incorporated into permit conditions even in the absence of or prior to establishing other regulations to accomplish the same purposes." We dispute the value of any self-regulation measure. Meaningful change must be binding on the industry, and a meaningful alternatives analysis requires the Applicant to propose binding measures.	Comment noted. As stated by the DLNR, the Applicant cannot ensure enforcement. The Applicant is proposing a limited issuance of permits, issuance of permits only for the WHRFMA, and a reduction in the Achilles Tang bag limit. The Applicant can only propose but not ensure regulations; therefore, it is up to the DLNR to make these binding (e.g., changing the law/regulation or including a a condition of the permit). Any permit issued would require the permit holder to abide by all conditions of the permit.
A reasonable alternative would require the Agency to first determine: 1) the life history, spawning grounds and offspring/recruitment patterns for each species to be collected for aquarium purposes (see DLNR list of aquarium species at Appendix 4); 2) natural abundance (i.e. unfished) levels and complete stock assessments, for each island as a whole in addition to each collection zone, for those same species (see DLNR map of aquarium fish zones at Appendix 5); 3) a definition for "sustainable" as it relates to the natural abundance of coral reef species taken for aquarium purposes; and 4) annual total allowable catch, by species, designed to restore and then sustain natural abundance levels, with negligible impacts as defined in the Queensland Ecological Risk Assessment of the Marine Aquarium Fish Fishery, for each species to be taken for aquarium purposes, in each zone. After making these necessary threshold determinations, the Agency should issue limited numbers of Aquarium Permits, by zone and by species with corresponding total allowable catch limits, per the above parameters. Additionally, the Agency should require Aquarium Collection Permits, for all take for aquarium purposes, regardless of the method of collection.	Comment noted. The alternatives included in the DEIS address the issues raised by the commenter as follows: 1) the DEIS includes overviews of known ecology of each of the 40 White List Species in Section 4.4.1, and the DLNR monitors populations in the WHRFMA through the WHAP (described in Section 4.4.7.1). 2) the DEIS is limited to the island of Hawai'i. As stated in Section 4.4, there is connectivity around the island (Christie et al. 2010), but genetic breaks between the island of Hawai'i and the rest of the MHI (Toonen et al. 2011). Therefore, population data from the island of Hawai'i (CREP 2018) are used as the basis of the DEIS analysis. The most recent population data are used as the baseline, because that is the environment which would be impacted by each of the five alternatives. 3) the DEIS defines "sustainable" as collection of 5% to 25% or less of the population, based on the available research by Ochavillo and Hodgson (2006). 4)the Queensland Ecological Risk Assessment of the Marine Aquarium Fishery defines "negligible" as "insignificant impacts to populations (dynamics/structure/size)". The DEIS concludes that collection under the Preferred Alternative represents less than 3% of each White List Species population when considering average collection rates, and less than 4% when considering maximum collection rates (less than 1% for 32 of the species, 1%-4% for 6 species). This level of take is below what is considered to be sustainable reef fish harvest based on available research (5% - 25%; Ochavillo and Hodgson 2006). The Preferred Alternative in the DEIS limits the number of commercial aquarium permits to 14, limits collection to only the open zones within the WHRFMA (no collection in the FRAs or MPAs), and limits collection to the 40 White List Species.

Responses to comments received from For the Fishes/The Humane Society of the United States/Center for Biological Diversity/Kalanihale Mololi'i/Moana Ohana Comment dated September 7, 2018

Comment	Response
HEPA also requires an EIS to consider mitigation measures. With minor exceptions, such a discussion is plainly absent from both FEAs. Decades of Applicant actions have directly impacted more than 200 species and indirectly impacted an unknown number of additional vertebrate and invertebrate species found in Hawai'i's coral reefs, one of the most complex ecosystems on Earth, where the fate of each species is determined by the existence, abundance and diverse actions of a multitude of other species that inhabit or otherwise rely upon these unique places. Yet, the FEAs claim there are no significant impacts whatsoever, and therefore, propose no mitigation measures outside of those found in the Preferred Alternatives, related to just two species and one area, which were designed to mitigate potential impacts to cultural resources only. In addition to proposing mitigation measures to address biological and related impacts to the various socio-economic values described herein, the EISs must also propose mitigation for impacts to cultural resources and for the ethical concerns and harm done to the animals, themselves, also described herein.	Comment noted. The DEIS states in Section 5.6 that no significant adverse effects would occur as a result of the Preferred Alternative. Therefore, mitigation for impacts is not warranted and no mitigation measures would be implemented. Sections 5.2.4, 5.3.3 and 5.4.4 specifically address mitigation for socioeconomics, cultural resources and biological resources.
PIJAC additionally failed to conduct the required early consultations prior to submitting its DEAs/FEAs. HEPA requires that the application must "at the earliest practicable time, . . . consult with . . . those citizen groups and individuals which the approving agency reasonably believes to be affected." In this case, it is clear from the long history of litigation that Commenters, at the very least, should have been consulted. PIJAC should also have consulted Native Hawai'ian groups and experts such as Gail Grabowsky. As a result of this failure to abide by HEPA's mandate of early consultation, the FEAs fail to analyze all impacts, and are skewed toward a favorable result for industry.	Comment noted. PIJAC engaged with interested parties prior to publication of the DEA (Section 6.5 in the Hawai'i FEA). The DEAs were widely distributed to a range of parties prior to publication. Public comments on the DEA and FEA were fully considered during the development of the DEIS. Individuals and groups who requested to be consulted parties for the DEIS are listed in Section 6.0, and comments and responses are included in Appendix B of the DEIS. A Cultural Impact Assessment (CIA) was prepared that includes additional consulted parties, and is included as Appendix A of the DEIS.

From:	Kealoha Pisciotta
To:	Sakoda, David; Kealoha Pisciotta
Subject:	Draft EIS Comments relating to the Aquarium Trade and Trafficked Industry
Date:	Friday, September 07, 2018 7:52:29 PM

Aloha Mr. Sanoda, please find attached comments provided by Mauna Kea Anaina Hou and Kai Palaoa the Marine Protection Organization. Aloha and Mahalo for you time and consideration. Please feel free to contact me if u have any questions regarding our testimony submission.

Aloha
Kealoha Pisciotta
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P.O.Box 5864
Hilo, HI 96720

Our request to be consulting parties and testimony:

Aloha,
I write here as President Of Mauna Kea Anaina Hou and Founder Of Kai Palaoa.
We believe that this EIS relating to the Aquarium Fish Trade and Trafficking has significant and cumulative impacts not only on the reef itself but on the people of Hawai'i, including Native Hawaiians(Kanaka Maoli).

We have reviewed the responses to our previous comments beginning on P. 436 of the Draft EIS. It is our testimony, in light of those responses, that all Traditional and Customary Cultural and Religious Practices of the Reef systems that will have a significant impact under this project/action (that being the Aquarium Trade and Trafficking of Wildlife from within the water and near shore reefs of Hawai'i) must be considered and included and the EIS analysis.

I live on Hawai'i Island where much of the wildlife and aquarium fish are collected, contained and shipped to North American pet stores and private collectors for profit and commercial exploitation.

I and my Organizations wish to be a consulting parties for the purpose of providing oral and written testimony regarding our collective and personal families traditional and customary cultural and religious use and practices relating to the reef and wildlife and for testifying to the significance impact the Aquarium Fish Trade and Trafficking will and has had on our cultural and religious practices and use.

The States DLNR as submitted remarks to be added for consideration in the scoping, which have many good points that we also concur with, however, we wish at this time to add the following:

1. Because many species are considered 'Aumakua (family guardians)
the Native Hawaiian religious significance of each and every species collected must also be included in the EIS analysis and impact statement.

2. The social and cultural impact must also be taken into account.

3. The social, cultural and even economic impact as secondary impacts to non-commercial and

or to local fishermen who fish in part for subsistence and in part to help provide some economic relief must also be considered.

4. The impact of the Aquarium Trade and Trafficking Industry has on the health and well being of of the various cultural groups including Native Hawaiians must be considered and taken into account.

5. The EIS must include graphical and other analysis of the socio-economic impact on Native Hawaiian Communities with high incidence of of Commercial Aquarium Trade and Trafficking in their area, Ahupua'a or placed base analysis.
How does this industry impact traditional Hawaiian communities such as Miloli'i for example?

6. The EIS should include other sources of significant and cumulative impacts such as:

7. Climate change in coral systems and reef wildlife.

8. Climate change impacts on run off, water diversion for development or and impacts when added to pollution and contamination for all run off sources; including golf courses, hotels, housing development and other projects that contribute to the destruction and or contamination of the reef and near shore eco-systems.

9. Any other activities that frustrate or negatively impact or produce irreparable harm to the reefs and the reef wildlife should all be apart of the significance and cumulative impact analysis.

We reserve our rights to add more comments as consulting parties to the Aquarium Trade and Trafficking Industry EIS. Can you please add my email (Keomaivg@gmail.com) onto the list for future reference and forward any relevant public documents we may need to review. Thank you very much for your time and consideration.

Aloha and Mahalo,
———-/s/——————
Kealoha Pisciotta
Mauna Kea Anaina Hou and Kai Palaoa

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Hilo, Hawai'i 96720

Responses to comments received from Mauna Kea Anaina Hou and Kai Palaoa
Comment dated September 7, 2018

Comment	Response
Aloha, I write here as President Of Mauna Kea Anaina Hou and Founder Of Kai Palaoa. We believe that this EIS relating to the Aquarium Fish Trade and Trafficking has significant and cumulative impacts not only on the reef itself but on the people of Hawai'i, including Native Hawaiians(Kanaka Maoli).	Comment noted. A DEIS has been prepared analyzing the significance of impacts to the human and natural environment.
We have reviewed the responses to our previous comments beginning on P. 436 of the Draft EIS. It is our testimony, in light of those responses, that all Traditional and Customary Cultural and Religious Practices of the Reef systems that will have a significant impact under this project/action (that being the Aquarium Trade and Trafficking of Wildlife from within the water and near shore reefs of Hawai'i) must be considered and included and the EIS analysis.	Comment noted. A Cultural Impact Assessment (Appendix A of the DEIS) has been prepared, and cultural impacts are discussed in Section 5.3 of the DEIS.
I live on Hawai'i Island where much of the wildlife and aquarium fish are collected, contained and shipped to North American pet stores and private collectors for profit and commercial exploitation.	Comment noted.
I and my Organizations wish to be a consulting parties for the purpose of providing oral and written testimony regarding our collective and personal families traditional and customary cultural and religious use and practices relating to the reef and wildlife and for testifying to the significance impact the Aquarium Fish Trade and Trafficking will and has had on our cultural and religious practices and use.	Comment noted. Kealoha Pisciotta was contacted as part of the consultation process of the DEIS, as noted in Section 6.0 of the DEIS and in the Cultural Impact Assessment (Appendix A of the DEIS).
The States DLNR as submitted remarks to be added for consideration in the scoping, which have many good points that we also concur with, however, we wish at this time to add the following:	Comment noted. Responses to specific comments provided below, and response to the DLNR are also provided in Appendix B of the DEIS.
1. Because many species are considered 'Aumakua (family guardians) the Native Hawaiian religious significance of each and every species collected must also be included in the EIS analysis and impact statement.	Comment noted. The cultural significance of each White List Species has been added to Section 4.4 of the DEIS, and is described in detail in the Cultural Impact Assessment (Appendix A of the DEIS).
2. The social and cultural impact must also be taken into account.	Comment noted. A Cultural Impact Assessment (Appendix A of the DEIS) has been prepared, and cultural impacts are discussed in Section 5.3 of the DEIS.
3. The social, cultural and even economic impact as secondary impacts to non-commercial and or to local fishermen who fish in part for subsistence and in part to help provide some economic relief must also be considered.	Comment noted. A Cultural Impact Assessment (Appendix A of the DEIS) has been prepared, and cultural impacts are discussed in Section 5.3 of the DEIS. Socioeconomic impacts are discussed in Section 5.2 of the DEIS. Both the cultural and socioeconomic impacts include direct, indirect, and cumulative impact assessments.
4. The impact of the Aquarium Trade and Trafficking Industry has on the health and well being of of the various cultural groups including Native Hawaiians must be considered and taken into account.	Comment noted. A Cultural Impact Assessment (Appendix A of the DEIS) has been prepared, and cultural impacts are discussed in Section 5.3 of the DEIS.
5. The EIS must include graphical and other analysis of the socio-economic impact on Native Hawaiian Communities with high incidence of of Commercial Aquarium Trade and Trafficking in their area, Ahupua'a or placed base analysis. How does this industry impact traditional Hawaiian communities such as Miloli'i for example?	Comment noted. A Cultural Impact Assessment (Appendix A of the DEIS) has been prepared, and cultural impacts are discussed in Section 5.3 of the DEIS.

Responses to comments received from Mauna Kea Anaina Hou and Kai Palaoa
Comment dated September 7, 2018

Comment	**Response**
6. The EIS should include other sources of significant and cumulative impacts such as:	Comment noted. Cumulative impacts are assessed in Section 5.0 of the DEIS.
7. Climate change in coral systems and reef wildlife.	Comment noted. The cumulative impact of climate change is assessed in Section 5.4.3.5 of the DEIS.
8. Climate change impacts on run off, water diversion for development or and impacts when added to pollution and contamination for all run off sources; including golf courses, hotels, housing development and other projects that contribute to the destruction and or contamination of the reef and near shore eco-systems.	Comment noted. The cumulative impact of climate change is assessed in Section 5.4.3.5 of the DEIS.
9. Any other activities that frustrate or negatively impact or produce irreparable harm to the reefs and the reef wildlife should all be apart of the significance and cumulative impact analysis.	Comment noted. Cumulative impacts are assessed in Section 5.0 of the DEIS.

Comments Received From Consulted Parties and Applicant Responses

August 30, 2019

Terry VanDeWalle
Stantec Consulting Services Inc.
2300 Swan Lake Boulevard Suite 202
Independence IA 50644-9708

VIA Email: Terry.Vandewall@Stantec.com

RE: Pending Proposed DEIS for the West Hawaii Aquarium Trade

Mr. VanDeWalle,

Preliminarily, we must note Stantec's failure to comply with the Hawaii Environmental Policy Act (HEPA) process, including contacting us at the outset of the environmental assessment phase (*see* Haw. Admin. R. § 11-200-9(b), and as formally requested Consulted Parties in this environmental impact study phase (*see* Haw. Admin. R. § 11-200-15(a)). Stantec contacted us only after we (1) heard through happenstance that Stantec was conducting cultural consultations for its Draft Environmental Impact Statement (DEIS) and (2) reported this failure to consult to the Board of Land and Natural Resources Chair, Suzanne Case. Therefore, by not contacting us early in the process, as required, we were deprived of the opportunity to meaningfully participate in the consultation and decision-making process early on, which is a critical and imperative part of the HEPA process. We expected the Applicant to endeavor to develop a fully acceptable EIS prior to the time the EIS is filed with the Hawaii Office of Environmental Quality Control (OEQC) through a full and complete consultation process, rather than relying solely upon environmental review documents to expose environmental concerns. For examples of some of our expectations regarding the consultation process, see page two of our Sept. 7, 2018 comments on the FEA-EISPN, as well as the 2014 HEPA Citizen's Guide, published by the OEQC. Despite our objections, we submit these comments and questions to inform and improve the forthcoming DEIS.

The below questions were prompted after recently being made aware of the limited geographic scope of the forthcoming DEIS, to include only West Hawaii, as well as the DEIS's intent to provide exclusive aquarium collection privileges to 14 individuals, contrary to the earlier Draft Environmental Assessments (DEAs). Some of the Consulted Parties learned of the scope of the proposed DEIS only this week, from other Consulted Parties. Stantec's failure to provide this crucial information to all Consulted Parties limited some of the Consulted Parties' ability to meaningfully comment, and undermines HEPA's notice requirements.

We also continue to await your response to our earlier questions and comments, submitted on the DEA in May 2018 and on the FEA-EISPN in September of 2018 – which are attached in the email and incorporated herein by reference.

Your thorough response to these new and earlier outstanding questions is necessary to inform our response to the pending DEIS, and to ensure that you are thoroughly evaluating the environmental impacts of this proposed action pursuant to HEPA.

1. What are the **environmental benefits** of removing tens to hundreds of thousands of animals annually for the West Hawaii aquarium trade?

2. Why is the proposed DEIS limited to West Hawaii? Collection continues in East Hawaii and at even greater rates since the Supreme Court of Hawaii's September 2017 opinion. Why would other areas of collection be excluded? Do the 14 collectors propose to collect only in West Hawaii, or is this due to the need for an additional West Hawaii permit to take in this area?

   Research suggests that larval connectivity and dispersal extends across all areas of potentially all islands, without barriers, thus, a depletion of species in one area may have a much larger impact on that species in other areas as well. Specifically, what research has led you to not consider this important aspect of connectivity, or considering the broader effects of aquarium collection as a whole throughout the state?

The Proposed DEIS would provide exclusive access, take and related privileges to 14 individuals that no other person would otherwise have access to. Given these 14 applicants are requesting special permission to access and remove constitutionally protected public trust resources, the below information is needed to explain how and why these 14 applicants should be granted this exclusive access, that would otherwise be denied to others.

3. Please identify the 14 applicants by name and business name (DBA).

4. How many reef animals have been taken by the 14 applicants in the past decade (list per year, per species and method of collection) and in what area, and how many are the applicants proposing to take each year for the next decade (list per species and method)?

5. Have any of the applicants been charged with any offense related to the aquarium trade or occurring during the course of aquarium trade activities, or county or state natural resource related offenses? If so, include date, offense and outcome of each offense.

6. What steps will be taken by the 14 applicants to reduce the impacts of climate change, specifically, coral bleaching and ocean temperature rise, which is predicted to occur more frequently and more severely over the next decade, given they will be removing thousands of herbivorous species?

   The environmental review must fully disclose the changing baseline from climate change and the effects of the proposed activities on the reef in light of climate change. The

Fourth National Climate Assessment, released in late 2018, projects that by 2040 Hawaii's coral reefs will bleach annually which will result in the loss of 71% of the state's current coral reef cover by mid-century, and 99% by 2100. Unprecedented coral bleaching across Hawaii and especially in West Hawaii has already occurred: back-to-back years of increased sea temperatures in 2014 and 2015 caused 50% of bleached corals to die in West Hawaii.

Further, on August 23, 2019, the Hawaii Dept. of Land and Natural Resources (DLNR) warned of possible severe and widespread coral bleaching across the state within the next two months as the result of sea temperatures that are currently 3 degrees above normal. Because temperatures are expected to rise even further, this bleaching event will likely be even worse than the one that damaged so many of Hawaii's reefs 4 – 5 years ago. Reefs in West Hawaii are already showing signs of stress such as bleaching and both DLNR and the National Oceanic and Atmospheric Administration (NOAA) have asked the public to take actions to minimize any additional stress to Hawaii's reefs. Notably, among the actions to be avoided are many that are widespread and/or inherent to the aquarium trade, referenced below.

7. How will the 14 applicants 1) specifically comply with the following recommended actions, and, given the extremely limited enforcement resources and capabilities of DLNR, 2) how do they propose to show compliance with these recommended actions?

   - Reduce or stop taking herbivorous fishes such as surgeonfish which are needed to keep algae growth under control so as not to smother and kill corals stressed from bleaching
   - Avoid touching, standing in corals
   - Keep vessel anchors and chains off corals

8. How do the 14 applicants propose to prevent population reductions of reef species when, outside of the current court order, there are **no limits on**:

   - the issuance of West Hawaii aquarium collection permits
   - the issuance of State aquarium collection permits
   - the issuance of Commercial Marine Licenses
   - caps on the issuance of the above permits or a limited entry program
   - the use of certain types of gear that may be detrimental to the environment
   - overall take (Total Allowable Catch)
   - area/geographical limitations outside of "no take" areas
   - collection of species outside of the "white list"
   - number of "white list" species that may be taken

9. The Hawaii Department of Land and Natural Resources (DLNR), specifically the Division of Aquatic Resources (DAR) and their enforcement arm, the Division of Conservation and Resource Enforcement (DOCARE) has severely restricted resources,

such as inadequate staff and funding for enforcement, and there are current statutory restrictions on searches of certain containers carrying marine life and certain vessels.

How do the 14 applicants propose that enforcement will be achieved on any proposed limits to their activities, including verifiable compliance with current administrative rules, and state and federal laws, including those listed below. How are the 14 applicants currently complying?

- Federal Lacey Act requirements USC Title 16
- Hawaii Misdemeanor Cruelty to Animals statute HRS 711-1109

10. The commercial aquarium trade has long operated with fewer regulations, oversight and compliance-verification mechanisms than those that commercial food fisheries must adhere to. Further, while the issuance of aquarium collection permits is discretionary, and subjects the permit holder to certain legal obligations, including inspection of facilities holding marine life, many of these regulations have not been actively enforced. For clarification, do the 14 applicants cooperate and comply with the following:

    - provide open and immediate access to coolers, containers, vessels and other aquarium related gear, equipment and holding facilities upon request of a DLNR-DOCARE Officer, as per the conditions of their permits?
    - allow observers on their vessels with/without notice?

11. The earlier DEAs for the aquarium trade failed to include data and records which are not readily accessible to the public and other interested parties. Please provide the necessary data and response to the following to address our outstanding concerns with enforceability of the above-referenced laws specifically as it relates to animal health, welfare and mortality rates:

    a) Thousands of fish have been taken since the Supreme Court opinion and subsequent District Court orders were issued in September and October of 2017 which prohibited the use of fine mesh nets (nets with a mesh less than 2 inch). Ninety plus percent of catch prior to the court ruling involved the use of fine mesh nets.

       Please explain in detail the gear and method(s) of collection **currently** (October 2017 to present) used by each of the 14 applicants and for what species. If the 14 collectors did NOT collect during this period please provide that information as well.

    b) Per HDOA intrastate shipment records, thousands of fish have been shipped since the above-referenced court order took effect. For the 14 applicants please provide:
       - how many fish/animals were shipped by each applicant per month since October 2017 to the present and;
       - specifically where these fish/animals were shipped to (e.g., intrastate to Honolulu, interstate or international) and;
       - the mortality rates for each shipment (a) upon arrival and (b) at 14 days post-shipment;

- what percentage of animals remain in Hawaii (for resale) versus those who are shipped 1) to the US mainland and 2) international;

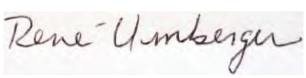
c) For each of the 14 applicants please note whether the collector is also a dealer. If the collector is not a dealer, provide who the collector sells their catch to;

d) For each of the 14 applicants, please note which collectors engage in the following practices in contradiction to HRS 711-1109:

- withholding of food (starvation) and for what period of time;
- fizzing or puncturing of the swim bladder;
- cutting of spines or dorsal fins;
- body compression (squeezing animal to force out ejection of fecal matter).

In conclusion, we emphasize that the environmental review must address every phase and aspect of the proposed action to determine the "overall and cumulative effects of an action," Haw. Admin. R. § 11-200-12(a), which may include "ecological effects (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic effects, [] cultural effects, [and] economic effects . . . whether primary, secondary, or cumulative." Haw. Admin. R. § 11-200-2. It is vitally important that the environmental review provide a comprehensive analysis of the environmental and cultural effects of the proposed action. These effects combined with the cumulative effects should be fully mitigated or the actions should not be approved. We also reiterate that thorough answers to the questions posed here, as well as thorough responses to our earlier comments are necessary in order for us to adequately provide consultation on this matter.

Thank you,



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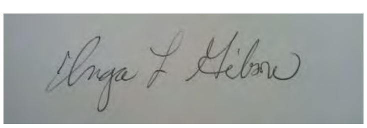

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Responses to comments received from For the Fishes/Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana
Comment dated August 30, 2019

Comment	Response
Preliminarily, we must note Stantec's failure to comply with the Hawaii Environmental Policy Act (HEPA) process, including contacting us at the outset of the environmental assessment phase (see Haw. Admin. R. § 11-200-9(b), and as formally requested Consulted Parties in this environmental impact study phase (see Haw. Admin. R. § 11-200-15(a)). Stantec contacted us only after we (1) heard through happenstance that Stantec was conducting cultural consultations for its Draft Environmental Impact Statement (DEIS) and (2) reported this failure to consult to the Board of Land and Natural Resources Chair, Suzanne Case. Therefore, by not contacting us early in the process, as required, we were deprived of the opportunity to meaningfully participate in the consultation and decision-making process early on, which is a critical and imperative part of the HEPA process. We expected the Applicant to endeavor to develop a fully acceptable EIS prior to the time the EIS is filed with the Hawaii Office of Environmental Quality Control (OEQC) through a full and complete consultation process, rather than relying solely upon environmental review documents to expose environmental concerns. For examples of some of our expectations regarding the consultation process, see page two of our Sept. 7, 2018 comments on the FEA-EISPN, as well as the 2014 HEPA Citizen's Guide, published by the OEQC. Despite our objections, we submit these comments and questions to inform and improve the forthcoming DEIS.	Comment noted. The commenters were included in the consultation process for the DEIS, as described in Section 6.0.
We also continue to await your response to our earlier questions and comments, submitted on the DEA in May 2018 and on the FEA-EISPN in September of 2018 – which are attached in the email and incorporated herein by reference. Your thorough response to these new and earlier outstanding questions is necessary to inform our response to the pending DEIS, and to ensure that you are thoroughly evaluating the environmental impacts of this proposed action pursuant to HEPA.	Comment noted. The responses to the comments on the DEA were included in the publication of the FEA and are not repeated here. They can be found online here: http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2018-08-08-HA-FEA-EISPN-Hawaii-Island-Commercial-Aquarium-Permits.pdf The comments and responses on the FEA are included in this Appendix.
What are the environmental benefits of removing tens to hundreds of thousands of animals annually for the West Hawaii aquarium trade?	Comment noted. The environmental impacts of commercial aquarium collection in West Hawai'i are evaluated in the DEIS in Section 5.0.
Why is the proposed DEIS limited to West Hawaii? Collection continues in East Hawaii and at even greater rates since the Supreme Court of Hawaii's September 2017 opinion. Why would other areas of collection be excluded? Do the 14 collectors propose to collect only in West Hawaii, or is this due to the need for an additional West Hawaii permit to take in this area?	Comment noted. The DEIS evaluates the impact of commercial aquarium collection on the entire island of Hawai'i. However, the Applicant is not requesting any permits to be issued for East Hawai'i. The collection that has continued in East Hawai'i since the October 2017 ban on commercial aquarium collection in the WHRFMA is legal and does not require a commercial aquarium permit. Nonetheless, the DEIS does evaluate the impacts of continued collection in East Hawai'i, as well as the impacts that issuing permits for the WHRFMA may have on collection in East Hawai'i.

Responses to comments received from For the Fishes/Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana
Comment dated August 30, 2019

Comment	Response
Research suggests that larval connectivity and dispersal extends across all areas of potentially all islands, without barriers, thus, a depletion of species in one area may have a much larger impact on that species in other areas as well. Specifically, what research has led you to not consider this important aspect of connectivity, or considering the broader effects of aquarium collection as a whole throughout the state?	Comment noted. As stated in Section 4.4 of the DEIS, Toonen et al. (2011) conclude that the Hawaiian Archipelago is not a single, well-mixed marine community, but rather there are at least four significant multi-species barriers to dispersal along the length of the island chain, and that species that appear capable of extensive dispersal, such as Yellow Tang and Kole, show significant population differentiation within the Hawaiian Archipelago. In addition, there are significant consensus genetic breaks that restrict gene flow between islands, including a barrier between the island of Hawai'i and the rest of the Main Hawaiian Islands (MHI).
Please identify the 14 applicants by name and business name (DBA).	Comment noted. The applicant information is provided in the DEIS.
How many reef animals have been taken by the 14 applicants in the past decade (list per year, per species and method of collection) and in what area, and how many are the applicants proposing to take each year for the next decade (list per species and method)?	Comment noted. The average and maximum collection by species of the 14 fishers has been added to Table 5-11. It should be noted that these fishers waived their right to confidentiality, and as such, this includes all their collected numbers from 2000 through 2017 (no data are excluded due to Hawai'i confidentiality laws). The collection numbers are limited to the WHRFMA for the analysis. It is assumed for the environmental consequences that the collection rates seen over the past 18 years will remain relatively the same over the 5-year analysis period, though the maximum collection is also included in the analysis. Collection would occur via fine mesh nets or other legal methods.
Have any of the applicants been charged with any offense related to the aquarium trade or occurring during the course of aquarium trade activities, or county or state natural resource related offenses? If so, include date, offense and outcome of each offense.	Comment noted. We do not possess this information. Enforcement and information concerning it is within the purview of the State of Hawaii.

Responses to comments received from For the Fishes/Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana
Comment dated August 30, 2019

Comment	**Response**
What steps will be taken by the 14 applicants to reduce the impacts of climate change, specifically, coral bleaching and ocean temperature rise, which is predicted to occur more frequently and more severely over the next decade, given they will be removing thousands of herbivorous species? The environmental review must fully disclose the changing baseline from climate change and the effects of the proposed activities on the reef in light of climate change. The Fourth National Climate Assessment, released in late 2018, projects that by 2040 Hawaii's coral reefs will bleach annually which will result in the loss of 71% of the state's current coral reef cover by mid-century, and 99% by 2100. Unprecedented coral bleaching across Hawaii and especially in West Hawaii has already occurred: back-to-back years of increased sea temperatures in 2014 and 2015 caused 50% of bleached corals to die in West Hawaii. Further, on August 23, 2019, the Hawaii Dept. of Land and Natural Resources (DLNR) warned of possible severe and widespread coral bleaching across the state within the next two months as the result of sea temperatures that are currently 3 degrees above normal. Because temperatures are expected to rise even further, this bleaching event will likely be even worse than the one that damaged so many of Hawaii's reefs 4 – 5 years ago. Reefs in West Hawaii are already showing signs of stress such as bleaching and both DLNR and the National Oceanic and Atmospheric Administration (NOAA) have asked the public to take actions to minimize any additional stress to Hawaii's reefs. Notably, among the actions to be avoided are many that are widespread and/or inherent to the aquarium trade, referenced below.	Comment noted. There is no evidence that suggests that commercial aquarium collection is a major contributer to climate change, including coral bleaching or ocean temperature rise, though these impacts are included in the cumulative impacts analysis in the DEIS. As stated in Section 5.4, no impacts on populations of herbivores are anticipated. Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. The DAR (2019) concluded that commercial aquarium collecting is not having any measurable negative impact on percent coral cover or change in coral cover over time.
How will the 14 applicants 1) specifically comply with the following recommended actions, and, given the extremely limited enforcement resources and capabilities of DLNR, 2) how do they propose to show compliance with these recommended actions? Reduce or stop taking herbivorous fishes such as surgeonfish which are needed to keep algae growth under control so as not to smother and kill corals stressed from bleaching; avoid touching, standing in corals; keep vessel anchors and chains off corals	Comment noted. Section 5.4.2 of the DEIS evaluates the impacts of the alternatives on herbivores and coral reefs. As stated in Section 5.4, no impacts on populations of herbivores are anticipated. Tissot and Hallacher (2003) concluded that there were no significant differences in damaged coral between control and collected sites (i.e., sites where aquarium collection occurs) to indicate the presence of destructive fishing practices. In addition, they found no increases in the abundance of macroalgae where the abundance of herbivores was reduced by aquarium collecting. The DAR (2019) concluded that commercial aquarium collecting is not having any measurable negative impact on percent coral cover or change in coral cover over time.
How do the 14 applicants propose to prevent population reductions of reef species when, outside of the current court order, there are no limits on: the issuance of West Hawaii aquarium collection permits; the issuance of State aquarium collection permits; the issuance of Commercial Marine Licenses; caps on the issuance of the above permits or a limited entry program; the use of certain types of gear that may be detrimental to the environment; overall take (Total Allowable Catch); area/geographical limitations outside of "no take" areas; collection of species outside of the "white list"; number of "white list" species that may be taken	Comment noted. The Preferred Alternative in the DEIS limits the issuance of commercial aquarium permits to 14 fishers, and limits the permits geographically to the WHRFMA, eliminating some of the uncertainty inherent with an unlimited issuance of permits (as was previously done and analyzed in the DEIS). Existing bag limits would remain in effect, and the Preferred Alternative includes a reduced bag limit for the Achilles Tang. As evaluated in Section 5.0 of the DEIS, based on the low percentage of the overall populations collected annually by commercial aquarium fishers, which is spread throughout the year and across multiple areas,

Responses to comments received from For the Fishes/Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana
Comment dated August 30, 2019

Comment	Response
	as well as the targeted collection of smaller, less fecund individuals, commercial aquarium collection would have a less than significant direct impact on reef fish populations.
The Hawaii Department of Land and Natural Resources (DLNR), specifically the Division of Aquatic Resources (DAR) and their enforcement arm, the Division of Conservation and Resource Enforcement (DOCARE) has severely restricted resources, such as inadequate staff and funding for enforcement, and there are current statutory restrictions on searches of certain containers carrying marine life and certain vessels. How do the 14 applicants propose that enforcement will be achieved on any proposed limits to their activities, including verifiable compliance with current administrative rules, and state and federal laws, including those listed below. How are the 14 applicants currently complying? Federal Lacey Act requirements USC Title 16; Hawaii Misdemeanor Cruelty to Animals statute HRS 711-1109	Comment noted. Enforcement is within the purview of the State of Hawaii.
The commercial aquarium trade has long operated with fewer regulations, oversight and compliance-verification mechanisms than those that commercial food fisheries must adhere to. Further, while the issuance of aquarium collection permits is discretionary, and subjects the permit holder to certain legal obligations, including inspection of facilities holding marine life, many of these regulations have not been actively enforced. For clarification, do the 14 applicants cooperate and comply with the following: provide open and immediate access to coolers, containers, vessels and other aquarium related gear, equipment and holding facilities upon request of a DLNR-DOCARE Officer, as per the conditions of their permits?; allow observers on their vessels with/without notice?	Comment noted. Permit holders must comply with law. Enforcement is within the purview of the State of Hawaii.
Thousands of fish have been taken since the Supreme Court opinion and subsequent District Court orders were issued in September and October of 2017 which prohibited the use of fine mesh nets (nets with a mesh less than 2 inch). Ninety plus percent of catch prior to the court ruling involved the use of fine mesh nets. Please explain in detail the gear and method(s) of collection currently (October 2017 to present) used by each of the 14 applicants and for what species. If the 14 collectors did NOT collect during this period please provide that information as well.	Comment noted. Within the WHRFMA, collection of aquarium fish is not ocurring under any method. In East Hawai'i, collection can occur without fine mesh nets, and the 2018 collection numbers are presented in Table 5-2 of the DEIS, and the impact of increased collection is described in Section 5.4.1.1.

Responses to comments received from For the Fishes/Pono Advocacy LLC/The Humane Society of the United States/Center for Biological Diversity/Moana Ohana
Comment dated August 30, 2019

Comment	**Response**
Per HDOA intrastate shipment records, thousands of fish have been shipped since the above-referenced court order took effect. For the 14 applicants please provide: how many fish/animals were shipped by each applicant per month since October 2017 to the present and; specifically where these fish/animals were shipped to (e.g., intrastate to Honolulu, interstate or international) and; the mortality rates for each shipment (a) upon arrival and (b) at 14 days post-shipment; what percentage of animals remain in Hawaii (for resale) versus those who are shipped 1) to the US mainland and 2) international;	Comment noted. Available collection data is provided in the DEIS from 2018 (when collection was conducted without the use of fine mesh nets and restricted to East Hawai'i).
For each of the 14 applicants please note whether the collector is also a dealer. If the collector is not a dealer, provide who the collector sells their catch to;	Comment noted. This information is not available. Available information is presented in the DEIS.
For each of the 14 applicants, please note which collectors engage in the following practices in contradiction to HRS 711-1109: withholding of food (starvation) and for what period of time; fizzing or puncturing of the swim bladder; cutting of spines or dorsal fins; body compression (squeezing animal to force out ejection of fecal matter).	Comment noted. Permit holders must comply with law. Enforcement is within the purview of the State of Hawaii.
In conclusion, we emphasize that the environmental review must address every phase and aspect of the proposed action to determine the “overall and cumulative effects of an action,” Haw. Admin. R. § 11-200-12(a), which may include “ecological effects (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic effects, [] cultural effects, [and] economic effects . . . whether primary, secondary, or cumulative.” Haw. Admin. R. § 11-200-2. It is vitally important that the environmental review provide a comprehensive analysis of the environmental and cultural effects of the proposed action. These effects combined with the cumulative effects should be fully mitigated or the actions should not be approved. We also reiterate that thorough answers to the questions posed here, as well as thorough responses to our earlier comments are necessary in order for us to adequately provide consultation on this matter.	Comment noted. The direct, indirect, and cumulative impacts of the Proposed Action are analyzed in the DEIS in Section 5.0. Responses to all comments are provided in Appendix B of the DEIS.

APPENDIX C—DISTRIBUTION LIST FOR THE DEIS

Distribution List for the DEIS

GOVERNMENT OF THE STATE OF HAWAI'I(S)

Agency	Mailing Address	Electronic Mail or Internet Address	Telephone
State of Hawai'i Department of Agriculture	1428 S. King Str. Honoluolu, HI 96814	hdoainfo@hawaii.gov	(808) 973-9550
State of Hawa i'i Department of Accounting and General Services	P.O . Box 119 Honolulu, HI 96810	dags@hawaii.gov	(808) 586-0400
State of Hawai'i Department of Business. Economic Development and Tourism	P.O. Box 2359 Honolulu, HI 96804	dbedt.director@hawaii.gov	(808) 586-2355
State of Hawai'i Department of Business, Economic Development and Tourism, Research Division Library	No. 1, Capitol District Bldg. 250 S. Hotel Street, Ste. 435 Honolulu, HI 96813	Joseph.A.Roos@dbedt.hawaii.gov Tammy.Lam@hawaii.gov	(808) 586-2481
State of Hawai'i Department of Business, Economic Development and Tourism, Strategic Industries Division	235 S. Beretania St., 5th flr. Honolulu, HI 96813	dbedt.energyoffice@hawaii.gov	(808) 587-3812
State of Hawai'i Department of Business, Economic Development and Tourism, Office of Planning Attn: Mary Alice Evans, Director	235 S. Beretania St., 6th Floor Honolulu, HI 96813	http://hawaii.gov/dbedt/op/	(808) 587-2846
State of Hawai'i Department of Defense	3949 Diamond Head Road Honolulu, HI 96816	hi.dod.pa@icloud.com	(808) 733-4258
State of Hawai'i, Department of Education, Hawaii State Library, Hawai'i Documents Center	478 S. King Street Honolulu, HI 96813	https://www.librarieshawaii.org/locations/index.htm	(808) 586-3555
State of Hawai'i Department of Hawaiian Home Lands	P.O. Box 1879 Honolulu, HI 96805	dhhl.icro@hawaii.gov	(808) 620-9501
State of Hawai'i, Department of Health, Environmental Health Administration	P.O . Box 3378 Honolulu, HI 96801	webmail@doh.hawaii.gov	(808) 586-4424
State of Hawai'i, Department of Land and Natural Resources	P.O. Box 621, Honolulu, HI 96809	dlnr@hawaii.gov	(808) 587-0400
State of Hawai'i Department of Land and Natural Resources State Historic Preservation Division	601 Kamokila Blvd., Rm. 555 Kapolei, HI 96707	Alan.S.Downer@hawaii.gov	(808) 692-8015
State of Hawai'i Department of Transportation	869 Punchbowl Street Honolulu, HI 96813	dotpao@hawaii.gov	(808) 587-2160
University of Hawai'i Water Resources Research Center	2540 Dole Street, Room 283 Honolulu, HI 96822	thomas@hawaii.edu	(808) 956-7847
University of Hawai'i Environmental Center	2500 Dole Street Krauss Annex 19 Honolulu, HI 96822	envctr@hawaii.edu	(808) 956-7362
University of Hawai'i Thomas H. Hamilton Library	2550 McCarthy Mall Honolulu, HI 96822	uhmlib@hawaii.edu	(808) 956-8264
University of Hawai'i at Hilo Edwin H. Mo'okini Library	200 W. Kawili Street Hilo, HI 96720	mookini@hawaii.edu	(808) 974-7346
University of Hawai'i Maui College Library	310 Ka'ahumanu Avenue Kahului, HI 96732	uhmclib@hawaii.edu	(808) 984-3233

University of Hawai'i Kaua'i Community College Library	3-1901 Kaumualii Highway Lihu'e, HI 96766	kcclib@hawaii.edu	(808) 245-8233
Office of Hawaiian Affairs	711 Kapi'olani Blvd., Suite 500 Honolulu, HI 96813	info@oha.org	(808) 594-1835
Legislative Reference Bureau Library	State Capitol 415 S. Beretania St., Rm. 005 Honolulu, HI 96813	lrb@capitol.hawaii.gov	(808) 587-0690

GOVERNMENT OF THE COUNTY OF HAWAI'I(H)

Agency	Mailing Address	Electronic Mail or Internet Address	Telephone
County of Hawai'i Department of Environmental Management	Pu'ainako Town Center 2100 Kanoelehua Avenue, Bay C-5, Hilo, HI 96720	cohdem@hawaiicounty.gov	(808) 961-8083
County of Hawai'i Department of Parks and Recreation	101 Pauahi Street, Suite 6 Hilo, HI 96720	parks_recreation@co.hi.us	(808) 961-8311
County of Hawai'i Planning Department	101 Pauahi Street, Suite 3 Hilo, HI 96720	planning@co.hi.us	(808) 961-8288
County of Hawai'i Department of Public Works	101 Pauahi Street, Suite 7 Hilo, HI 96720	public_works@co.hawaii.hi.us	(808) 961-8321
County of Hawai'i Department of Water Supply	345 Kekuanao'a Street, Suite 20 Hilo, HI 96720	dws@hawaiidws.org	(808) 961-8050

GOVERNMENT OF THE UNITED STATES OF AMERICA (USA)

Federal Agency	Mailing Address	Electronic Mail or Internet Address	Telephone
Department of the Interior, Geological Survey, Pacific Islands Water Science Center	677 Ala Moana Boulevard, Ste. 415, Honolulu, HI 96813	santhony@usgs.gov	(808) 587-2400
Department of the Interior Fish and Wildlife Service	300 Ala Moana Boulevard, Rm. 3-122, Honolulu, HI 96850-0056	pifwo_admin@fws.gov	(808) 792-9400
Department of Commerce National Marine Fisheries Service	Pacific Islands Regional Office 1611 Kapi'olani Boulevard, Suite 1110 Honolulu, HI 96814	pirohonolulu@noaa.gov	(808) 944-2200
Department of the Interior National Parks Service	Pacific Islands Support Office 300 Ala Moana Boulevard, Rm. 6-226 Honolulu, HI 96850	melia_lane-kamahele@nps.gov	(808) 541-2693
Department of Agriculture National Resources Conservation Service	Pacific Islands Area Office PO Box 50004 Honolulu, HI 96850	travis.thomason@usda.gov	(808) 541-2600
Department of Transportation Federal Aviation Administration	300 Ala Moana Boulevard, Rm. 7-128 Honolulu, HI 96850-7128	kevin.h.nishimura@faa.gov	(808) 312-6030
Department of Transportation Federal Transit Administration	90 7th Street, Suite 15-300 San Francisco, CA 94103	ted.matley@dot.gov	(415) 734-9490

Department of Homeland Security Coast Guard	Commander, 14th Coast Guard District, 300 Ala Moana Boulevard, Room 9-204, Honolulu, HI 96850-4982		(808) 535-3325

LIBRARIES AND DEPOSITORIES (LD)

Library or Depository	Mailing Address	Electronic Mail or Internet Address	Telephone
North Kohala Public Library	54-3645 Akoni Pule Hwy Kapaau, HI 96755	http://www.librarieshawaii.org/locations/index.htm	(808) 889-6655
Hilo Public Library Attn: Justin Rajkowski	300 Waianuenue Ave. Hilo, HI 96720	justin.rajkowski@librarieshawaii.org	(808) 933-8890
Kailua-Kona Public Library	75-138 Haulalai Rd. Kailua-Kona, HI 96740	http://www.librarieshawaii.org/locations/index.htm	(808) 327-4327
Honokaa Public Library	45-3380 Mamane St., Bldg #3 Honokaa, HI 96727	http://www.librarieshawaii.org/locations/index.htm	(808) 775-8881
Kealakekua Public Library	81-6619 Mamalahoa Hwy Kealakekua, HI 96750	http://www.librarieshawaii.org/locations/index.htm	(808) 323-7585
Pahoa Public and School Library	15-3070 Pahoa-Kalapana Rd. Pahoa, HI 96778	http://www.librarieshawaii.org/locations/index.htm	(808) 965-2171
Thelma Parker Memorial Public and School Library	67-1209 Mamalahoa Hwy Waimea, HI 96743	http://www.librarieshawaii.org/locations/index.htm	(808) 887-6067
Naalehu Public Library	95-5669 Mamalahoa Hwy Naalehu, HI 96772	http://www.librarieshawaii.org/locations/index.htm	(808) 939-2442

NEWS MEDIA (NM)

Organization	Mailing Address	Electronic Mail or Internet Address	Telephone
Honolulu Star Advertiser	Restaurant Row 7, Waterfront Plaza, Suite 210, 500 Ala Moana Boulevard, Honolulu, HI 96813	citydesk@staradvertiser.com	(808) 529-4747
Hawai'i Tribune Herald David Bock, Publisher and Editor	P.O. Box 767 Hilo, HI 96721	dbock@hawaiitribune-herald.com	(808) 930-7323
West Hawai'i Today Tom Hasslinger, Editor	P.O. Box 789, Kailua-Kona, HI 96745-0789	thasslinger@westhawaiitoday.com	(808) 329-93 I I
The Garden Island	P.O. Box 231, Lihu'e, HI 96766	neagle@thegardenisland.com	(808) 245-3681
Maui News	100 Mahalani Street, Wailuku, HI 96793	citydesk@mauinews.com	(808) 244-3981
Moloka'i Dispatch	P.0. Box 482219, Kaunakakai, HI 96748	editor@themolokaidispatch.com	(808) 552-278 I

ELECTED AND OTHER OFFICIALS (EO)

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U.S. Representative - Ed Case	2443 Rayburn House Office Building Washington, DC 20515	ed.case@mail.house.gov	(202) 225-2726
U.S. Representative - Tulsi Gabbard	1433 Longworth House Office Building Washington, DC 20515	tulsiOffice@mail.house.gov	(202)225-4906
State Senator - Dru Mamo Kanuha Senate District 3	Hawaii State Capitol, Rm. 206	senkanuha@Capitol.hawaii.gov	(808) 586-9385
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State Representative - Ryan Yamane House District 37	Hawaii State Capitol, Rm. 420	repyamane@capitol.hawaii.gov	
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State Representative- David A. Tarnas House District 7	Hawaii State Capitol, Rm. 328	reptarnas@Capitol.hawaii.gov	(808) 586-8510
County Council Representative - Maile Medeiros David	86-4310 Mamalahoa Hwy Captain Cook, HI 96704	maile.david@hawaiicounty.gov	(808) 323-4277
Mayor Harry Kim	Hawai'i County Building 25 Aupuni Street Hilo, HI 96720	harry.kim@hawaiicounty.gov	(808) 961-8211

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