Global Trade and Consumer Choices: Coral Reefs in Crisis

Papers Presented at a Symposium held at the 2001 Annual Meeting of the American Association for the Advancement of Science

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AAAS

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The AAAS Annual Meeting and Science Innovation Exposition is one of the world's largest general scientific gatherings. Several hundred speakers, participating in more than one hundred symposia, address crucial and timely areas of science, technology, and engineering. This report is based on papers presented in a symposium at the 2001 Annual Meeting, held in San Francisco.

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Overview

Barbara Best
Alan Bornbusch

Coral reefs around the world are in crisis. Over 25% have already died or are severely damaged, and another 30% are seriously threatened and may die—from global warming, overfishing, destructive fishing practices, and unsound coastal development.[1] Contributing to the problem, many coral reef animals and products are collected globally for commercial purposes, including food fish, the marine aquarium trade, live food fish markets, curios and knick-knacks, jewelry, and traditional medicines. Global trade is leading to overexploitation of reef animals and the use of fishing practices that destroy the reefs. Recent surveys of reefs worldwide found that many species of high commercial value were absent or present in very low numbers, in almost all the reefs surveyed.[2] Results suggest that almost all coral reefs have been affected by overfishing, and that there may be no pristine reefs left in the world.

The United States is the number one consumer of live corals and fish for the marine aquarium trade, and of coral skeletons and other dried animals for the curio and jewelry markets. American consumers are unknowingly contributing to the decline and degradation of coral reefs. As a major importer and world leader in both trade and coral reef conservation efforts, though, the U.S. can play a critical role in shaping conservation strategies, consumer awareness, and international trade policies.

The symposium, *Global Trade and Consumer Choices: Coral Reefs in Crisis*, held at the 2001 American Association for the Advancement of Science Annual Meeting and Science Innovation Exposition in San Francisco, California, featured five experts who spoke on the global trade in coral reef species and coral reef conservation. They analyzed the causes and consequences of global trade in coral reef animals, the role of the U.S. as a major importer, and presented solutions to reduce the negative impacts of trade on these unique ecosystems while promoting long-term benefits to local communities through sustainable resource use. This report presents their papers, as well as the following overview of their main points.

Franklin Moore and Barbara Best of the U.S. Agency for International Development[3] note that "coral reefs are invaluable resources to local communities around the world, serving as sources of food, jobs and livelihoods, and as coastal protection." By one estimate, coral reefs provide economic goods and ecosystem services worth about $375 billion each year to millions of people. "However," observe Moore and Best, "international trade is driving overfishing and destructive fishing practices, such as the use of cyanide to collect live reef fish. The unsustainable and destructive use of these precious resources jeopardizes the potential of coral reefs to sustain…local communities and future generations."

Roger McManus, former President of the Center for Marine Conservation[4] and Senior Advisor for Oceans in the U.S. Department of the Interior, notes that the trade in coral reef species is in actuality trade in an entire ecosystem. McManus asks if this trade, though, is consequential in light of other threats posed by global change and pollution. Fishing and collecting of other coral reef species are probably not

1 See Wilkinson, C. (editor). 2000. *Status of the coral reefs of the world: 2000.* Global Coral Reef Monitoring Network and Australian Institute of Marine Science, Cape Ferguson and Dampier, Australia. **(http://www.aims.gov.au/scr2000).**
2 Hodgson, G. 1999. *A global assessment of human effects on coral reefs.* Marine Pollution Bulletin. 38(5): 345–55.
3 See **http://www.usaid.gov/environment/**
4 See **http://www.cmc-ocean.org/**

sustainable in most cases, are the most significant threat to many targeted species, and in many areas are a significant threat to the overall health of reef ecosystems. McManus adds "it is culturally and politically important to address all threats to natural resources to ensure equitable treatment."

McManus also argues that the U.S. should not allow the World Trade Organization to influence its actions in the global trade arena. "The U.S. should exercise its authority as an international leader in both trade and environmental conservation, and address its own trade policies on coral reef animals." He suggests that the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) "was not designed to be implemented as a comprehensive wildlife management tool at this scope of [the coral reef] trade." McManus recommends the creation of more marine protected areas with no-take zones, as well as a phase-out of U.S. imports of wild coral reef species except where the trade can fulfill criteria for sustainability more stringent than those now in use under CITES.

Charles Birkeland, from the University of Hawaii's Hawaii Cooperative Fishery Research Unit[5], noting the diversity of coral reef ecosystems, the life history adaptations of reef species, and the close knit intricacies of species interactions, cautions that coral reefs are inherently more vulnerable to overuse than are other marine ecosystems. If the coral reef trade is to be sustainable, reefs must be managed using an ecosystem-based approach. However, the fisheries management laws of the U.S. constrain the use of best management practices, such as an ecosystem-based approach, and are particularly ill suited to promote sustainable management of coral reefs.

The Coral Reef Ecosystem Fishery Management Plan for the western Pacific, though, is charting new territory as the first ecosystem-based fishery management plan for U.S. waters. It adopts a precautionary approach that shifts the burden of proof through a permitting system, applies adaptive management through continuous use of new information, creates marine protected areas with no-take zones, and requires "insurance" against unforeseen ecosystem impacts.

There is already strong international concern that some coral reef species are threatened or may become threatened through trade. Those species are listed under CITES, and include 2000 species of hard (stony) corals, black coral, giant clams, Queen conch, and sea turtles. However, most of the coral reef animals in trade are not covered under CITES.

Susan Lieberman, former Chief of the U.S. Fish and Wildlife Service (USFWS) Division of Scientific Authority[6] and currently Director of the Species Programme of WWF International, and John Field, also with USFWS, discuss the potential for international trade agreements, such as CITES, to address environmental concerns. They note that "under CITES, exporting countries are required to conduct scientific determinations that this trade is sustainable, and will not jeopardize species or their ecosystems." However, this ideal is often not fulfilled in reality. While the primary responsibility for ensuring the sustainability of harvests and exports under CITES rests with exporting countries, Lieberman and Field suggest that "as an importing country, [the U.S.] also must share some of the responsibility, whether through cooperative bilateral and multilateral efforts or regulatory actions." They add that it is "vital to couple those strategies with increasing public awareness...An informed consumer is powerful—and can guide industry best management practices, government policies, and of course Congressional interest and action."

Vikki Spruill and Lisa Dropkin, of SeaWeb[7], though, observe that "Americans have little knowledge of the real threats to coral reefs and the life they support." Surveys show that Americans believe pollution is the greatest ocean threat, and that most consider coral reef conservation a second tier concern. But, there is support for coral reef protection and there is growing momentum to use consumer choice to drive ocean conservation. Spruill and Dropkin note that "Americans often express their conservation values by what they purchase. We need to make Americans aware of how consumers can contribute to reef conservation by buying sustainably caught reef animals." They add that informal data suggests aquar-

5 See **http://www2.hawaii.edu/~zoology/www.assoc.coop.fish.html**
6 See **http://international.fws.gov/**
7 See **http://www.seaweb.org/**

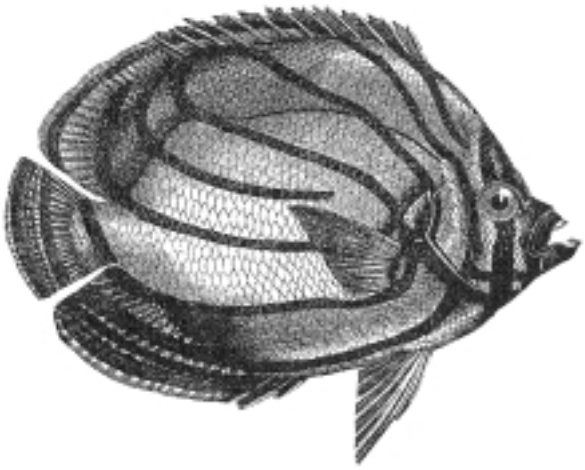
ium hobbyists want an industry based on sustainability and are willing to modify their purchasing behaviors to support reef conservation.

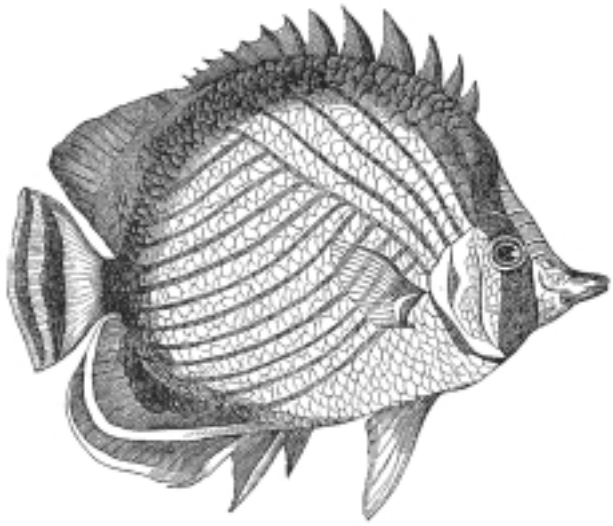
Clearly, there is an urgent need to address the trade threat to coral reefs. Dire as the picture may seem, the papers presented here point to a way forwards. Potential remedies are known. Some are already being tested—like coral reef reserves with no-take zones, and consumer awareness campaigns with likely application to reef species. To achieve an equitable and sustainable solution will require that all must be pursued, engaging communities, exporters and importers, governments, non-governmental organizations, consumers, scientists, and international institutions.

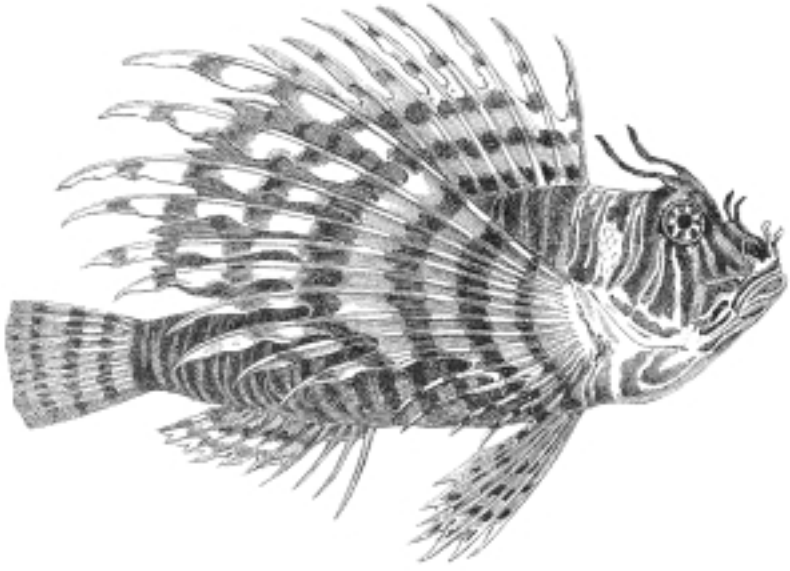
For additional information about coral reef monitoring and conservation efforts, visit the websites of the:

Global Coral Reef Monitoring Network
http://www.coral.noaa.gov/gcrmn,
the International Coral Reef Initiative
http://www.icriforum.org,
and the U.S. Coral Reef Task Force
http://www.coralreef.gov.

To learn more about U.S. efforts to address the trade threats to coral reefs, contact Dr. Barbara Best, Coastal Resource and Policy Adviser for the Environment, U.S. Agency for International Development at **bbest@usaid.gov**, telephone: +1-202-712-0553.







Coral Reef Crisis: Causes and Consequences

Franklin Moore
Barbara Best

This paper presents an overview of the value of coral reef ecosystems to developing countries, the impacts of international trade on coral reefs and local communities, and the role of the U.S. as a major consumer nation and driving factor in the international trade of corals and coral reef species.

Coral Reefs are Invaluable Coastal Ecosystems

By any measure, coral reefs are among the most diverse and valuable ecosystems on earth. Coral reefs occur in over 100 countries, most of them developing countries without the capacity or financial resources to adequately manage these vital resources. Reefs support at least a million described species of animals and plants, and another 8 million coral reef species are estimated to be as yet undiscovered.

According to one estimate, coral reefs provide goods and services worth about $375 billion each year —a staggering figure for an ecosystem which covers less than one percent of the earth's surface. Reef systems provide economic and environmental services to millions of people as shoreline protection from waves and storms, as places for recreation and tourism, and as sources of food, pharmaceuticals, livelihoods, and revenues.

In developing countries, coral reefs contribute about one-quarter of the total fish catch, providing food to an estimated one billion people in Asia alone. Globally, half a billion people are estimated to live within 100 kilometers of a coral reef and benefit from its production and protection. In light of expected climate change and associated sea level rises, coral reefs can offer a natural, self-building and self-repairing breakwater against wave and storm damage. These extremely valuable ecosystems constitute the economic base and future hope for sustained development in many countries, particularly small island nations.

Coral Reefs in Crisis

A recent report from the Global Coral Reef Monitoring Network estimates that 25% of the world's reefs are already gone or severely damaged and that another third are degraded and threatened. This coral reef crisis is happening here at home in the U.S. and in far away places, in some of the most remote areas of the world.

Coral reefs are in serious trouble worldwide from a powerful combination of stresses that are threatening their survival, including:

- overexploitation of resources for subsistence and commercial fishing;
- destructive fishing practices, that degrade and destroy the habitat itself;
- increasing coastal populations, which are expected to double in the next 50 years;
- poor land use practices and runoff of pollutants, sediments and nutrients;
- disease outbreaks, which may be associated with poor water quality and pollutants;
- coral bleaching, associated with increasing seawater temperatures and global change; and
- removal of coastal mangrove forests.

These direct and indirect human activities pose significant threats to coral reef ecosystems, and the human populations that depend on them, particularly small island developing countries. For example:

- In northern Jamaica, it is estimated that almost all of the reefs are dead or severely degraded from

overfishing and coastal runoff. Fish stocks have declined to a point where local fishers are now straining fish larvae out of the sea for fish soup.

- In the Philippines, degraded reefs and fish populations have led to an 18% decrease in the amount of protein in the average diet.

Human impacts are also occurring on U.S. reefs, oftentimes for use as luxury items. For example, in Hawaii at Honaunau, the top ten aquarium fish species have decreased by 59% over the last 20 years, and at Kona the most popular aquarium fish show declines in abundance from 38 to 57%.

Even under ideal conditions, it would take more than a lifetime for some reefs to recover. We can no longer continue to take coral reefs or mangrove forests for granted, or to assume that they can support unlimited resource use or unmanaged global trade.

Trade, Mangrove Forests, and Coral Reefs

While coral bleaching may be one of the largest threats facing coral reefs, international trade is having significant impacts on even the most remote and pristine reefs. Recent surveys of reefs worldwide found that many species of high commercial value were absent, or present in very low numbers, in almost all the reefs surveyed (Hodgson, 1999). Results suggest that almost all coral reefs have been affected by overfishing, and that there may be no pristine reefs left in the world.

International trade is also posing significant threats to mangrove forests, another critical coastal ecosystem that is intimately connected to coral reefs. Mangrove forests serve as important nurseries for many reef species. They help to maintain coastal water quality by reducing the run-off of sediments, pollutants, and excess nutrients from the land. Nutrients and energy flow between these habitats as species move between them.

In some areas of the world, the major loss of mangrove forests is due to the construction of shrimp mariculture ponds for the world market. The cheap shrimp we consume here in the U.S. comes with enormous ecological and social costs for the local communities where mariculture ponds are inappropriately sited and intensively farmed.

Trade Drives Destructive Fishing Practices

How does the international trade in wild coral reef animals and products more directly impact reefs? Primarily through overfishing and the use of destructive fishing practices. Live fish for both the food trade and marine ornamental trade are often caught with the use of cyanide or other poison, which temporarily stuns the fish for easy collection. Cyanide use is a serious threat to some of the world's richest coral reefs, as the cyanide kills corals and many other coral reef organisms. The lucrative and unregulated international trade in reef fishes drives the use of cyanide. It is estimated that since the 1960's, more than one million kilograms of cyanide has been squirted onto Philippine reefs alone, and the practice has spread throughout East Asia and the Indo-Pacific (Bryant, et al., 1998).

Various explosives, such as dynamite and homemade bombs, are also used to kill fish for easy collection, but at an enormous cost to the reef which is reduced to rubble. In Komodo National Park in Indonesia, about half of the reefs have already been destroyed through the use of explosives, forming beds of coral rubble that can extend several football fields in length. While the use of explosives to collect dead fish is usually for domestic trade, some of the fish that are only stunned will enter the international trade stream.

International trade is also driving the removal of the calcareous skeleton or base of the reef itself; reef skeletons are sold as "live rock" for marine aquaria. This base is the resulting accumulation of coral skeletons over tens to hundreds and thousands of years. Living coral, which constitutes the essential reef habitat for a myriad of species, is also collected and shipped live for marine aquaria, or killed and dried for the curio and shell trade.

Trade Drives Overfishing and Removal of Targeted Groups

In addition to destructive practices, international trade is driving overfishing and the selected removal of key groups from coral reefs. Major groups targeted for trade are:

- groupers and wrasses for the live food fish trade;
- dead fish and invertebrates for food, medicinal products, and ornamentals including sharks, sea cucumbers, sea stars, mollusks and sea horses;
- live fish, coral and other invertebrates for marine aquaria and the ornamental hobby; and,
- "live rock" or the calcareous base of the reef for marine aquaria.

The marine ornamental trade for the pet industry often targets rare fish and coral species, as these can fetch the highest prices. The trade is also targeting large-polyped corals, which tend to be the slowest growing and the least common. By targeting the large groupers and wrasses, the live food fish trade removes key species from these ecosystems, thus altering their dynamics. The loss of some is comparable to the loss of major predators from terrestrial ecosystems. Other fishes feed on algae, and thus play an important role in ensuring that corals are not overgrown by more rapidly growing algae. The removal of coral for the marine aquarium trade and for use as curios and knickknacks, and the removal of the "live rock" base, reduces the essential reef habitat.

There are strong economic incentives associated with this international trade. The live food fish trade through Hong Kong alone is estimated to have a retail value of about one billion dollars a year. Some species of fish, selected live from a restaurant tank, can sell for almost $300 per plate. The global retail of marine ornamental fishes and aquarium hobby supplies is estimated at $500 million. Last year, for example, a pair of rare fish sold for over $5,000 each. Over 1000 different species of coral reef animals are now traded for marine aquaria.

The impacts from international trade are quite different from other more chronic causes of reef degradation, as these impacts are felt even in the most remote, pristine reefs. The use of destructive fishing practices, such as the use of cyanide, is spreading throughout the Indo-Pacific as fishing boats venture farther to find new unexploited fishing grounds.

There is already strong international concern that some coral reef species are threatened or may become threatened through trade. Those species are listed under the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES), and include 2000 species of hard (stony) corals, black coral, giant clams, Queen conch, and sea turtles.

Consequences of Destructive and Unsustainable Fishing Practices on Local Human Communities

International trade is driving destructive fishing practices and unsustainable harvests from coral reef ecosystems, reducing the value of coral reefs to local communities and prospects for long term sustainable use. In some areas, depletion of stocks and the destruction of the reefs are threatening peoples' food security.

This international trade is a highly mobile trade; as stocks are depleted in one area or country, the trade moves on to other areas, often spreading the use of destructive fishing practices. Thus, the nature of the trade provides few incentives for long-term sustainable use by a community, and few benefits are channeled to the local communities.

The use of poisons and hooka gear can have serious consequences for the collectors themselves. Cyanide fishing poses human health risks to the fishers through exposure to the poison. A hooka rig is a low-tech approach to scuba diving that involves a compressor on the boat that pushes air down long tubes to divers below. Divers can spend many long hours under water collecting with hooka rigs. Unsafe diving practices by untrained divers can lead to the diver's "bends" and result in joint disease and even paralysis and death. Each week, several divers who have contracted the bends are taken by fishing boats in Honduras for treatment in the local diving decompression chamber. These divers have been collecting spiny lobsters to supply the growing U.S. appetite for seafood. Similar reports of injuries to divers come from South East Asian countries where hooka rigs are used for collecting marine ornamental fish and live food fish.

U.S. Role in International Trade

In 1998, in response to the coral reef crisis, the Executive Order for the Protection of Coral Reefs was signed. The Order created the U.S. Coral Reef Task Force as a way of coordinating federal and state

efforts, and charges federal agencies with the conservation and sustainable use of reef resources both domestically and worldwide. The Task Force was also asked to analyze and address the U.S. role in the international trade of coral and coral reef species.

The results of the trade analysis reveal that while live reef fish for the food fish market primarily go to Asian markets, the U.S. is the number one consumer of live coral and marine fishes for the aquarium trade and of coral skeletons and precious corals for curios and jewelry. Inadvertently, American consumers are contributing to the worldwide decline and degradation of reefs.

A closer examination of the U.S. trade reveals that the U.S. was consistently the largest importer of live coral during the 1990s, importing over 80% of the live coral and 95% of the live "rock" or reef base. Ironically, the U.S. prohibits the collection of coral and live rock in its own waters as they are considered essential fish habitats.

In addition to coral, the United States imports nearly half (eight million) of the total worldwide trade in aquarium fishes (15–20 million/year). Many of the fish imported for the marine aquarium market in the U.S. are captured with the use of cyanide and other poisons, which kills non-target animals and the coral reef itself. Sustainability concerns will only increase with the growing international trade. The international trade in coral and live rock to supply the aquarium trade has increased at a rate of 12 to 30% per year since 1990.

The U.S. Role in Addressing the Trade Threat

The U.S. is part of the problem. The U.S. needs to be part of the answer. As a major consumer and importer of coral reef organisms, a major player in the world trade arena, and a leader in coral reef conservation efforts, the U.S. has a critical responsibility to not only address the degradation and loss of coral reef ecosystems worldwide, but to also encourage more responsible trade. As consumers, the U.S. should discourage the use of destructive or unsustainable collection practices that may jeopardize the future potential of coral reefs to sustain the local communities who depend on them for food and livelihoods. Rather, we should reward and encourage responsible use of these precious resources, and shift the burden of proof of sustainable use, for commercial and recreational purposes, to the users.

We need to emphasize community-based management of coral reef resources so that people living on and around coral reefs may share in the profits from coral reef activities. Other exploiters, whose primary interest is in making money without sharing benefits with local communities, should not be allowed to profit from these precious resources.

Oftentimes, local communities or national fisheries departments lack the capacity to sustainably manage reef resources, or to resist the short-term, high gain, economic incentives associated with the live food fish and marine ornamental trades. The U.S. Agency for International Development (USAID) is the principal agency of the U.S. Government responsible for building capacity in sustainable resource use in developing countries. USAID is presently working with local communities and national governments in about 20 countries to assist them in conserving and managing their coral reef and coastal resources through capacity building for integrated coastal management, better land-use practices, sustainable fisheries management, and marine protected areas.[8]

There are also immediate actions available to the U.S. public in terms of awareness and individual consumer choice.[9] There is an urgent need to develop positive trade regimes so that only products from reefs under sustainable management plans are allowed into or out of the U.S., to ensure that consumer demand by Americans is not contributing to the decline and degradation of coral reefs.[10]

We must change our view of how we treasure and value natural resources. For example, last month, the U.S. adopted new trade measures covering the import of antiquities from Italy into the U.S.; all antiquities from Italy must now be accompanied by documentation and certification as to how they were collected and where they are from, to ensure that they are from legitimate sources.

We must take a similar approach to natural resources. The U.S. government is promoting the

[8] See paper by Birkeland for discussion of sustainable management of reef fisheries.
[9] See paper by Spruill and Dropkin.
[10] See papers by McManus, and Lieberman and Field.

idea among other nations within the Asia Pacific Economic Cooperation forum that consuming nations must bear some of the responsibility for their imports, and it is considering this approach for reef resources.

The U.S. could play a significant role by helping reward responsible practices, creating market incentives for responsible behaviors, and requiring certification of non-destructive collection practices and demonstration of sustainable collection of coral reef species. In this way, government, consumers, hobbyists and industry members can work together to ensure a responsible trade.

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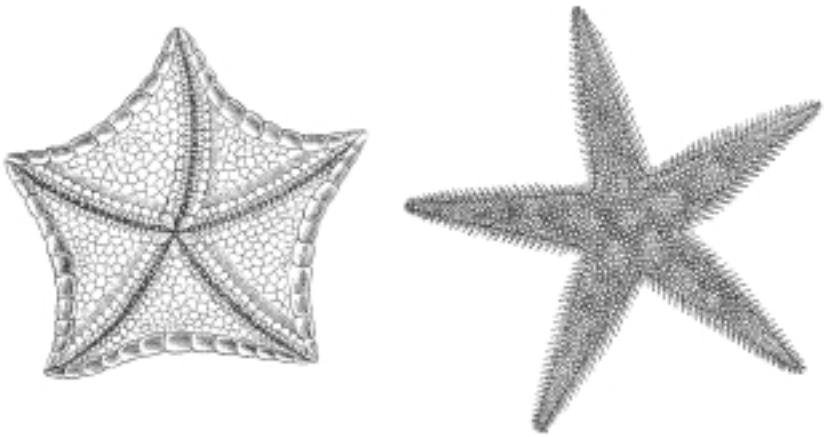

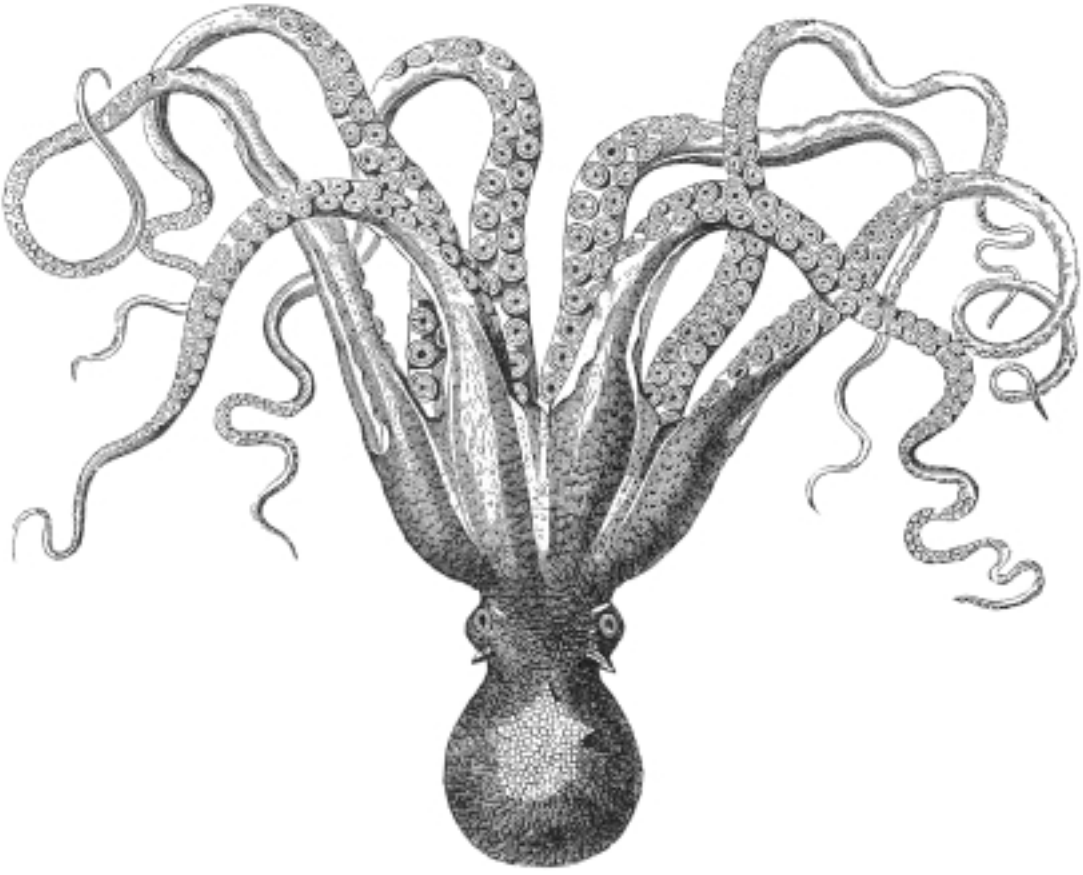

U.S. Efforts to Protect Domestic and International Coral Reefs: Trade in the Larger Context

Roger McManus

Trade in an Ecosystem

Well over a year ago I attended one of those Georgetown dinners in which policy makers and those that would influence them meet to come to political terms. The order of the evening was to convince environmental organization leaders to support Clinton Administration policies regarding free trade agreements and the World Trade Organization (WTO).

A focus of the discussion was the trade in coral reefs. I say coral reefs, not coral reef organisms, because as recent trade studies have documented, the trade is in dead and live coral, other coral reef invertebrates and associated algae, and fishes. This is literally trade in an ecosystem; the majority of the trade is in its underlying structure. (There is a conversation evolving referring to "biotic" reefs recognizing that a majority of reef components are not living corals, but including algae and other "reef" building invertebrates.) In any case, the largest importer by far is the U.S., primarily for the aquarium trade. The U.S. is a major importer, too, of sea horses and Queen conchs.

Is this trade consequential in light of global change, reefs being mined for building material, or otherwise destroyed by pollution? The answer is probably mixed. Global change is the major threat to reefs worldwide, and mining and pollution probably are the next biggest threats accounting for the largest losses. Nevertheless, fishing and harvest for the aquarium trade are probably not sustainable in almost all circumstances, and in many areas may be the most significant threat to coral reefs. In cases where the trade is targeted at rare species, the trade may be a threat to their continued survival. Moreover, it is culturally and politically important to address all threats to natural resources to ensure equitable treatment. However one gives weight to the relative threats, the destruction of coral reefs by human action is clearly ongoing.

All of this continues despite the fact that:

- tourism is emerging as the number one world industry, and that coral reefs have enormous economic value as a sustainable basis of tourism for many countries, for fisheries, and for other purposes;
- many coral species are recognized as threatened by trade, or potentially so, and are protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- there is clear acknowledgement that harvest of coral reef organisms is a significant contributing factor to the degradation of coral reefs;
- the U.S., recognizing the threat of trade to coral reefs, largely restricts the extraction of corals and coral reef organisms from most of its own federal, state and territorial waters; and
- many of the fishes taken for export for food and for the aquarium trade are captured using cyanide and other poisons, or other methods destructive to their habitats. The result is more often than not consumer fraud as diners and aquarium fanciers frequently buy fish that are in the process of dying from the poisons used to capture them. Many of the divers conducting the captures are exposed to the poisons, and are not trained divers, increasing incidents of death and injury.

The World Trade Organization and Environmental Controls

During that evening in Georgetown, I noted that the Clinton Administration would do nothing to curtail

its role in this destruction. I reasoned that the Administration simply would not take on the World Trade Organization (WTO) and its policies supporting free trade over any other concern. State Department officials assured me that I was wrong. But, sadly, I was right, the U.S. would effectively do nothing to stem imports of coral reefs into our county and the international trade continues to grow virtually unabated. We have instead essentially limited our efforts to assisting exporting nations to care for their coral reefs, to education, and to appealing for voluntary restraint by consumers.

Why can't the world's only remaining superpower curtail its domestic commercial imports of coral reef products when it is clear that the trade is unsustainable, destroying reefs, and undermining the present and future economies of developing countries?

Because the World Trade Organization won't let us. If Congress passed a law controlling trade in imports of coral reef products, one or more of the exporting countries would complain to the WTO that we are inappropriately interfering with free trade. The burden would be on the U.S. to prove to the WTO's satisfaction that our actions were justified. This may seem fair enough, except that the WTO has upheld every challenge to environmental controls, and the burden of proof is always on those seeking to help conserve and protect the environment and our natural resources.

If a country does not agree to curtail its "unfair" efforts to protect the environment, then the court provides for the offending country to suffer financial penalties. If the U.S. won't stand up to offended nations, consider what a small developing country would do in the face of threatening complaints from another nation bent on profiting from the elimination of offending pollution controls or wildlife protections?

WTO's unbridled advocacy of trade no matter what its social and environmental costs is unacceptable if we are going to foster the kind of natural resource stewardship that ironically will make sustainable economies possible. That is why worldwide opposition to the WTO is rising and won't go away.

Of course it is not necessary to open all environmental controls to attack to prevent some countries from trying to promote inappropriate protectionism. A solution to this problem must be forged if we are to continue the benefits of expanding world free trade, and protect our planet's environment and its wildlife.

The highest priority for the new U.S. Trade Representative, Robert Zoellick, is to secure "fast-track authority" from the Congress for the President to negotiate new trade agreements. He has criticized the arguably modest efforts by the Clinton Administration to ensure trade agreements do not undermine environmental protection. During his confirmation hearing, it was clear that Congress will be facing a contentious battle on how fast-track legislation will ensure needed environmental protection. One way to resolve conflict is to find equitable solutions.

Can Trade in Coral Reefs be Sustainable? The Limitations of CITES

Through Executive Order no. 13089 for the Protection of Coral Reefs, President Clinton directed the Secretary of State and the Administrator of the Agency for International Development, in cooperation with other members of the Coral Reef Task Force to assess the role of the U.S. in international trade in coral reef species, and to implement strategies and promote conservation worldwide to protect coral reefs. The report from the Trade Subgroup of the International Working Group to the U.S. Coral Reef Task Force helps to respond to this directive.

The conclusions presented above about the threats of trade to coral reef ecosystems echo those of the Working Group. The report noted an accumulating suite of references to coral reefs providing economic and environmental services worth hundreds of millions of dollars a year. The report suggests that almost all reefs have been affected by over-harvesting, and that there may be no pristine reefs left in the world. In addition, the Working Group made numerous recommendations on how to address the problem, including establishing new authorities to reduce the adverse impacts of the trade.

There is a fundamental assumption in these recommendations that it is possible to have sustainable, commercial exploitation of coral reef ecosystems. Many coral reef species are slow growing and slow to mature. Reefs are generally characterized as ecosystems with large numbers of species with relatively few num-

bers of individuals. Whether one measures sustainability by sustained biomass production, biomass remaining from exploitation, or stability in biodiversity measures, many observers of coral reef ecology are skeptical that such exploitation can be conducted in a relatively benign manner. More likely it is through a series of no-take reserves in marine protected areas, and rotating exploitation in sacrifice zones, that the impacts of the exploitation can be managed. Such management regimes in Australia have been held out as successful examples of this approach. Whether such a regime could be held to be really sustainable would presumably be dependent on whether some steady state over some meaningful time frame could be documented.

Nevertheless, while more research is needed to ascertain the impacts of all threats to coral reef ecosystems, and to demonstrate sustainability of their use, the burden of proof now generally lies with those who would constrain exploitation. Current public process assumes that those who profit from these resources are conducting their activities in a sustainable manner notwithstanding our knowledge of coral reef biology and data on harvest methods, quantities, and impacts that belie such an assumption.

That is not to suggest demonstrating confidence in sustainability would be straightforward. Thousands of species are involved in the trade, and the general tenor of the Working Group report is to seek sustainability on a species by species basis. No doubt, particularly with respect to live rock, many of the species in trade have not been described, the taxonomy of others is under debate or difficult to ascertain, and for most their biology is so imperfectly understood that our ability to suggest any level of exploitation as sustainable is speculative at best. Coupled with the fact that most organisms in this trade are identified in public documents at best to genera or even higher taxa, the conversation that meaningful decisions about the sustainability of harvest or trade is happening or could be so is highly questionable.

Imagine for a moment you are an official in Fiji in charge of issuing export permits under CITES. For stony corals under Appendix II you are charged with ensuring that the species to be exported were taken legally and in a manner that was "not detrimental to the survival of the species." There are 2000 corals listed under CITES, and you are presented with an export application for "live rock," including some species controlled by CITES, others controlled by other domestic law, and some for which there is no domestic or international law for their management. What do you do? What is your decision? How did you come to it? How do you decide this shipment and the ones before it and after it can be considered sustainable uses of the resource?

Keep in mind that the major substantive CITES standard for exports of Appendix II species is that the export is "not detrimental to the survival of the species". There are many people involved in this debate that view this standard as equivalent to a requirement for sustainability, but a clear reading suggests the CITES standard relates to probable extinction rather than a capacity to maintain commercial exploitation—arguably two very distinct standards. As the Fijian official you are lucky with regard to this standard. All you really have to suggest to allow the shipment is that it is not likely to be detrimental to the survival of any species it contains.

However, the treaty also suggests that exports should be limited to maintain the species throughout its range at a level consistent with its role in the ecosystem. Whether this is a legal standard for issuance of the permit that is enforceable is unclear. Whether "consistent with its role in the ecosystem" is a standard equivalent to "sustainable" is also uncertain. Sustainability, defined or not, is not a standard of international trade law, and for those purposes you are free, as that Fijian official, for all intents and purposes to ignore the question.

Imagine now that you are a border official in the U.S., and you receive a shipment of stony corals from Indonesia with an official permit attesting that the material was legally obtained and taken in a manner not detrimental to the survival of the species. You have several problems. You may not have a clue what species are really in the container, and if you did, how many are controlled by CITES or the U.S. Endangered Species Act. Under current U.S. policy, the pressure is to accept the shipment unless you challenge the authenticity of the export permit. You could also question the underlying assertions concerning whether the specimens were legally obtained or in the judgment of the Indonesian officials whether the shipment was detrimental to the survival of the species

included. You are likely not in a strong position to do this. In the experience of CITES implementation, you are also on very thin ice with respect to the "role in the ecosystem" standard. Hence, you approve the import and waive the shipment through.

These two examples suggest that CITES simply was not designed to be implemented as a comprehensive wildlife management tool at this scope of trade.

Recommendations

The International Working Group of the Coral Reef Task force identifies a series of actions being taken by U.S. agencies and makes recommendations that inherently make sense and are or would no doubt be beneficial, including research, education, better enforcement of existing domestic and international controls, and enactment of needed, restrictive legislation. The legislation did not happen, in part because some in the conservation community did not want interference with their "sustainable" coral reef projects. Nevertheless, enforcement of existing law is not likely to alleviate significantly the harmful impacts of the trade, except in some highly managed habitats

I would emphasize and add to those recommendations the following with the view to strengthen their potential impact:

1. Establish more coral reef marine protected areas with no-take reserves. This is undoubtedly the most efficient means to conserve the abundance and diversity of coral reefs. The U.S. has demonstrated leadership in this regard with the designation of the Northwestern Hawaiian Islands Coral Reef Reserve, and Palymra Island and Kingman Reef National Wildlife Refuges. [11]

2. United States leadership has been less admirable in trying to resolve the conflicts between promoting free trade and the conservation of natural resources. The U.S. government needs to be a leader in trying to find solutions.

3. The U.S. should phase out imports of wild coral reef species except in those specific cases where operations providing such commodities are operating in a manner demonstrated to fulfill some kind of numerically objective definition of sustainability. The current means and vision for controlling the trade are so disproportionate to its immensity as to render them largely ineffectual.

4. The U.S. government should reassess its role in dealing with global change, through its domestic management policies and international assistance, recognizing the impacts such change will have on coral reefs. One of the many consequences of sea level rise and global warming will be the decline of coral reefs throughout much of their range.

5. All governments concerned with marine conservation should take efforts to reduce and discourage mining of coral reefs and to prevent otherwise their physical modification and pollution.

The 21st century will be the most important in the existence of coral reefs over the past 5,000 to 10,000 years. In this century, we will make important decisions either intentionally or by indecision on whether we want to conserve a majority of coral reef biological diversity and how many coral reefs we want to see survive into the next century.

With regard to the coral reef trade, what does it say about us as a species, when we continence destructive trade in one of our planet's richest and sensitive ecosystems?

A trade that is argued excusable because it damages coral reefs less than other threats.

A trade that directly and predictably threatens the health and safety of our fellow humans.

A trade that captures and holds other organisms for our aesthetic enjoyment when we know their lives are essentially treated as consumables being acquired largely by poisoning their bodies and maintained without expectation of their survival.

How can we experience beauty and pleasure in such a process?

What do we consider potentially sustainable about this exploitation?

[11] See paper by Birkeland.

Can Ecosystem Management of Coral Reefs be Achieved?

Charles Birkeland

Coral reef ecosystems have the highest gross primary productivity in the sea, but the net productivity and potential fisheries yield are relatively low. The low net productivity in coral reef ecosystems is because of their complexity and diversity. A high diversity of phyla leads to a more complete partitioning and consumption of resources. A major portion of the primary productivity in the coral reef ecosystem is based on recycling of chemicals between algal symbionts and a variety of animal phyla. Coral reef communities are characterized by about six trophic levels and a disproportionate prevalence of predatory species, and much of the energy is lost in transfer among trophic levels rather than exported from the ecosystem. Coral reef ecosystems differ qualitatively and fundamentally from other ecosystems and the appropriate management strategies for coral reef ecosystems must also differ from the traditional species-by-species management plans.

Vulnerability of Coral Reef Species and Ecosystems

Populations of animals on coral reefs can be fished down quickly and if severely depleted, may not return. For example:

- Fish populations on a newly discovered pinnacle off northwestern Guam were monitored when fishing began in 1967. The populations were fished down in about six months. They have been monitored ever since by the Government of Guam's Division of Aquatic and Wildlife Resources and it has been documented that the populations have not recovered after 34 years.
- Likewise, a grouper spawning aggregation was extirpated by a Taiwanese fishing boat in the Denges Channel of Palau in 1986 and the population has not returned after 15 years.
- Over a hundred tons of *Pinctada margaritifera* (the black-lipped pearl oyster) were taken from the population on Pearl and Hermes Reefs in the NW Hawaiian Islands in 1927. Paul Galtsoff found several hundred survivors in 1930, but only a few were found during a NMFS survey in 1993 and six were found during an intensive survey late in the year 2000.
- Hundreds of tons of sea cucumbers were harvested from Truk (now Chuuk) Lagoon in the late 1930s, but only two individuals of the valuable species *Holothuria nobilis* were observed in a survey of eight sites in 1988.
- The kupuna (master fisherman) Louis Agard tells of finding a school of large moi (*Polydactylus sexfilis*) at Shark Island in the French Frigate Shoals, Northwest Hawaiian Islands in the early 1950s. He caught the school and never saw more moi there, although he continued to fish the area for ten years. He tells of how he learned from numerous examples of the fragility of the reef fishery resources and how one fishing boat can make permanent changes.

The vulnerability of coral-reef species is partly because of their life-history adaptations to uncertainty in survival of recruits and juveniles in diverse communities where predation and competition are intense. With low rates of survival of recruits, multiple attempts at reproduction are favored through longevity and large size. These traits lead to low rates of population turnover and special vulnerability to overfishing.

Because of the life-history traits of the targeted species and because of the nature of the ecosystem

processes, we must be careful about expecting too much from coral reefs. Even though they have the highest gross primary production of marine habitats, the fisheries yield of coral reefs should not be expected to keep pace with the growing human population and its demand for protein.

Another special consideration is the effects of overfishing on food-web dynamics or ecosystem function, and multispecies assemblage composition. Unlike pelagic fishery systems, overfishing a coral reef can have ecosystem-level effects. Examples of alternate stable states of algae resulting in part from overfishing of herbivores are found around Ngaderrak Reef in Palau which began with a crown-of-thorns outbreak in 1979, and the north coast of Jamaica which began with multiple factors in the early 1980s. Pelagic species might be managed on a species-by-species basis, but because of ecosystem-level effects resulting from coral-reef fisheries, the coral reef must be dealt with using an ecosystem approach. The maximum sustained yield for reef fisheries may not correspond with the level at which the species may be harvested without ecosystem overfishing. (Ecosystem overfishing occurs when overfishing affects multispecies assemblage composition, food-web dynamics, or ecosystem function.)

Shortcomings in U.S. Fisheries Management for Coral Reefs

The marine fisheries in the U.S. are managed under the Magnuson-Stevens Fishery Conservation and Management Act (as amended 11 October 1996). The Magnuson-Stevens Act requires the management units to be species or taxonomic groups, with a maximum sustained yield calculated for each. Unless identified with a specific maximum sustained yield, the resource will not be considered to be regulated or managed. This may work for north temperate fisheries for which the Magnuson-Stevens Act was originally designed, but these criteria do not work for coral-reef fisheries where bioprospecting harvests new unnamed resources, new technologies such as mixed gas diving open up new resources, multispecies interactions bring about unpredicted ecosystem overfishing, ecosystem overfishing does not necessarily correspond with maximum sustainable yield, and recruitment is erratic and unpredictable. The temperate fisheries are mainly for food resources, but in addition to food, coral-reef fisheries are for pharmaceuticals, ornamentals, and aquaculture brood stock. In temperate regions, catch per unit effort is often used as a proxy for overfishing, but it has yet to be shown as a reasonable proxy for ecosystem overfishing.

Ecosystem-Based Coral Reef Management in the Western Pacific

The Coral Reef Ecosystem Fishery Management Plan (CREFMP) for the western Pacific is the first ecosystem-based fishery management plan for U.S. waters. Its objectives are to:

- develop sustainable use of multispecies coral-reef resources, especially by indigenous fishermen and local fishing communities,
- prohibit destructive fishing methods,
- develop integrated data collection on resources,
- develop cooperative and coordinated management of resources and information among agencies, and
- provide education of the public in order to foster support for responsible management.

The CREFMP is not only focused on management of food resources, but also on new creative endeavors such as pharmaceuticals, live rock, live fish trade for restaurants and ornamentals, and aquaculture brood stock. Because of the complexity of the coral-reef system and the rapid development of new and unexpected technological advances, the strategy must be to anticipate, but facilitate, the management of unknown resources.

The approach of the Magnuson-Stevens Act is that resources are open to unmanaged exploitation until the resource is named and a maximum sustained yield is calculated (Magnuson-Stevens Act Section 303). In the CREFMP, we take the opposite approach, a **precautionary approach**, with the Permitting System in which a plan must be developed before the harvest can proceed. A committee of scientists should examine potential ecosystem effects before a permit is given. To assess potential effects, the committee may consider the interactions of the resource with the trophic levels below and above. If the resource is harvested, does this release the prey of

the resource species from its regulation (e.g., if a herbivore is harvested, does this potentially release algae from control to the extent that it shifts the system into an alternate state where algae inhibit coral recruitment?) If the resource is harvested, are humans competing with the natural predators of the resource (e.g., does the harvest of spiny lobsters from the Northwest Hawaiian Islands substantially reduce the food supply of the endangered monk seal?) Each resource should be examined in terms of its role in the ecosystem. Does it provide structure and topographic complexity? Does it have symbionts? The **burden of proof is reversed** when a plan must be provided before a permit is granted. **Enforcement** is enhanced by the information provided in the reporting process required by the permit. If there were no report, the permit would not be renewed.

Coral-reef ecosystems are too complex to completely understand, but the permitting system continuously provides new **information** through the reporting process. Permit forms require the catch to be reported, and as the information is compiled, changes over time in catch per unit effort and size distribution of the resource allows management to improve. Scientific study or monitoring of all fisheries programs would be prohibitively expensive, but the required reporting of catch and bykill provides an inexpensive source of information. A permit may be revoked or modified at any time it becomes evident that the harvest is having deleterious effects on the ecosystem. A permit may also be revoked or modified if unseen natural events such as the El Niño Southern Oscillation or a typhoon occur. The permit system allows for **adaptive** management, whereas regulations are more difficult to change quickly, as new information becomes available. The CREFMP also provides flexibility in the management by providing a framework process involving administratively simplified procedures for changing regulations.

Marine Protected Areas

The CREFMP for the western Pacific has taken a holistic ecosystem approach by establishing Marine Protected Areas (MPAs). In the 1200-mile long Northwest Hawaiian Island chain, no-take MPAs are at 0–10 fathoms (to 60-foot depth) for all the chain. No-take MPAs are also from 10–50 fathoms (to 300 feet) at French Frigate Shoals, Laysan, and the northern half of Midway. The southern half of Midway is only for recreational catch and release. The no-take MPAs at remote Pacific islands (Jarvis, Baker, Palmyra, Howland, Kingman, and Rose Atoll) are from 0–300 feet. The no-take MPAs are **holistic** in that they allow natural process to be maintained without needing detailed knowledge of each species, multispecies interactions, or ecosystem functions, and they provide **insurance** against unpredicted climatic events and irregularities in recruitment. **Enforcement** is easier with MPAs than with quotas and gear restrictions, and MPAs constitute areas that are **informative** on how the natural system works in the absence of exploitation by humans.

MPAs are touted for two contradictory purposes, to preserve biodiversity (greater gross primary productivity, but reduced net productivity or yield) and to preserve and enhance fisheries yield (less gross primary productivity, but increased net productivity or yield).

Coral reefs in other areas of the Exclusive Economic Zone of U.S. waters are categorized as low-use MPAs. They can be harvested within fishery management plans that have already been developed (bottomfish, crustacean, and precious coral fisheries). Except for these fisheries, any take and scientific research require a special permit as described above. Low-use MPAs are from 60 to 300 feet in the Northwest Hawaiian Island chain except French Frigate Shoals, Laysan and the northern half of Midway. Recreational fishing is allowed at Johnston, Wake, and Guam southern banks.

Keeping Up with New Technologies

The CREFMP for the western Pacific takes the approach of approving gear rather than prohibiting gear because technology is developing so rapidly that new gear would be put into use faster than it could be examined, tested, and prohibited if necessary. (An example of new gear that has had devastating effects before there was time to prohibit it was the hunting of lumphead parrotfishes and Napoleon wrasses with nightlights and scuba at American Samoa and Guam). Just as the permit system is the reverse of the regulatory system (in the permit system, a resource cannot be harvested until a management plan is accepted), the CREFMP allows harvest only with gear that has

been approved. New inventions are not given free use until prohibited, they are only allowed after approval. (In order to emphasize the explicit prohibition of gears that are destructive of habitat, the CREFMP prohibits dredges, trawls, poisons, gillnets, tanglenets, and explosives.)

Another tactic for general habitat protection stipulated by the CREFMP is that all fishing vessels are required to post bond or carry insurance to cover the expense of repair to the reef in case of grounding.

Summary

The ecosystem approach of the CREFMP for the western Pacific, as submitted by the plan team to the Western Pacific Regional Fishery Management Council, includes the permit system, marine protected areas, essential fish habitat, marine habitats of particular concern, bonds for fishing vessels, and a list of allowable gear. It is hoped that this plan is not substantially altered as it progresses through the administration for approval. It fulfills the policies advocated in the Report to Congress from the Ecosystem Principles Advisory Panel of the National Marine Fisheries Service: change the burden of proof, apply the precautionary approach, purchase "insurance" against unforeseen ecosystem impacts, and apply adaptive management.

Global Solutions to Global Trade Impacts?

Susan Lieberman
John Field

Introduction

Coral reefs are some of the most productive and diverse ecosystems on Earth. Although they occupy less than 0.25 percent of the marine environment, reefs support more than a quarter of all known fish species (Bryant et al., 1998). Coral reefs are an example of a highly complex and interconnected ecosystem. The rich complexity found in the reef ecosystem is a result of the evolution of many symbiotic associations which couple photosynthesis with processes that increase the retention of limited nutrients within the system. Despite their high gross productivity, reefs rely on a fairly closed nutrient cycle that yields little surplus production for extraction. They serve as critical habitat for numerous tropical species, provide storm and wave protection for coastal communities, and yield renewable resources for human populations around the globe. Yet these same human populations, often in areas of rapid development and growth, are placing increasing stress on these vulnerable ecosystems, due to various economic and social pressures.

Coral reefs now face a multitude of anthropogenic stressors. According to a 1998 World Resources Institute report, nearly 58% of the world's reefs are at risk from a range of human activities—global warming, marine pollution, coastal development, destructive fishing practices, overexploitation of resources, disease, runoff from improper land-use practices—and many have been degraded beyond recovery (Bryant et al., 1998). The study concluded that overexploitation of resources, destructive fishing practices, and coastal development pose the greatest potential risks. The international trade in coral, reef fish, live rock, and other reef organisms also contributes significantly to the decline and degradation of reefs.

These stressors have a cumulative and synergistic effect on reef health, and often occur in countries that lack the institutional or financial capacity or political will to mitigate them. Thus, it falls upon the international community to continue to mobilize funding, foster cooperation, monitor trade, and provide expertise to coral range countries if the reefs are to recover and thrive in the 21st century. This paper focuses on the role of international trade, and multilateral and domestic efforts to regulate and control that trade.

The Role of International Trade

Coral reef species are traded as a variety of products in numerous international markets, including live reef food fish, traditional food fish, curios, traditional medicines, live marine ornamentals, coral and live rock for aquaria, limestone production, and construction materials. Each of these arenas has its own set of issues, management regimes, and industries but all are subjected to some degree of international control or scrutiny. The impact of international trade on coral reefs relative to other stressors (pollution, bleaching events, etc.) is not well quantified, but the fragility of reef ecosystems means that even secondary threats cannot be ignored. In fact, the partners within the International Coral Reef Initiative (ICRI) adopted a resolution in the fall of 1999 recognizing that "international trade in corals and coral reef species is contributing to the stresses on these systems."

The best available information on trade in coral species listed under the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a recent study by the World Conservation Monitoring Center. Analysis of CITES records for black corals (from 1982–1997) and stony

corals (from 1985–1997) revealed that 70 nations imported a total of 19,262 tons from 120 exporting nations over this period (Green and Shirley, 1999). The trade in dead coral peaked in the early 1990s but has since declined to levels comparable with the mid-1980s. The decline in trade is due to a number of factors including an export ban on dead coral from the Philippines, the primary source of coral in the 1970s. However, the quantity of corals traded live for the marine aquaria market has increased tenfold from 1985 to constitute more than half of the global trade in 1997, between 600–700 tons, and is continuing to increase 20–30% each year.

The live food fish trade is centered in Hong Kong, which imports a variety of species from Southeast Asia and the South Pacific archipelagoes at a wholesale value of $500 million per year (Lau and Parry-Jones, 1999). Specimens imported to Hong Kong are also re-exported to China, but little or none of this trade currently affects the U.S. (Lau and Parry-Jones, 1999). The U.S., however, does import significant amounts of traditional food fish (e.g., shrimp, spiny lobster, and queen conch) from coral reef ecosystems and thus has a responsibility to participate in their conservation as well.

The U.S. is a significant part of the curio and marine ornamentals industry: we import more than 80% of the stony coral in trade, and more than 50% of the marine aquarium fish (Anonymous, 2000). This trade is growing by 10–20% per year (Green and Shirley, 1999) and could have a substantial impact on reef health in the coming decade. In addition to a lack of science-based sustainable management, the marine ornamentals industry continues to experience destructive fishing practices (e.g., sodium cyanide use), harvest of multiple age classes within species, and poor survivability of traded specimens. The magnitude and growth of the U.S. market in the marine ornamental industry over the last decade all indicate that the U.S. should take a leading role in promoting sustainable use of coral reefs within range countries. As discussed below, several U.S. initiatives and international agreements with U.S. involvement are working toward this end.

Means to Address International Trade

The problems identified above are addressed in a number of arenas, including capacity building, cooperative management and planning, international regulation, and domestic U.S. measures. Each of these approaches addresses a slightly different aspect of international coral reef trade, and each has benefited from U.S. participation. This paper will note all of these areas, but will focus on the regulation of international trade, in both a CITES and non-CITES context.

Capacity Building

The U.S. remains committed to building the capacity for marine resource conservation in developing nations, particularly those that are coral reef range countries. Tropical marine ecosystems are crucial to our development plans in food security, the environment, economic growth, health, disaster mitigation, biodiversity conservation, and climate change (Anonymous, 2000). Many U.S. government agencies have committed funds and personnel to this effort, including the Department of State, the U.S. Agency for International Development, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the National Oceanic and Atmospheric Administration (Anonymous, 2000). Agency programs often focus on training or personnel loans to promote and implement coastal zone management, marine park administration, law enforcement, institutional decentralization, and fishery retraining. In addition, funds may be provided for partnerships with governments, non-governmental organizations, and academia.

International Cooperative Management

Since the mid-1990's, the U.S. has taken an increasingly active role in international fora aimed at coral reef conservation. These include the International Coral Reef Initiative (ICRI, an intergovernmental negotiation and planning forum), the Convention on Biological Diversity (which the U.S. has signed but not yet ratified; it includes active discussions over destructive fishing practices on coral reefs), the International Queen Conch Initiative, North American Wildlife Enforcement Group, World Customs Organization, ICPO-Interpol, Asian-Pacific Economic Cooperation, and the South Pacific Regional Environment Program. Most of these fora have focused on means to identify and reduce destructive fishing practices in tropical systems (e.g., sodium cyanide fishing), and the U.S. has

participated actively through the commitment of funds, personnel, and expertise.

International Trade Regulation—CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) remains the primary instrument for monitoring and regulating trade in wildlife, including coral reef organisms. CITES is the only international legal mechanism with the mandate to protect species from overexploitation due to international trade. The opening paragraph of the Convention explicitly recognizes that each species of wild fauna and flora is an integral component of the natural ecosystem in which it is found, and it acknowledges that wild fauna and flora are to be conserved in perpetuity, in the wild. The ecological principles underlying this statement are reflected in Article IV of the treaty, which provides for its scientific underpinning.

There are now 154 countries that are Parties to CITES, making it one of the most extensive international agreements for species conservation and protection. CITES currently affects international trade in over 30,000 species of plants and animals. Over 2000 species of hard coral (all Scleractinia, organ pipe, fire, and blue coral), ten species of giant clams (Tridacnidae), and one conch species (*Strombus gigas*) are included in Appendix II of CITES, in addition to several non-reef building coral species. However, no species of coral reef fish are listed under CITES.

CITES entered into force more than 25 years ago, and benefits global species conservation through required scientific and management findings and action, annual species-specific trade statistics, international oversight on range country resource management, and a system of dual control in exporting and importing countries.

CITES offers three different levels of protection and regulation for listed species. Appendix I includes species threatened with extinction, which are or may be affected by international trade; commercial trade in these species is prohibited. Appendix II includes species that may become threatened if their trade is not brought under control. Commercial trade in Appendix II species is subject to regulation, and is allowed only if permits are obtained stating that trade will not be detrimental to the species. Appendix III includes species that are listed unilaterally by range countries, which require international cooperation in monitoring trade; commercial trade is permitted. All coral reef species covered by CITES are currently in Appendix II, which places obligations on both exporting and importing Parties. The treaty requires that each signatory nation establish a CITES Management Authority (to issue permits and perform certain other duties) and a CITES Scientific Authority (to monitor biological sustainability of trade).

CITES Article IV

Article IV of CITES provides the supporting framework and flexibility to scientifically evaluate the management of listed species—the very core of CITES. The export of Appendix II species requires a management finding that specimens to be exported were all obtained legally; it also requires a scientific finding that the export of the specimen(s) is not detrimental to the survival of that species. Once trade is underway, the status of the species must be monitored to ensure that it is maintained throughout its range at a level consistent with its role in the ecosystem.

All exports of specimens of CITES Appendix II species must comply with Article IV, which requires a two-tiered analysis for determining whether trade is biologically and ecologically sustainable. The first tier, Article IV paragraph 2(a), requires that the Scientific Authority determine that an export will not be detrimental to the survival of that species. The second tier, Article IV paragraph 3, further provides that the Scientific Authority must monitor the status of the species to ensure that it is maintained throughout its range at a level consistent with its role in the ecosystem and well above the level at which the species might become eligible for inclusion in Appendix I (which prohibits all trade). Conservation of species and their functional roles within the ecosystem would benefit from integrally linking Article IV paragraph 2(a) and a thorough implementation of Article IV paragraph 3 by the Parties; this is sorely lacking in most all cases.

Since Appendix II coral species constitute and create critical reef habitat, their abundance and health affects the overall vitality of the reef ecosystem. The linkage between Article IV paragraph 2(a) and paragraph 3 provides a check and balance mechanism to

ensure sustainability of the Appendix II species in trade, and thereby the sustainability of the coral reef ecosystem. As the Scientific Authority fulfills its obligations under Article IV paragraph 3, non-detriment findings under Article IV paragraph 2(a) should take into account this scientifically based assessment of the species' role within its ecosystem and of the management of natural resources within the entire harvest site. Of course, it is a significant scientific challenge to effectively implement Article IV for coral species. There are uncertainties with regard to the biological and ecological sustainability of exploitation of coral reef ecosystem species, and controversy over the taxonomy of stony corals in the trade. Nevertheless, the listing of reef-building corals on CITES Appendix II was a decision of the CITES Conference of the Parties based on much conservation foresight, and provides unique opportunities and challenges to fully implement the scientific requirements of the treaty, by necessitating concomitant consideration of Article IV paragraphs 2 and 3.

Although these represent relatively simple concepts, such mandates require exporting countries to first develop and then examine, revise, or overhaul national management programs for listed species. Without robust and reasonable management schemes in place, range countries find it difficult to explain their permitted export levels, national licensing systems, or harvest quotas to other bodies within CITES.

Importing countries must ensure that each shipment is accompanied by a valid CITES export permit or refuse its acceptance. The U.S. Fish and Wildlife Service clears all wildlife shipments, and requires declaration from importers for all shipments containing wildlife, including coral and coral reef species. CITES permits are required for CITES-listed species, and a database is maintained for all of these imports. The U.S. reports these data annually to the CITES Secretariat, as part of its CITES obligations.

In addition, the treaty specifically authorizes CITES Parties to institute so-called stricter domestic measures, which may restrict otherwise permitted trade. These can include establishment of measures by importing countries to ensure that their imports from range countries are sustainable. For example, the European Union temporarily banned the import of six genera of stony corals from Indonesia after examining the high export quotas established by the Indonesian government. Indeed, the European Union has far-reaching legislation that requires import permits for all imports of CITES-listed species, and they can restrict imports by species or country, if they have information that CITES is not being effectively complied with by the exporting country. In particular, their scientific experts meet regularly to evaluate whether or not the Article IV sustainable use/ non-detriment findings are being effectively made, and if not they can (and often do) stop imports of species from specified countries.

Such activity shows the impact of an Appendix II listing, and the powerful framework provided by CITES for monitoring and controlling international trade in coral reef species. The U.S. also has several stricter domestic measures that restrict imports of certain species based on conservation factors, including several CITES-listed species; these include the Endangered Species Act, Marine Mammal Protection Act, and Wild Bird Conservation Act. However, current U.S. law does not allow it to restrict imports of CITES Appendix II coral shipments, even if there are good reasons to believe that trade levels and practices are indeed in contravention of CITES' requirements, and are harmful to the species and its reef ecosystem. We will return to this concern in more detail later.

It is important to note that while the U.S. is the major importer of stony corals, commercial harvest of these species is banned or severely restricted in all U.S. range states and territories (Anonymous, 2000). This prohibition undoubtedly has many rationales, but U.S. policy makers often cite reef vulnerability as a prime factor in their decision. For example, the Caribbean Fishery Management Council (which develops management plans for several coral reef species in U.S. federal waters) has stated:

> *The principal value of coral reefs (including live-rock) is considered to be non-consumptive and are viewed as essentially non-renewable resource[s]...The importance of corals and associated plants and invertebrates lies in their relationship to the marine ecosystem. (CFMC, 1999)*

Given the dichotomy between U.S. imports and U.S. domestic policies regarding reef management and our own trade, it is imperative that the U.S. ensures that it is not contributing to coral reef

destruction in other parts of the world. The U.S. Coral Reef Task Force (USCRTF) accepted this challenge and requested that the Council on Environmental Quality (CEQ) lead an interagency team to investigate possible domestic measures (including trade restrictions) to address unsustainable U.S. imports of coral reef species (Anonymous, 2000). It is our personal view that it is important that our importation policies and practices are consistent with our domestic policies and management practices (regarding exports in particular). A case in point is the Wild Bird Conservation Act of 1992. When Congress was considering whether or not to restrict imports of CITES-listed wild birds, primary consideration was given to the fact that all commercial exports of native wild birds are prohibited under U.S. law.

U.S. Industry Efforts

The U.S. marine ornamentals industry has recognized the need to promote a sustainable supply of organisms harvested in a non-destructive manner from source countries. Toward that end, the Marine Aquarium Council (MAC) has been established as a non-governmental organization (NGO) to start dialog between collectors, wholesalers, retailers, and hobbyists on these subjects and to develop a means to certify environmentally sound products in the worldwide marketplace (Holthus, 1999).[12] MAC intends to define, establish, and promote a certification scheme to be used throughout the chain of custody in the marine ornamentals trade, using best practice standards developed from multilateral consultations with industries, governments, and other NGO's (Holthus, 1999). The standards developed within MAC could help alleviate the poor shipment survival of many marine ornamentals, and may attract more consumers to "environmentally friendly" products. Obstacles to overcome in this process include market economics (uncertified, cheaply collected specimens will cost less than certified ones) and industry consensus. Obviously, as an industry organization MAC's interest is to avoid additional regulatory action or any legislative restrictions on U.S. imports. However, MAC has been actively involved in the U.S. Coral Reef Task Force discussions for many years, has been a positive partner, and has provided useful advice to U.S. agencies addressing these issues.

Domestic U.S. Measures

The USCRTF International Working Group appointed a small Trade Subgroup to examine the CEQ process and develop possible measures to channel U.S. demand toward sustainably harvested reef species. The subgroup recommended a variety of actions for the U.S. to consider, including:

1. The U.S. should prohibit domestic harvest or collection and the import or export of coral reef species and products listed under CITES that are not sustainably managed or from environmentally sound mariculture programs. Exceptions might include organisms intended for approved captive breeding programs, scientific research, or public display. Restrictions might be extended to other species of concern under certain circumstances.

2. The U.S. should work with members of the marine aquarium industry, environmental organizations and other stakeholders to develop, within a specified time limit, responsible practices and guidelines for collection and transport of coral reef species that reduce mortality rates throughout the trade stream, improve product quality, and ensure survival in captivity.

3. After working with stakeholders over a specified time period, the U.S. should prohibit the domestic harvest and collection of any coral reef species by defined destructive fishing practices, such as the use of reef dredging, explosives, or poisons.

4. After working with stakeholders over a specified time period, the U.S. should prohibit the import or export of any coral reef species unless accompanied by certification that the products were not taken through the use of destructive fishing practices.

5. The U.S. should develop a coordinated national strategy for conservation and sustainable management of coral reef species and ecosystems within the U.S., and then work with the international community to share this strategy and develop criteria for the conservation and sus-

[12] At press time, the first phase of this effort has been implemented by participating industry members, with a certification system in place between exporting and importing countries.

tainable management of coral reef ecosystems in other parts of the world (Anonymous, 2000).

All of these are important options to consider. Such efforts would be intended to channel the U.S. demand toward source countries with effective management plans and/or those species that are harvested sustainably.

The legislative option would create a legislative and regulatory situation comparable to the U.S. Wild Bird Conservation Act (WBCA), which supports CITES by allowing importation into the U.S. of certain approved captive-bred species, but also allows for importation of wild-caught birds from approved science-based sustainable use management plans. It is a "reverse list" approach. The WBCA, passed in 1992, was stimulated by unsustainable trade, and challenges to effective CITES implementation by range countries, similar to what we are seeing now with the trade in CITES Appendix II coral species. The WBCA also encouraged the rapid development of captive breeding and husbandry techniques analogous to those that are emerging in the marine ornamentals industry today. Such a legislative option for U.S. imports would certainly benefit from more discussion between Congress, the Administration, scientists, conservation organizations, industry, and others.

Options that relate to cooperative work with industry are already underway, working through MAC and others. Certainly best management and trade practices are vital to both ensuring sustainable trade, and to conservation of coral reef ecosystems. We personally believe that such "voluntary" efforts are often most successful when coupled with regulatory/legislative solutions and incentives, and as such further dialogue on these options would be very useful.

Finally, all of these options address U.S. import (and export) policy options, and options available to the export and import industry. We believe that it is vital to couple those strategies with increasing public awareness.[13] We strongly urge efforts to create informed consumers, so that anyone purchasing coral jewelry, coral reef-based curios, coral for a home aquarium, or ornamental fish, should be able to be aware of the origin of the products they are purchasing. We are not recommending consumer boycotts of coral reef-based products. Rather, consumers should be educated to demand products that are produced in a biologically, culturally, and economically sustainable manner, and provide both economic benefits to local people, and incentives for coral reef ecosystem conservation. An informed consumer is powerful—and can guide industry best management practices, government policies, and of course Congressional interest and action.

[13] See paper by Spruill and Dropkin.

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Ocean Attitudes 2001: Conservation through Consumer Action

Vikki Spruill
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Note: The following summarizes a PowerPoint presentation. The complete set of slides may be viewed at: ***http://www.aaas.org/international/ssa/coralreefs.*** *The findings presented here are a compilation from polls commissioned by SeaWeb, as well as surveys undertaken by other organizations. Information on data sources may be obtained from the authors.*

Setting the Context

To assess public attitudes regarding a variety of ocean issues, between 1996 and 2001, SeaWeb has worked with professional market research firms. The results reported here represent a subset of the opinions expressed by survey respondents. In all cases, the surveys were conducted using industry-standard market research techniques and included sample sizes that allowed for accurate calculation of statistical significance.

Most Americans care about the oceans and believe that the health of oceans is threatened. Fifty-nine per cent of those responding to a 1999 poll rated the overall health and quality of the oceans as "only fair" or "poor," while less than one-third thought the oceans are in "good" or "excellent" condition. The same poll showed that over half believe that the condition of the oceans is deteriorating, having gotten worse in recent years. An even larger percentage—nearly three-quarters—evaluate the condition of coastal waters as negative. Coastlines are where the majority of people interact most directly with oceans.

Studies consistently show that the public—caring most about human health—views pollution with greatest concern and as the topmost threat to ocean health.

- From among a range of environmental problems—water pollution, rain forest loss, development, overconsumption, etc.—people consider most urgent those with the most direct impact on human health, namely water pollution and toxic wastes.
- The 1999 poll gave people a list of specific ocean issues—ranging from oil spills, corporate farm runoff, and improperly treated sewage to coastal development, commercial overfishing, and damage from boating/jet skis—and asked respondents to rank them. Deterioration of coral reefs was a middle tier concern, ranked well below pollution concerns but above such concerns as damage from boating and recreational overfishing. While this places coral reefs in a context of other concerns, it is difficult to know whether people would have themselves volunteered reef loss in the survey.
- In 1996, while testing messages that would help communicate more effectively about oceans, SeaWeb found that people connect to the need for ocean conservation mostly through two themes—a sense of responsibility to future generations and concern for human health. Making the case for coral reef conservation could use examples that fit these themes.

Communicating about specific threats to coral reefs and solutions is complicated by public confusion about reef systems. Approximately four in ten Americans either believe that fish breeding grounds and coral reefs are found throughout the oceans (versus only in certain places, as is the case) or do not know.

Towards Coral Reef Conservation and Consumer Action

However, there is strong support for establishing marine reserves. Respondents in the 1999 poll includ-

ed protection of ocean life and habitats—and coral reefs specifically—as some of the top goals for marine protected areas. These were placed well above such other goals as responsible management for oil exploration/drilling and commercial fishing, maintaining clean areas for swimming and diving, and providing recreational areas for boating. Nearly three-quarters of the public would support prohibiting the collection of tropical fish and corals from protected areas.

The public clearly is concerned about the state of the world's oceans. The public believes that humans can do lasting damage to the oceans, and supports efforts to strengthen ocean protection. However, many do not believe that their personal actions have much impact on ocean health. On the other hand, taking environmental action as a consumer—for example, recycling motor oil, cleaning up litter, eating only environmentally safe fish, and buying non-overfished seafood—is more popular than other kinds of individual action (such as contacting politicians and joining an environmental group).

Indeed, there are substantial numbers of people willing to modify their purchasing behaviors to help oceans. For example, many strongly support actions to protect oceans, even if it meant paying more for seafood. Sixty-two per cent of respondents in one survey said they would not eat fish classified by the government as overfished, and 44 per cent would only eat fish caught or farmed in a way that protects oceans.

Americans are increasingly connecting to conservation through consumerism and there is growing momentum to use consumer markets to drive ocean conservation.

- The Marine Stewardship Council has developed a certification program for sustainable fisheries.
- Various organizations, like the Monterey Bay Aquarium, National Audubon Society, and the Chefs Collaborative have developed seafood-buying guides for consumers, chefs, and restaurateurs.
- SeaWeb has started the Seafood Choices Alliance as a trade association to provide the seafood sector with the information it needs to make sound choices and provide the best options for its customers.

For coral reefs, there are two areas of consumer concern—food fish and marine ornamental fish, coral, and live rock. To address the consumption of fish, the Seafood Choices Alliance and other organizations are working to create a sustainable food fish industry. To address the trade in ornamentals, the Marine Aquarium Council seeks to create a sustainable trade through certification of marine ornamental fish.

In addition to formal opinion polling, SeaWeb conducted an informal survey of 77 aquarium hobbyists attending a conference of the Marine Aquarium Societies of America. The results of this survey suggest that there is great interest in using purchasing behavior to support reef stewardship. Most respondents indicated they want to support an industry based on quality and sustainability. Some hobbyists currently seek out suppliers of healthy animals, and are "very interested" in the source and collection methods of the fish they purchase. More importantly, they are willing to pay more for fish that are certified as being caught and handled in an environmentally responsible way. While based on a small, self-selected sample of hobbyists, these results point to a positive atmosphere for providing information that would allow marine aquarists to make environmentally sound choices.

Conclusion

There is a need to better understand the public's knowledge about and attitudes towards coral reefs so that campaigns and communications can be crafted more effectively. There is the opportunity to use consumer initiatives as a tool to augment legislative and enforcement solutions to the coral reef crisis. This will require communicating the link between reef conservation and informed consumer purchases—a difficult task in the face of public confusion about coral reef ecosystems and how they work.

However, saltwater aquarium hobbyists and the trade can be a force for change. And, with growing interest in linking consumer behaviors to conservation, there needs to be continued investigation of how environmentally responsible aquaculture—whether for food fish or ornamentals—can relieve pressure on coral reefs without unintended consequences for reef-based economies.

About the Authors

Barbara Best is a Coastal Resource and Policy Adviser for Environment at the U.S. Agency for International Development (USAID). Trained as a marine biologist, she has worked on marine and coastal management issues in the Caribbean, Central America, Southeast Asia, and the Middle East. Her expertise includes integrated coastal zone management, marine resource use, and marine biodiversity conservation. She previously held research and teaching positions at Columbia University, University of California—Berkeley, and Colby College.

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Now Director of the Center for Conservation and Sustainable Development at the Missouri Botanical Gardens, **Roger McManus** was President of the Center for Marine Conservation (CMC) for 15 years. CMC is the largest U.S. environmental organization dedicated to marine conservation issues. In 2000, McManus was on special assignment to the U.S. Department of the Interior as Senior Adviser for Oceans. He has worked on a variety of issues related to endangered species and trade in the international and domestic arenas.

Charles Birkeland recently moved from the University of Guam to the University of Hawaii where he is with the Hawaii Cooperative Fishery Research Unit. He is also serving as Chairman of the Coral Reef Ecosystem Fishery Management Plan Team of the Western Pacific Fishery Management Council. Birkeland has studied coral reef ecology for over 30 years at the Smithsonian Institution and the University of Guam Marine Laboratory. He has authored a book on the crown-of-thorns starfish as a major management problem for coral reefs, and edited the 1997 book *Life and Death of Coral Reefs.*

Now Director of the Species Programme at WWF (Worldwide Fund for Nature)—International, **Susan Lieberman** was previously Chief of the Division of Scientific Authority of the U.S. Fish and Wildlife Service (USFWS). She held that position for three years, and worked in the International Affairs Program of the U.S. Fish and Wildlife Service for 11 years. The Division has the lead for all scientific work and assessments related to CITES and other laws and treaties, including conservation evaluations of the impacts of international trade on species of plants and animals. Lieberman has an extensive background in all aspects of international conservation policy, with a focus on international wildlife trade and the conservation of threatened and endangered species. Her current position with WWF involves directing the global species conservation programme of the WWF Network (found in more than 96 countries), and includes a major focus on international wildlife trade.

John Field has worked for the USFWS International Affairs Program since 1999. In his work with the Service's Division of Scientific Authority, he helps develop U.S. positions on diverse international marine conservation issues such as whaling, the marine ornamental pet trade, and high seas fisheries. These tasks are part of the Division's responsibility for implementing certain aspects of CITES, and for listing foreign species under the U.S. Endangered Species Act. Prior to joining USFWS, he held positions with the National Ocean Service and Atlantic States Marine Fisheries Commission.

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Lisa Dropkin is currently research director for SeaWeb. Prior to joining SeaWeb, she was Vice-President at the Mellman Group, a public opinion research and campaign strategy firm. While at the Mellman Group, she conducted research and consulted for a number of conservation organizations across a wide variety of environmental issues, including overseeing SeaWeb's public opinion research. Dropkin also serves as a professional guide to American politics for the Meridian International Center's democracy exchange program.