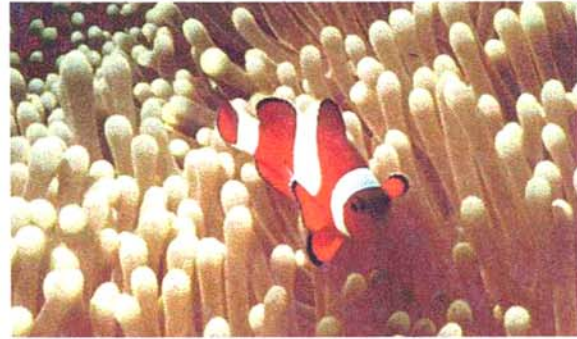
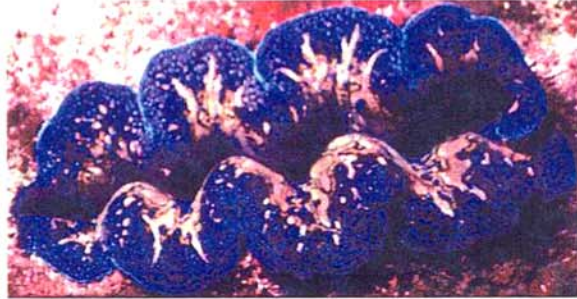


INTERNATIONAL TRADE IN CORAL AND CORAL REEF SPECIES: THE ROLE OF THE UNITED STATES



All photos by Andrew Bruckner



*March 2, 2000
Washington, D.C.*

**Report of the Trade Subgroup of the International Working Group
to the U.S. Coral Reef Task Force**

**INTERNATIONAL TRADE
IN CORAL AND CORAL REEF SPECIES:
THE ROLE OF THE UNITED STATES**

“The Secretary of State and the Administrator of the Agency for International Development, in cooperation with other members of the Coral Reef Task Force and drawing upon their expertise, shall assess the U.S. role in international trade and protection of coral reef species and implement appropriate strategies and actions to promote conservation and sustainable use of coral reef resources worldwide. Such actions shall include expanded collaboration with other International Coral Reef Initiative ("ICRI") partners, especially governments, to implement the ICRI through its Framework for Action and the Global Coral Reef Monitoring Network at regional, national, and local levels.” From the Executive Order (#13089) for the Protection of Coral Reefs.

**Report of the Trade Subgroup of the International Working Group
to the U.S. Coral Reef Task Force**

*March 2, 2000
Washington, D.C.*

TABLE OF CONTENTS

EXECUTIVE SUMMARY	pg. ii
I. OVERVIEW – ECOSYSTEMS AT RISK AND THE ROLE OF TRADE	pg. 1
II. KEY THREATS OR ISSUES AND THE U.S. ROLE	pg. 3
A. Destructive Fishing Practices	
1. Cyanide Fishing	
2. Other Destructive Fishing Practices	
B. Overexploitation of Resources	
1. Coral and Live Rock	
2. Coral Reef Fish and Invertebrates for the Marine Aquarium Trade	
3. Coral Reef Fish for the Live Food Fish Trade	
4. Seahorses	
5. Giant Clams	
6. Queen Conch	
7. Marine Animals for the Jewelry and Curio Trades	
III. CURRENT U.S. ACTIVITIES TO ADDRESS THREATS	pg. 13
A. International Capacity Building	
B. Participation in International Fora	
C. Domestic Activities	
IV. PROPOSED STRATEGIES AND ACTIONS	pg. 19
1. Active Participation in International Fora	
2. Continue Consultations with Exporting Countries	
3. Expand Capacity-Building Efforts in Exporting Countries	
4. Improve Domestic Enforcement of Illegal Coral Reef Species Trade	
5. Raise Domestic Consumer Awareness	
6. Improve U.S. Collection, Reporting and Monitoring of Trade	
7. Develop Additional Measures Including New Authorities	
APPENDICES	pg. 25
A. Primary Importers and Exporters of Coral Species (1997 CITES import data)	
B. Foreign National Laws Pertaining to Coral Trade/Harvest and Destructive Fishing Practices	
C. U.S. Laws Pertaining to Coral Trade/Harvest and Destructive Fishing Practices	
D. Draft educational/outreach materials for marine aquarium hobbyists	
E. List of International Trade Subgroup Members	
F. References	

EXECUTIVE SUMMARY

Many coral reef species and resources are harvested globally for commercial purposes, including food fish, the aquarium trade, live fish markets, construction materials, curios, jewelry, pharmaceuticals and traditional medicines. International trade in coral, reef fish, live rock, and other coral reef animals are activities that contribute to the decline and degradation of reefs, primarily through the use of destructive collection practices and overexploitation of resources.

The Executive Order (#13089) for the Protection of Coral Reefs charged the U.S. Coral Reef Task Force with analyzing and addressing the United States's role in the international trade of coral reef species. The analysis found that 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. Thus, American consumers of coral reef products may inadvertently be contributing to the worldwide decline and degradation of reefs.

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.

Although the U.S. is the largest importer of coral and live rock, the U.S. either prohibits or strictly limits the extraction of hard corals in most of its own federal, state and territorial waters, due to widespread concerns that these animals are vulnerable to overexploitation. Coral extraction also leads to the loss of important fisheries habitat.

In addition to coral, the United States imports nearly half of the total worldwide-trade in aquarium fishes. 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. This destructive practice is spreading to other countries to meet the growing worldwide demand for ornamental and live food fish.

Presently, hundreds of thousands of kilograms of hard corals and live rock, and 15 to 20 million coral reef fishes are traded each year for use in marine aquaria -- over 1000 different species are in the trade. Localized depletion of certain species due to commercial collection has already occurred. Improper transportation, handling and husbandry of live coral reef species for aquaria may also be leading to high mortality rates and unsustainable trade. Sustainability concerns will only increase with the growing international trade.

Concern about the impact that the trade in marine ornamentals is having on reefs and the viability of the industry has recently brought members of the marine aquarium industry together with environmental organizations to try to address these impacts. Their goal is to promote responsible collection, handling and transportation of coral reef animals within the industry.

The following report examines the nature and extent of threats to reefs related to the international trade in coral reef resources, assesses the role of the United States in the trade, describes current relevant activities of the U. S., and recommends strategies and actions to address these threats.

Recommended Strategic Actions.

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 United States has a critical responsibility to address the degradation and loss of coral reef ecosystems that may arise from commerce in coral reefs species and products, and to encourage more responsible trade. 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, particularly in developing countries, by rewarding and encouraging responsible use of these precious resources. Recommended strategic actions include:

- Actively participate in the international arena to highlight and address trade issues.
- Continue consultations with exporting countries.
- Expand capacity-building efforts in exporting countries.
- Increase consumer awareness.
- Improve domestic law enforcement of illegal coral reef species trade.
- Develop measures to reduce unsustainable collection and take of CITES-listed species, reduce destructive fishing practices, and reduce mortality rates of animals during transportation and handling.

Suggestions for New Authorities. Following are some measures that have been suggested to reduce the adverse impacts of trade and collection in coral and coral reef resources, encourage more responsible trade, and encourage the conservation and sustainable management of coral reef ecosystems both domestically and internationally.

- The United States should prohibit domestic harvest or collection and the import or export of coral reef species and products listed under the Convention on International Trade in Endangered Species of Fauna and Flora 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.
- 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.
- 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.
- 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.
- 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 sustainable management of coral reef ecosystems in other parts of the world.

I. OVERVIEW – CORAL REEFS AT RISK AND THE ROLE OF TRADE

Coral reefs are among the most diverse and valuable ecosystems on earth. According to one estimate, coral reefs provide economic and environmental services worth about \$375 billion each year to millions of people as shoreline protection, areas of natural beauty, recreation and tourism, and sources of food, pharmaceuticals, jobs, and revenues (Costanza et al., 1997).

However, coral reefs are being seriously degraded by human activities, especially overexploitation of resources, destructive fishing practices, coastal development and runoff from improper land-use practices. A 1998 World Resources Institute study concluded that nearly 58% of the world's reefs are at risk from human impacts, and many have been degraded beyond recovery (Bryant et al., 1998). In addition, unprecedented levels of coral bleaching and mortality have occurred worldwide, associated with abnormally high sea temperatures reported in 1998. On some shallow Indo-Pacific reefs, 70 to 90% of the corals died as a result of the largest ever-recorded bleaching event.

International trade in coral, reef fish, live rock, and other coral reef organisms are activities that contribute to the decline and degradation of reefs, primarily through destructive fishing practices and the overexploitation of resources. Coral reef resources traded internationally supply a wide number of markets and industries, including the seafood industry, live food fish markets, the aquarium trade, the curio and jewelry trade, and the pharmaceutical and research industries. Recent surveys of 300 reefs worldwide found that key target species of commercial interest were absent, or present in very low numbers, in almost all of the reefs surveyed (Hodgson, 1999). This suggests that almost all reefs have been affected by overharvesting, and that there may be no pristine reefs left in the world.

The Executive Order (#13089) for the Protection of Coral Reefs mandates that the U.S. Coral Reef Task Force "...assess the U.S. role in international trade and protection of coral reef species and implement appropriate strategies and actions to promote conservation and sustainable use of coral reef resources worldwide." The initial assessment found that the U.S. is the primary consumer of live coral and marine fishes for the aquarium trade and of coral skeletons and precious corals for curios and jewelry. As a major consumer of coral reef organisms, a major player in the world trade arena, and a leader in coral reef conservation efforts, the United States has a critical responsibility to address coral reef trade issues.

The following report examines the nature and extent of threats to reefs related to the international trade in coral reef resources, assesses the role of the United States in the trade, describes current relevant activities of the U. S., and recommends strategies and actions to address these threats and reduce some of the negative impacts of the trade on coral reefs. Included are several recommendations for encouraging a more responsible use of these precious resources as jewelry and curios, and for marine aquaria.

II. KEY THREATS OR ISSUES AND THE U.S. ROLE

A. Destructive Fishing Practices

1. Cyanide fishing. Although illegal in most countries, the use of cyanide to capture coral reef fish alive is widespread, and is driven by the lucrative, growing, and largely unregulated international trade in live reef food fish and marine aquarium industry.^{1/} Cyanide has been used in the collection of aquarium fish in the Philippines since the 1960's (Rubec, 1986). More recently, it has spread throughout Indonesia and to Sri Lanka, Taiwan, Malaysia, Papua New Guinea, Marshall Islands, Solomon Islands, Vietnam and Micronesia for capture of live reef food and aquarium fishes (Couchman and Beumer, 1992; Pajaro, 1992; Barber and Pratt, 1998). Cyanide is used to stun hard-to-catch reef fish that seek cover among the coral and in crevices. However, cyanide causes damage to the liver, intestine, and reproductive organs of the target fish, and a large percentage of the cyanide-caught fish may die in the trade stream, or shortly after purchase by the consumer (Rubec, 1986). Cyanide is extremely destructive since it can kill both target and non-target organisms such as small fish, corals, other and invertebrates and destroys important coral reef habitat (Johannes and Riepen, 1995). Laboratory studies have demonstrated that a very brief exposure to cyanide causes corals to bleach and inhibits photosynthesis and calcification, and coral mortality can occur after a prolonged (30 minute) exposure to concentrations several fold lower than that used by fishers (Jones and Stevens, 1997).

In addition, cyanide fishing poses human health risks to the local fishers who are exposed to the cyanide and who dive under unhealthful conditions (Barber and Pratt, 1997 and 1998). As fish populations are depleted from shallow, nearshore areas, divers have to go further offshore and dive deeper, to as much as 200 feet, to catch the desired species. Furthermore, many cyanide fishers spend several hours at considerable depths breathing compressed air without any formal training or an understanding of problems that may arise from exceeding recommended diving times. Surveys in several Filipino communities undertaken in 1993 and 1994 indicate that 10% or more of the fishers developed serious cases of the bends involving paralysis, and as many as 5% of the fishers died (Johannes and Riepen, 1995); more current information is needed to assess whether this problem persists. In addition, the health risks of eating fish caught with cyanide have not been studied or documented.

In addition to cyanide, other poisons including chlorine bleach, quinaldine and plant toxins, are used to capture reef fish alive. Although cyanide fishing does not occur in U.S. waters, the use of other poisons is reported for Puerto Rico, American Samoa, CNMI, Guam and Hawaii (Green, 1997). Effects of these poisons on the reef and target animals are poorly understood.

2. Other Fishing Practices with Destructive Effects on Reefs. Other fishing practices can have destructive impacts on reefs, and they are described briefly here. The rest of this report, however, does not focus on these issues.

Dynamite or blast fishing: Dynamite, which can reduce particular reefs to rubble, is used primarily by small-scale fishers to supply food for subsistence or for local markets.

Trawling and purse seining: Trawling and purse seining involve large nets that are towed behind a

^{1/} The use of cyanide has been documented in detail by various reports, including a report released by the Nature Conservancy in October 1995, and a report issued by the World Resources Institute and the International Marine Alliance in December 1997.

boat across soft bottom habitats to catch shrimp and small fish. Shrimp caught in trawls are a major source of shrimp in international trade. Trawling can scour the bottom and result in bycatch of non-target species. In addition, recent advancements in technology now make it possible to trawl across deeper coral habitats, disrupting the ecosystem and essential fish habitat.

Gill nets: Gill nets are nets that are dragged across coral or set on or near a reef; fish are caught when they swim through the net and are caught by their gills. Gill nets can damage coral and other benthic habitat as they are dragged along the bottom, and capture many non-target species.

Long-line: Long-lines are heavy lines with weights and hooks towed behind fishing vessels used to catch pelagics, sharks and other species. Fishers target spawning aggregations of grouper and other live reef fish using longlines. Lost gear end up as marine debris on coral reefs. Initial NMFS surveys in the Northwest Hawaiian Islands encountered a density of 4230 kg of marine debris per square kilometer, much of it due to international fishery operations in the Pacific.

B. Overexploitation of Resources

1. Coral and Live Rock. Although international trade in stony corals are monitored and regulated under the Convention on International Trade in Endangered Species (CITES), there are serious concerns that the international trade in live and raw coral, live rock, and coral products is not sustainable at present rates of harvest. Commercial harvest of corals causes localized destruction of coral reefs, including increased erosion and loss of critical fisheries habitat. Live rock is essential for the reef because it provides important habitat for motile fish and invertebrates; it provides vital substrates for the settlement and recruitment of benthic organisms; and it contributes to the structure of the reefs and to total coral reef biomass. The taxa harvested for curios are primarily branching corals, many of which suffered catastrophic mortalities during the unprecedented worldwide coral bleaching event of 1997-1998. In addition, coral collection for aquaria and jewelry targets a small number of species that are often rare, slow-growing and long-lived. Overexploitation of coral species could result in loss of diversity and severe localized extirpations (Green and Shirley, 1999). Studies have shown that unsustainable extraction and destructive collection practices of coral and other organisms can lead to phase shifts within the coral reef ecosystem resulting in the decrease in survival or extinction of coral species (Ross, 1984; Brown and Dunne, 1988).

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, with the majority of all coral in trade destined for the United States (NMFS analysis; Green, 1999). See Appendix A for a chart of the primary importers and exporters of coral species, based on 1997 CITES import data.

Corals listed on CITES Appendix II. Over 2000 species of hard corals are listed on Appendix II of CITES, which includes all species that may become threatened with extinction unless trade is subject to strict regulation, and other potentially threatened species which must be subject to regulation in order that trade may be brought under effective control (CITES, Art. II(2)). In order for an Appendix II-listed species to be traded, exporting countries must issue an export permit conditioned on certain findings of "sustainability" -- that the export will not be detrimental to the survival of the species, that the specimen was not obtained in contravention of the laws of that state; and that any living specimen was prepared to minimize risk of injury, damage to health or cruel treatment. However, many exporting countries may not have the resources to fully implement these requirements, and the scientific information necessary to make non-detriment findings is generally unavailable. Because of the concern that countries are extracting and exporting coral at a non-sustainable rate, some importing countries have set forth more restrictive import requirements. The European Union, for example, requires import permits in addition to the export permit, which is issued only when the importing party determines that the trade is sustainable. In September 1999, European Union member countries decided to temporarily prohibit the import of six to eight genera from Indonesia, based on serious questions about Indonesia's findings of "non-detrimental"

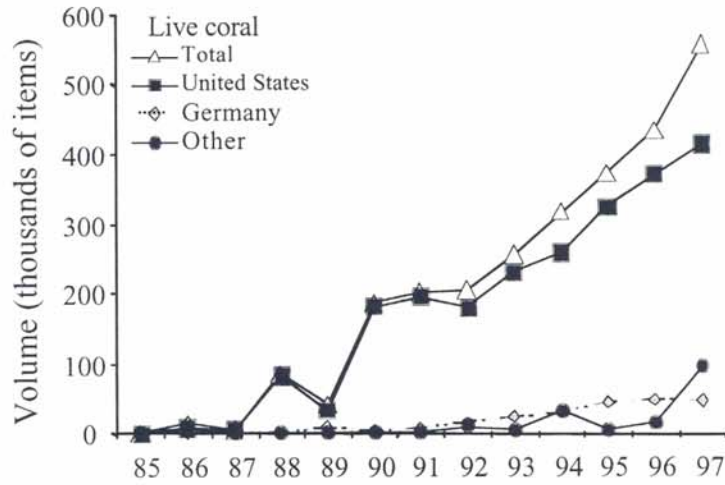
collection.

➤ **The United States role in coral/live rock trade.** To assess the United States' role in the trade of coral and live rock, an analysis of the CITES trade data was undertaken by the National Marine Fisheries Service (NMFS). The analysis found that the U.S. is currently the number one consumer of live coral and live rock for the aquarium trade. Based on CITES data, in 1997, the United States imported approximately 80% of all the live coral in trade representing at least 420,000 pieces. That same year, the United States imported over 95% of the live rock in international trade (reported as "scleractinia", or base rock for marine aquaria consisting of living marine organisms attached to dead coral substrate). Imports of dead coral have leveled off since 1993, but the imports of live coral and live rock have increased dramatically each year.

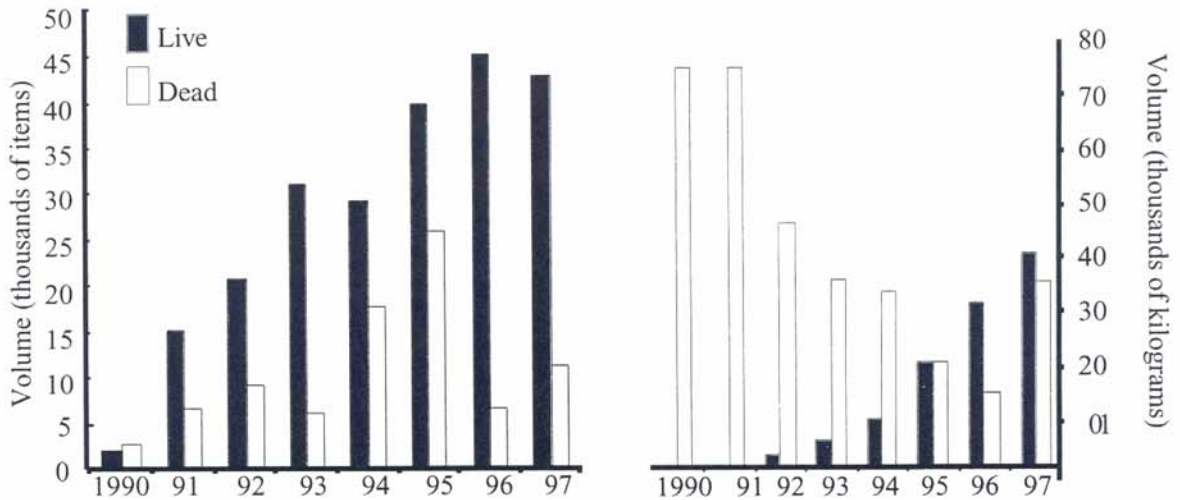
The World Conservation Monitoring Centre's 1999 report, *The Global Trade in Coral*, found similar trends in coral trade, with the U.S. market driving the rapidly increasing international trade (Green and Shirley, 1999). Note that the volume of trade in coral and live rock can be reported to CITES by either "number of pieces" or "weight" in the shipment. For the analysis in *The Global Trade in Coral*, these two reporting categories were combined using a conversion factor, while the analysis by the NMFS reports these categories separately.

Existing regulations/laws on coral trade. The United States strictly regulates or prohibits the domestic harvest of live rock and hard corals in most federal, state and territorial waters. (See Appendix C for a description of U.S. laws pertaining to coral harvest and trade). The domestic market for these items is supplied primarily through imports from other countries.

Internationally, concerns regarding the effects of the trade in coral have prompted Mozambique to impose a complete ban on exports of coral and aquarium fish until at least 2001. The Fiji government estimates that 3% of the reef surrounding Fiji's main island, Viti Levu, has been depleted by the coral trade, and it currently is reviewing the trade and considering measures to take to ensure sustainable exports. The Philippines has banned the collection, sale and export of corals since the late 1970s. Australia has allowed coral collection for domestic use for over 20 years, but only in 50 defined, authorized sites; collectors have removed 1-2% of the standing population each year with no noticeable impact reported on the resources. However, the situation in Australia may be unique in that the demarcated collection areas are not subject to additional pressures, such as subsistence or recreational fishing or coastal run-off, and are very well regulated and enforced. (See Appendix B for a description of foreign national laws pertaining to coral trade and harvest and destructive fishing practices).



The volume of coral in trade as live specimens, reported to the level of *Genus* as thousands of pieces. The volume in trade has increased by 20-30% per year since 1992. The U.S. has consistently imported 70-90% of all live coral in trade, with up to 10% destined for Germany and approximately 10% imported by all other countries. In recent years, imports to Japan have increased, and they currently exceed Germany in total volume. (Analysis of CITES data by NMFS.)



Total trade in coral reported as "Scleractinia" between 1990 and 1997. A. Trade in thousands of items in trade. B. Trade in thousands of kilograms. A substantial amount of unidentified coral skeletons were reported as Scleractinia in the early 1990s, however, the vast majority of the trade today consists of live rock. Most scleractinia reported by item originates in Indonesia, while most reported by weight is from Fiji; the volume of trade from Fiji has increased by 50-100% per year for the last several years. The U.S. imports most (>90%) of the live rock in trade. (Analysis of CITES data by NMFS.)

2. Coral Reef Fish and Invertebrates for the Marine Aquarium Trade. Concerns also have been raised regarding the potential over-exploitation of reef fish, coral and other coral reef organisms for the marine aquarium trade. No species of coral reef fish are listed under CITES, and therefore trade data are difficult to obtain. Most countries do not collect specific data on the aquarium fish trade, nor do they have management programs in place for collecting aquarium reef fish. More information and research is necessary to assess the impacts of this trade on coral reefs.

However, some data have been collected and reported on the size and nature of the marine aquarium trade. At least 800 to 1000 species of fish and 300 species of invertebrates are reported to be collected from the wild (in the trade (Moe, 1999; Wood, 1999). Approximately 15-20 million fish are traded annually, supplied from about 45 countries (Wood, 1999). The United States is reported to import nearly half of the total worldwide trade in aquarium fishes, with 66% to 90% originating in Indonesia and the Philippines. (Wood, 1999). An estimated 50-60% of the Philippines aquarium fish and 90% of the Indonesian aquarium fish imported into the United States are captured with cyanide (Cesar, H. 1996). Thus, the United States has been the major importer of cyanide-caught aquarium fish.

Collection of marine aquarium fish for both domestic and international trade occurs in some areas of the United States, such as in Hawaii, Florida and Puerto Rico. In Hawaii, concern over the effects of aquarium collecting on reef fish populations began in the early 1970's, primarily in response to multiple-use conflicts between aquarium fish collectors and recreational dive tour operators. Recent studies have only begun to document the extent and potential impact of collection for the marine aquarium trade on coral reef fish populations. For example, at Honaunau, Hawaii, the top 10 aquarium fish species have decreased by 59% over the last 20 years (Clark and Gulko, 1999). Another recent study, from Kona, Hawaii indicates that aquarium fish collectors are having a significant impact on eight of the ten most popular coral reef fishes, with an overall decline of 38-57% (Tissot and Hallacher, 1999). The total number of fish being collected is also increasing -- between 1993 and 1995, the number of fish collected around Kona increased 67%, and accounted for 59% of the State harvest (Tissot, 1999).

Aside from the concerns regarding the use of cyanide and other poisons for collecting, several factors relating to the marine aquarium trade have been identified that suggest a risk of overexploitation:

- ◆ Species collected as juveniles for the aquarium trade can be important to food fisheries as adults.
- ◆ One of the major groups of aquarium fish are herbivores that regulate the amount of benthic algae on the reefs; their removal could lead to increases in algae, which can overgrow and kill corals and inhibit settlement of coral larvae.
- ◆ Coral reef ecosystems have evolved in extreme nutrient poor conditions to become very efficient nutrient recyclers, resulting in having "little to spare" in terms of the amount of biomass that is exportable or harvestable through human activities.
- ◆ The level of "waste" in the aquarium trade is very high; it has been estimated that the mortality of reef species from source reefs to home aquaria may be as high as 90% in some cases. Some of the popular species are also ones that are difficult to maintain in captivity, which contributes to further mortality. The high level of mortality in the trade stream and in captivity creates additional harvest pressures.
- ◆ Species with the highest retail value are those that are the rarest and hardest to find in the wild, which creates economic incentives adverse to the survival of those species; determining the impact of removal of these species would be most difficult given their rare or uncommon status. New technologies now allow the collection of species that live several hundred feet deep, in depths relatively free from other human impacts. Almost no information exists on the biology and ecology of many of these deep-water species.

There are significant uncertainties with regard to the ecological and biological sustainability of exploitation of coral reef species. However, it is clear that overharvesting can disrupt the natural ecosystem by changing the relationships between predators and prey, and can potentially lead to the physical breakdown of the coral reef ecosystem and its functional integrity (Roberts, 1995).

Marine Aquarium Council. The Marine Aquarium Council, established in the United States in 1997, is an international multi-stakeholder effort that is attempting to bring together representatives of the aquarium industry, hobbyists, conservation organizations, government agencies, public aquariums, international organizations and others with a shared interest in promoting market-driven quality and sustainability in the marine aquarium industry. The mission of Marine Aquarium Council is "to conserve coral reefs by creating standards and education and certifying those engaged in the collection and care of ornamental marine life from reef to aquarium." The overriding goals of the organization are to develop standards for quality products and sustainable practices; establish a system to certify compliance with these standards; and create consumer demand and confidence for certification and labeling. Certification schemes are in the process of being developed for the responsible collection, handling and transportation of coral reef animals within the industry (Holthus, 1999).

Mariculture. The mariculture of coral reef fish and invertebrates for the marine aquarium market represents only a small percentage (approximately 1-2% for fish) of the current market, but may offer future potential to supply the growing demand (Moe, 1999; Stime, 1999; Wilkerson, 1999). While many fish species may not be good candidates for mariculture, about 25 species of maricultured fish are presently on the market and economically competitive with wild-collected animals (Wilkerson, 1999). The biological and economical suitability of other species is being explored, and may offer consumers a higher quality product than those collected from the wild (Wilkerson, 1999). Presently, it is possible to culture and "farm" at least 75 species of coral from branch tips or "cuttings" taken from adult colonies (The Coral Farm, Waikiki Aquarium), but often maricultured corals are not economically competitive on the market (Wilkerson, 1999). In addition, the large-polyp corals that currently dominate the live trade can not be readily propagated due to their slow rate of growth. Additional invertebrates, especially soft corals, giant clams and other molluscs are being cultured on a commercial scale.

Questions have been raised as to whether mariculture has the potential to relieve the pressure on wild-collection of coral reef species or benefit local communities. Most mariculture now occurs in developed countries. In the current trend, breeding stocks of animals are removed from the source countries (often developing countries), and brought to the United States (such as Hawaii or Florida) or other developed countries for mariculture; the business atmosphere and infrastructure is often more conducive in developed countries where the presence of rapid and overnight delivery service of organisms is critical. This trend increases the risk of non-native, invasive species and diseases, predators and pathogens being introduced into U.S. waters, as well as decreases any benefits local communities in the source countries may receive. Rearing or "farming" ornamental animals and plants in the countries from which they originate may help address both concerns. However, there are other issues that would need to be addressed, such as the social and cultural feasibility of converting "fishers" and wild animal "collectors" into "farmers" and "culturers" of domesticated animals, and ensuring local communities a fair stake in the business (Wood, 1999).

The farming of corals, rather than mariculture of aquarium fish, shows greater promise for benefiting local communities, but marketing approaches will need to be developed carefully. In addition, mechanisms are needed to ensure that "captive-breeding" facilities maintain a portion of their product as "seed stock" so farmers do not continue to remove corals from the wild. The issue of shared-benefits from host country genetic resources that are used in mariculture needs to be explored, although this issue has not been successfully carried forward on other genetic resources.

➤ **U.S. role in marine aquarium trade.** In addition to live fish, a large number of invertebrates, including soft corals, anemones, crustaceans, molluscs and many other phyla are imported into the United States for the aquarium trade. Because these animals are not listed in CITES, and the collection and trade in these taxa is largely unregulated, there is little information on the quantities collected or the impact of their removal on the resource. The United States is the primary importer of reef fish and other coral species for the aquarium trade, and thus may be driving an unsustainable harvest of these organisms. Approximately 1 million hobbyists are in the United States out of the estimated 1.5 million worldwide.

3. Coral reef Fish for the Live Food Fish Trade. Though live reef food fish have been collected for consumption in countries like China for centuries, the international live food fish industry (and use of cyanide to catch the fish) has increased dramatically only in the last two decades, and the use of cyanide to catch live reef food fish was introduced as recently as 1986 (McAllister et al., 1999). Hong Kong is the largest consumer of live reef food fish, importing approximately 30,000 metric tons of reef fish each year (Lau and Jones, 1999). In December 1997, the World Resources Institute and the International Marine Alliance reported that a conservative estimate of the wholesale value of the Hong Kong live food fish trade is about \$450 million, with a retail sales value that may top \$1 billion. Popular reef fish in this trade include various grouper species, the napoleon wrasse, and coral trout, all of which are taxa that are threatened or endangered throughout their range. Aside from concerns related to cyanide fishing, fishers are targeting spawning aggregations of coral reef fish and eliminating entire breeding populations. The ecological consequences of the live fish food industry is that reefs with abundant sources of target fish get “fished out” very rapidly, and the commercial harvesters move to other countries until those countries’ reefs become depleted of the target species as well.

➤ **U.S. role in live food fish trade.** Live reef food fish imports to the United States are negligible at this time and the U.S. role as a consumer is minor. However, the U.S. is playing a major role in addressing the use of destructive fishing practices, such as cyanide and other poisons, through a variety of international development assistance and policy activities. (See section on current U.S. activities.)

3. Seahorses. Extensive collecting of seahorses is occurring for the pet trade and curio trade, but the bulk of the harvest is for the Asian medicinal trade. The main threats to seahorse populations are widespread declines in abundance resulting from overfishing and habitat loss; seahorse populations in Indo-Pacific countries have declined by 25 to 75% over the past five years (Vincent, 1997). At least 46 nations and territories are trading in seahorses, including the United States, with at least 20 million specimens captured annually (Vincent, 1996). The largest importers of dried seahorses are China, Hong Kong and Taiwan, with an estimated annual consumption of 45 tons, representing 16 million individuals (Vincent, 1997).

Captive breeding programs designed to reduce the pressure on wild populations for both the traditional medicinal market and marine aquarium trade have been mostly unsuccessful, due to difficulties in rearing young seahorses, high incidence of disease, and a continued need for removal of adults from the wild to maintain brooding stock. As a result of newer technologies, however, several operations appear to be rearing seahorses successfully in captivity; it is too early to determine how successful the breeding operations will be in the long-term. Although seahorses are popular for aquaria, they are notoriously difficult to keep, and very few survive in captivity. At the present time there is no international organization responsible for the management of seahorses, including recommendations on catch quotas, gear restrictions, size limits or temporal or spatial closures of fishing environments.

➤ **U.S. role in seahorse trade.** The United States is an exporter and importer of seahorses, either live as aquarium fishes, or dried for traditional medicines and curios. The U.S. imports seahorses from the Caribbean, Indonesia, Philippines, Sri Lanka and through Singapore. Seahorses are brought in as bycatch of shrimp trawling in Florida; more seahorses are caught on Florida's west coast than on the east coast (Vincent, 1997). The number of seahorses landed in the United States has steadily increased since records were first taken in 1990, with over 112,000 seahorses taken in Florida waters in 1994.

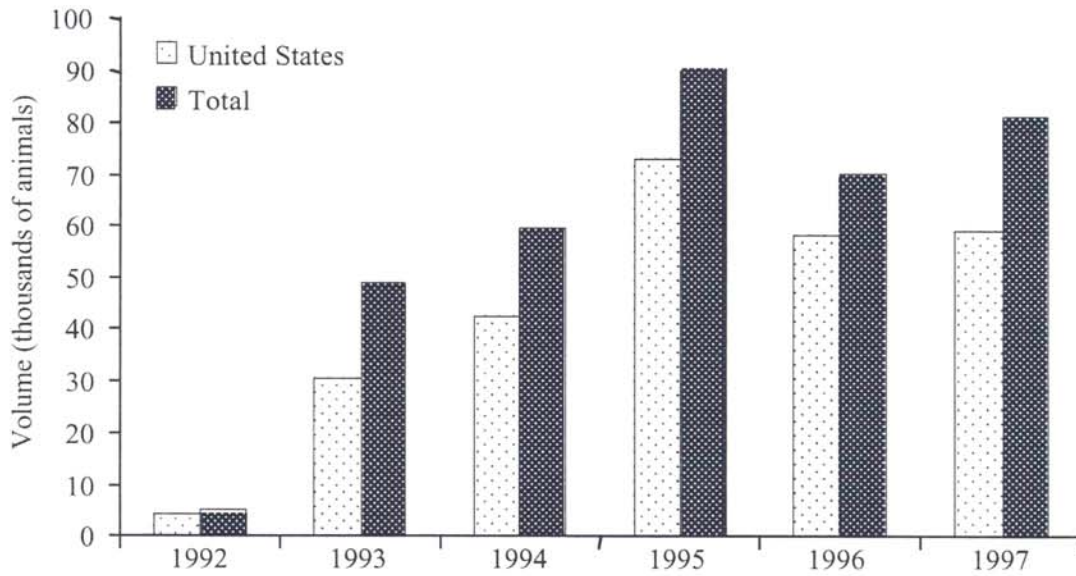
5. Giant Clams. Giant clams have formed an important part of the diet for some Pacific Islanders, and their meat and shells continue to be collected for subsistence and commercial purposes. A more recently developed industry involves harvest of live specimens for use in the aquarium trade. Eight of the nine Tridacnidae species of giant clams are on the IUCN Red List of Threatened Animals. The two largest species that are most desirable for meat and shells, *T. gigas* and *T. deresa*, have been extirpated throughout much of their range (Wells, 1997). Endangered from overuse and over-collection, giant clams are also listed on Appendix II of CITES.

However, because of the small size and rapid growth of juvenile clams, hatcheries and grow-out facilities can supply a portion of the aquaria trade through mariculture. For instance, in 1996, approximately 17% of all live clams in the aquarium trade were captive-reared, while in 1997, for the same volume of trade, that figure had risen to 38%. A very small portion of the trade in meat and shells is provided by mariculture facilities, as these products require many years to mature, and clam mariculture facilities have experienced high mortalities from storms, disease and predators. Much of the brood stock utilized in mariculture operations was provided by the Palau Marine Mariculture Demonstration Center, which is now closed. In addition, raising the largest, most desirable species is not economical, and attempted re-introductions to restock depleted reefs have met with limited success.

➤ **U.S. role in giant clam trade.** Live giant clams (Tridacnidae) are imported primarily for aquarium specimens and for brood stock for mariculture facilities. Between 60-80,000 animals are traded internationally each year with over 70% destined for the United States. Captive-reared clams supply an increasing portion of the trade for aquarium specimens. The U.S. also imports shells as curios, but not a significant amount of giant clam meat.

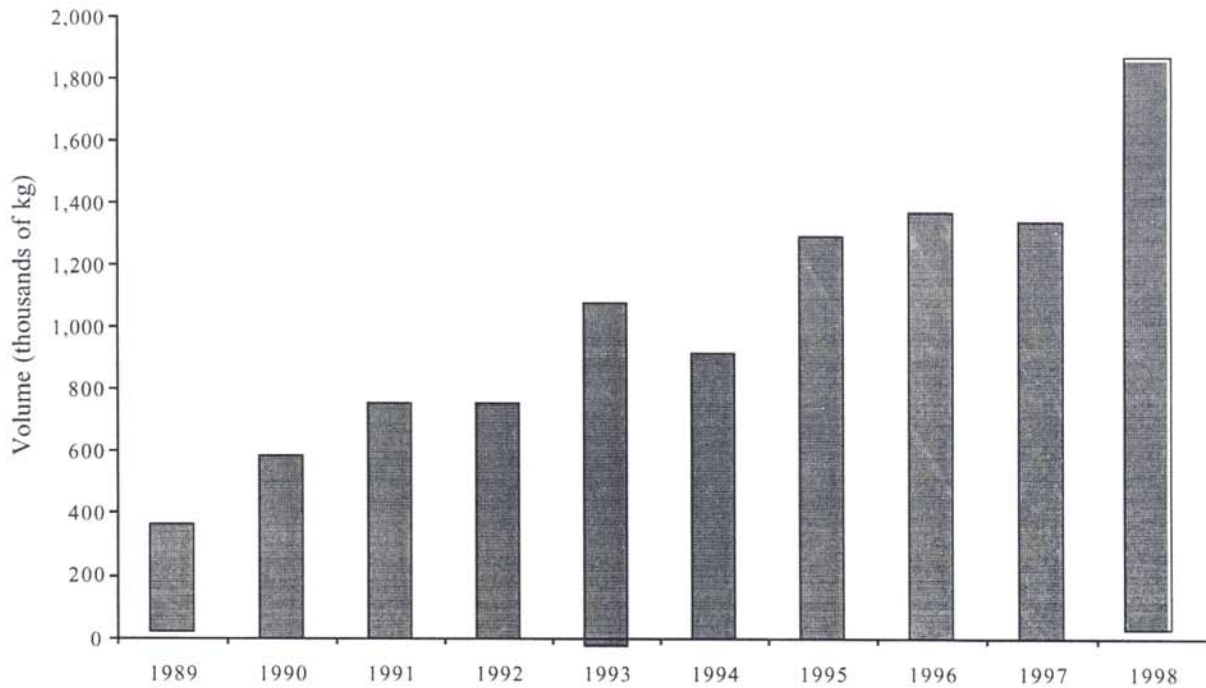
6. Queen Conch. Queen conch has been an important subsistence and commercial fishery in the Caribbean for centuries. The shell trade for jewelry and curios is a by-product of the large meat trade. There is growing concern about the conch fishery as populations have been depleted, and it is suggested that harvest may not be sustainable. Enforcement of existing harvest regulations and inspections of international shipments has not been effective. Hatchery techniques are well established, but survival in the wild of hatchery-reared juveniles has been poor. Mariculture facilities have not yet proven to be economically profitable. Queen conch are also listed on Appendix II of CITES.

➤ **U.S. role in queen conch trade:** Imports of queen conch meat into the United States have steadily increased in the last decade. The European Union also imports an unknown, although possibly large amount.



The total volume of live clams traded between 1992-1997 is shown for all countries, and the proportion that are imported into the U.S.

Queen Conch (*Strombus gigas*) imports into the U.S. (meat only)



7. Marine animals for the jewelry and curio trade. Stony corals traded as curios, jewelry, furniture or dead ornamentals (i.e. coral skeletons or “raw” coral that was collected alive, bleached and cleaned to remove tissue) accounted for more than 90% of the international trade in corals during the 1980s and early 1990s (NMSF analysis). The greatest volume overall was traded in 1992 when the Philippines exported close to 4.4 million colonies; since 1993, the volume has remained fairly constant. Other major exporters during the 1990s included Mozambique, Taiwan, New Caledonia, Fiji, Taiwan, Indonesia and Vietnam; however, Indonesia banned the export of dead coral skeletons in 1997 and Mozambique banned all coral exports in 1999. The major importers of coral curios are Spain, Portugal, Italy, the United States, Japan, and Hong Kong. Stony corals traded for curios are predominantly species with branching shapes. Although these “branching” corals for the curio trade are faster growing than many of the taxa traded as live coral, the size of individual items is significantly larger and may be up to one meter in diameter, representing a decade or more of growth to achieve that size.

Marine other types of marine animals besides coral are collected for the curio trade, including a myriad of conchs, snails and clams for the shell trade, starfish, seahorses, fishes, sea fans and sea whips, sponges, sand dollars, and sea urchins. These animals are not listed under CITES, and there is little data on the volume and extent of their trade.

III. CURRENT U.S. ACTIVITIES TO ADDRESS THREATS

Measures to address destructive fishing practices and overexploitation of resources depend first and foremost on education (of both the fisher and consumer), alleviating poverty and overfishing, proper legislation and regulation to eliminate improper techniques, development of sustainable management criteria, and enforcement of existing and new fishing regulations. In most cases, destructive fishing techniques are associated with poverty and a perceived lack of viable alternatives. Efforts are also needed at the international level, working within existing fora to strengthen and enforce international and regional treaties and conventions. For example, the adoption and implementation of the FAO Code of Conduct for Responsible Fishing and adherence to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) by all countries are also key steps.

A. International Capacity-Building

The United States is, and has been, a strong supporter of international capacity building in natural resource management through its development and outreach programs. Tropical marine ecosystems are critical to U.S. government development strategies in environment, food security, economic growth, health, disaster mitigation, biodiversity conservation and climate change in many countries. The sustainable use and protection of coral reefs depends upon building human and institutional capacity for in-country natural resource management and protection.

U.S. Department of State. Funds were allocated in FY 1999-2000 to support the Secretariat of the International Coral Reef Initiative (ICRI), and the work of the Global Coral Reef Monitoring Network (GCRMN) through the Intergovernmental Oceanographic Commission and through UNEP's Regional Seas Program in Africa, the Caribbean and East Asia, and the Pacific. New funds in FY 2000 were available to allocate to UNEP's Regional Seas Trust Fund for the Middle East Region. ICRI has recommended that GCRMN help monitor the socio-economic impacts of coral trade on the reefs.

U.S. Department of State/U.S. Agency for International Development. New funds were directed in 1999/2000 towards protecting coral reef resources under the "East Asia and Pacific Environmental Initiative." Programs under this initiative were specifically designed to address aspects of the international trade issue in coral and coral reef species, including:

- Actions to retrain fishers on the use of non-destructive fishing practices and to stop the spread of cyanide use, and to establish monitoring programs to assess and inventory the trade in live food fish, particularly through the port of Hong Kong. Implementation is through the Destructive Fishing Reform Initiative of the International Marinelife Alliance/World Resources Institute.
- Actions to address the live food fish trade through advancing policies, laws, management plans, awareness, and alternative livelihood programs such as maricultured live reef fish. Implementation is through The Nature Conservancy.
- Actions that engage the private sector in establishing cyanide-free and sustainability certification plans for aquarium fish and coral species. Implementation is through the Marine Aquarium Council.
- Coral reef conservation efforts of the South Pacific Region Environmental Program (SPREP). Activities will address destructive fishing practices, coral collection for foreign markets, coral bleaching and other threats, and include training workshops for member nations to develop permit systems, and certification and labeling protocols for coral collection and trade.

- Capacity-building in protected areas law enforcement for resource professionals, implemented by the Department of the Interior in conjunction with the World Wildlife Fund.
- Sea turtle conservation efforts through policy dialogue, information exchange, sea turtle monitoring of migratory range, and a multilateral conference to address regional conservation needs. Activities will be implemented by the Department of State and NOAA.
- Actions to protect the Sulu-Sulawesi Large Marine Ecosystem, an area rich in coral, fish and sea turtle biodiversity. Activities include increased management capacity and enforcement at marine protected areas and is implemented by the World Wildlife Fund.

U.S. Agency for International Development (USAID). USAID supports the conservation and sustainable use of coral reef resources through natural resource management in about twenty countries. Ongoing programs support human and institutional capacity-building in sustainable resource use, reduction in destructive fishing practices such as cyanide-use, community-based natural resource management, integrated coastal management, and marine park management. Programs also support national policy development, legislative and judicial reform, enforcement, alternative livelihood development, sustainable financing, pollution mitigation, certification, economic development, monitoring and assessment of reefs, and sea turtle conservation. These activities combine demonstrations of improved management by local communities with support from government, non-governmental organizations and the private sector, and they include policy reform for decentralizing and clarifying management authorities, institutional capacity building, technology transfer, and dispute resolution elements. Programs are implemented through partnerships with governments, non-governmental organizations, and public and private sectors.

USFWS/ NMFS Programs. In November 1998, the North American Wildlife Enforcement Group (NAWEG) convened a workshop on identification of CITES-listed marine invertebrate species as an aid to enforcement in the region. Among the materials distributed at the workshop was a full-color laminated identification guide to CITES-listed corals common in the trade. The guide, which is still in draft form, is now available in Spanish and English. Talks are underway with the CITES Secretariat to determine if wider distribution of this document might be feasible.

USFWS Programs. International Affairs and Law Enforcement routinely provide training and technical assistance for other CITES Party countries with support from USAID and other programs to encourage improved regulation of international trade in corals and other CITES-listed species.

NOAA Programs. NOAA's projects support capacity building for marine and coastal resource management, sustainable fisheries, implementation of the International Coral Reef Initiative, sustainable international trade of coral reef resources, monitoring and assessment of reefs, sea turtle conservation, and reduction in destructive fishing practices such as cyanide use. Specific trade-related projects include capacity-building assistance to the Indo-Pacific for coral identification; addressing fishing through APEC fora; and queen conch sustainable management assistance.

B. Participation in International Fora

The United States participates in a number of international activities to promote and support existing initiatives and agreements relating to the trade in coral species and destructive fishing practices. A brief summary of some of these activities follows.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Over 2000 species of corals including the reef-building corals, black coral, giant clams, and queen conch are listed in Appendix II of the Convention on International Trade in Endangered

Species of Wild Fauna and Flora (CITES). The fundamental principle of CITES is to protect species from over-exploitation through international trade. Trade is allowed in species listed under Appendix II, but shipments must include a permit from the country of origin that includes a finding that the trade in these species will not be detrimental to their survival in the wild. The World Conservation Monitoring Center (WCMC) recently completed a study on the global trade in coral based on CITES trade data going back to 1982. NOAA also recently did a report on CITES-listed hard corals.

At the July 5-9, 1999, CITES Animals Committee meeting, trade in CITES-listed corals was discussed. Indonesia discussed its coral harvest and how they set their export quotas. The United States, Indonesia, and the EU met informally and decided to continue discussions about reporting requirements. Concerns were expressed by the Parties on level of identification required on permits and the use of standardized units for annual reporting of volumes in trade. A coral working group, composed of observers from Indonesia, United Kingdom, United States, PIJAC, TRAFFIC and WCMC, examined in detail the problems associated with identifying corals to the species level and the unit of measurement used in trade reports. The Animals Committee will present a proposed resolution at the 11th Conference of the Parties in April 2000 based upon discussions within the Animals Committee on standardized coral reporting. Some of the solutions have focused on exempting certain coral commodities from CITES in order to remove workload burdens. The U.S. will continue to support standardization of coral reporting, but only where coral reef conservation is not undermined.

Additionally, the United States and Australia submitted a paper on seahorses (*Hippocampus spp*) for discussion at the 11th Conference of the Parties in April 2000. The United States will also express concerns regarding coral reef species trade in an information paper. At this meeting, no coral reef species are under consideration for a change in status under CITES listings.

International Coral Reef Initiative (ICRI). The U.S. was a primary force behind the founding of the International Coral Reef Initiative (ICRI) in 1994 and continues to be one of its strongest supporters. ICRI is a voluntary initiative aimed at mobilizing governments and a wide range of other stakeholders to address the threats to reefs. ICRI's 1998 Renewed Call to Action reflected increasing concern over the state of coral reefs. There was a recognition that destructive and unsustainable fishing practices, in addition to other forms of overexploitation, are destroying coral reef ecosystems. A commitment was made by the ICRI partners to eliminate unsustainable fishing practices. The partners also recognized that activities of the private sector, including tourism and trade, can protect or destroy coral reef ecosystems, and thus committed to working with these entities to foster appreciation of the value of coral reefs and encourage the private sector to use and protect coral reefs in an ecologically sustainable way.

In October, 1999, ICRI passed a resolution on trade in coral and coral reef species, and agreed to host a coral trade workshop in the Indo-Pacific region, to bring together exporting and importing countries, and the private sector, to discuss common challenges and approaches to problem resolution. ICRI also agreed to send a fact-finding team to the Indo-Pacific region to explore in-depth the extent and impact of the trade in coral and coral reef species, and to promote expansion of the GCRMN and Reef Check programs to enable monitoring and assessment of the ecological and socio-economic impacts of trade in coral and coral reef species. ICRI provides a good forum for the United States to continue to raise awareness of our interest in addressing concerns over trade in coral reef resources.

Convention on Biological Diversity. While the United States is not a Party to the Convention on Biological Diversity, it should be noted that concern over destructive fishing impacts on coral reefs was raised at a CBD meeting first in 1995. The United States, as an observer government, is continuing to participate in the work on the Jakarta Mandate on Marine and Coastal Biodiversity, and raise coral reef trade concerns.

International Queen Conch Initiative. Queen conch (*Strombus gigas*) was listed in Appendix II of CITES in 1992. With trade data now being reported, the true extent of the trade is being realized. In the 1996 Declaration of San Juan, countries in the region pledged to work together to strengthen bilateral, sub-regional, and regional mechanisms to establish common management regimes for the sustainable use of queen. More recently, range states in the Caribbean have begun to meet to develop harmonized management measures such as coordinated close seasons.

North American Wildlife Enforcement Group. The North American Wildlife Enforcement Group (NAWEG) under the Commission for Environmental Cooperation (NAFTA) is an on-going forum among Canadian, U.S. and Mexican wildlife enforcement agencies to exchange information, expertise, and strategies for enhanced enforcement and compliance with wildlife laws. In November 1998, the NAWEG held a workshop to train North American wildlife enforcement officers in the identification of corals. At the April 1999 trilateral meeting of NAWEG, the United States provided an overview of U.S. Coral Reef Task Force activities, highlighting the trade concerns.

World Customs Organization and Interpol. Meetings of, and communications from, the World Customs Organization subgroup on CITES and the Interpol subgroup on wildlife crime both provide opportunities to discuss illegal trade concerns regarding coral reef resources.

Asian-Pacific Economic Cooperation (APEC). The Forum on Asia-Pacific Economic Cooperation (APEC) has 2 working groups interested in international trade in coral reef species: the Marine Resource Conservation (MRCWG) Working Group and the Fisheries Working Group (FWG). The United States has been instrumental in putting the use of cyanide for collecting fish at the forefront of these two working groups.

In June 1997, NMFS sponsored a workshop in Mexico on reef-destructive fishing, cyanide fishing and the live reef fish trade in conjunction with an APEC FWG meeting. A resolution was drafted by United States delegates condemning the use of cyanide for this purpose and urging cooperative support. In December 1997 the MRCWG sponsored a follow-up technical workshop on the impacts of destructive fishing practices on the marine environment. A comprehensive list of draft recommendations relating to destructive fishing practices was prepared for APEC. As a result of this workshop, Hong Kong, the largest importer of live food fish, refined its data collection system and is preparing identification materials to assist in trade monitoring.

In October 1998, the United States hosted an APEC Oceans Conference where the Economies agreed that APEC should support strengthening the capacity of APEC economies to address destructive fishing practices, and set a priority on addressing cyanide fishing. The APEC economies also agreed to renew their commitments to implement the FAO Code of Conduct for Responsible Fisheries and to establish a small task force to draft a framework for cooperative action to address destructive fishing practices in the region, set management standards and guidelines for export and import, and share data, information and experience.

At the 10th APEC Fisheries Working Group Meeting held in May 1999 in Australia, the MRCWG and the FWG held a joint session. There, the U.S. proposed and agreed to organize and host a joint inter-sessional meeting of these two working groups to design a multi-year implementation program of the APEC coral reef workshop recommendations on destructive fishing and the live reef food fish trade.

South Pacific Regional Environmental Program (SPREP). SPREP is an intergovernmental organization charged with promoting protection and improvement of the Pacific islands environment and ensuring its sustainable development. Its members are the Governments and Administrations of 22 Pacific island countries and four developed countries (United States, France, Australia and New Zealand). Its permanent secretariat is in Apia, Samoa. The State Department

has supported SPREP's Action Plan for the Environment for a number of years. This year, the State Department and USAID continue support for SPREP's Coral Reef Action Plan to implement coral reef conservation activities. Various agencies (USAID, USFWS, DOI, NOAA, DOS) met with SPREP Director Tutangata during his July 12-14, 1999, visit to Washington, D.C. Topics included aid to SPREP for coral reef initiatives, coral trade, NOAA programs on oceans and environment, climate change and coral bleaching. In July of 1999, Deputy Assistant Administrator of USAID, David Hales, had the opportunity to raise coral trade issues at a regional climate change meeting in the Marshall Islands.

C. Domestic Activities

The United States, through the Coral Reef Task Force, has taken steps domestically to understand and address concerns raised about the international trade in coral and reef species. The State Department has gathered information from exporting countries through cable requests to our overseas missions. The USFWS provided updated coral identification training for all their wildlife inspectors with assistance from NMFS, and efforts are underway to improve data collection for live fish imports and exports. The DOI and USFWS held a public meeting to highlight Task Force concerns regarding coral reef species trade, outline the solutions that the subgroup has proposed to address the concerns, and discuss the need for additional trade legislation. The trade subgroup also has met frequently with members of industry and non-governmental organizations at conferences and other fora to discuss the concerns regarding unsustainable trade.

IV. PROPOSED STRATEGIES AND ACTIONS

The following section describes proposed strategies, actions and recommendations that the U.S. Coral Reef Task Force can take to address the issues described above.

International Strategy

- 1. Continue to actively participate in international and regional fora, including CITES, APEC and ICRI to address concerns regarding coral reef species trade and to raise global and regional awareness of the potential problems caused by this trade and possible solutions.**

The United States continues to work within existing international frameworks to address concerns regarding overexploitation of coral reef resources and destructive fishing practices. Our international strategy on coral trade involves working with existing international treaties, organizations and fora, regional organizations and meetings, and bilaterally through our embassies, missions, and official visits to the primary exporting countries. As many of the reefs exploited for trade are located in the Indo-Pacific and Caribbean regions, we should begin discussing our concerns with exporting countries from these regions. We also need to work closely with other importing countries such as the UK, Germany, the Netherlands and Japan. Some specific recommended actions include:

CITES

- NMFS will share its photographic identification manual for Indo-Pacific corals with interested countries and seek funding for additional publication.
- Support efforts at COP to establish standard reporting requirements for coral, and other efforts to protect coral reef ecosystems.
- Fund a workshop in Indonesia for CITES importing and exporting countries to evaluate their quota system and reef monitoring efforts.
- Work with the Conference of Parties to add other coral and reef fish species to the Appendices as warranted by scientific evidence.
- Support capacity building in the Pacific region to implement CITES requirements and monitoring

ICRI/GCRMN

- Continue to work with ICRI's Coordination and Planning Committee Meeting (CPC), and ICRI's International Coral Reef Information Network on fisheries and coral reef trade issues.
- Continue to engage the Global Coral Reef Monitoring Network (GCRMN) in assessing the potential impacts from international trade.
- Work with ICRI on joint ICRI experts/policy-maker visits to key exporting countries to discuss trade issues (e.g., to discuss technical, trade and legal approaches, and to explore further cooperation and technical assistance)
- Explore with federal agencies funding for an ICRI workshop on coral trade and destructive fishing.

APEC

- Host a joint Marine Resources Committee Working Group and Fisheries Working Group meeting to discuss implementation of the recommendations from the previous workshops

on destructive fishing practices.

South Pacific Region Environment Program (SPREP)

- Offer additional technical support to SPREP as it builds capacity in implementing CITES.
- Build in-country capacity to construct and implement ecologically and economically sustainable trade.
- Support SPREP's coral reef projects, and offer additional technical assistance.
- Encourage further cooperation between local and international non-governmental organizations and SPREP efforts.

Ramsar Convention

- Encourage Ramsar parties particularly in the Indo-Pacific area and the Caribbean to designate coral reef sites as Wetlands of International Importance.
- Encourage non-party countries to join, particularly Small Island States, and to designate their coral reef areas as Wetlands of International Importance.

Bilateral Consultations

- Engage both exporting and importing countries on the trade problem, through our embassies, missions, and official visits, and opportunities presented by meetings in the region and other venues.
- Consider engaging governments in setting common standards for the sustainable management of coral reefs.
- Consult with other importing countries (e.g., Japan, Germany, UK) to explore ways to increase consumer public awareness.

Education, Outreach and Research

- 2. Continue consultations with exporting countries and other stakeholders to assess the nature and extent of the problems associated with the trade in coral reef species, to express U.S. government concern about problems in the trade, and discuss possible approaches to mitigate the negative impacts of the trade.**

The United States should work with exporting and importing countries, NGOs, industry, scientists, and other stakeholders at the international and regional levels to better understand the nature of the trade in coral reef species, increase public awareness and education, and to develop collaborative or innovative mechanisms to address the concerns raised in this report. The United States could collaborate with others to:

- Understand the nature of trade impacts: assemble international trade data and statistics; understand the socio-economic impacts of coral reef trade on communities; review countries' laws and regulations on harvest, trade and aquaculture; assess the current situation regarding international enforcement and resource availability; and learn about existing efforts to promote sustainable use of coral resources.
- Raise awareness about the issues, particularly among consumers.
- Encourage alternatives: promote low-tech, community based alternatives to the wild harvest of coral reef species such as sustainable captive-breeding or artificial culture programs; encourage the development of sustainable management plans; and consider the feasibility of certification or labeling schemes.

Technical and Financial Assistance

- 3. Expand capacity-building efforts in countries with coral reefs to enforce relevant laws and regulations, collect trade data, assess the status of reefs, evaluate the impacts of extraction on reefs, develop and implement sustainable management plans, develop certification schemes and institute alternative and environmentally sound collection practices and alternatives, such as aquaculture and coral farming.**

The International Trade Subgroup recommends that the United States continue to provide both technical and financial assistance and training to exporting countries to address overexploitation of coral resources and destructive fishing practices. Specifically, the United States could:

- Expand efforts to develop and implement sustainable management programs by building capacity at the local and national levels. The United States should expand its work with source countries to develop coral reef management programs to prevent illegal fishing practices, achieve sustainable fisheries and harvests, and protect the ecological integrity of coral reefs. Examples of assistance would include: (1) encourage the development of guidelines for sustainable harvest of coral reef resources; (2) develop viable certification methods to verify that coral reef resources are sustainably harvested, handled and transported; (3) enhance a country's capacity to implement CITES through workshops focused on implementing legislation and regulations, law enforcement and implementation of Management and Scientific Authorities; (4) develop community-level or private sector management programs for biological monitoring; and (5) facilitate database-sharing of biological information among governments, and between governments and the community/private sector.
- Expand efforts to re-train collectors and fishers to teach non-destructive collection techniques and alternative livelihoods.
- Address international enforcement needs. The United States has played a lead role in assisting countries with enforcement of international trade regulations and other wildlife protections. Assistance in the form of inspection techniques, detection of document fraud and smuggling, identification of commonly traded species, detection of humane transport violations, and investigation of illegal trafficking schemes should continue as resources allow. Assistance could also include technical assistance and training support and mentoring programs for prosecutors and judges, to help assist countries in strengthening their legal and judicial system.

Domestic Enforcement

- 4. Improve domestic enforcement of illegal coral reef species trade and wildlife smuggling.**

The United States has the authority under the Endangered Species Act, 16 USC § 1531 *et seq.*, to monitor imports and exports of wildlife and ensure that shipments are in compliance with the Convention on International Trade in Endangered Species of Fauna and Flora (CITES). The United States also has the authority under the Lacey Act, 16 U.S.C. § 3372 *et seq.*, to prohibit the import, export, sale, receipt, possession or transportation of wildlife taken in violation of any state, federal, tribal, or foreign law. Most countries around the world have banned fishing by use of explosives, poisons, and other destructive practices which are often used to harvest coral and coral reef species for trade. The International Subgroup recommends the following actions that can help improve domestic enforcement of illegal trade in coral reef species:

- Explore use of U.S. cyanide tests on live coral fish. The National Fish and Wildlife Forensics Laboratory currently uses a detection test for migratory birds taken using cyanide. It has not been determined whether this test is effective for testing tropical fish at the point of import into the United States. Many source countries for tropical fish and food fish have prohibitions in place regarding the use of cyanide but enforcement capabilities are limited. If an effective test can be used in the United States to prove illegal take using cyanide, USFWS could assist source countries with enforcement of their cyanide prohibitions by using the Lacey Act. Inspection of shipments could also include random cyanide testing as resources allow.
- Increase federal enforcement capability through additional resources. International trade in most coral reef species is regulated by the U.S. Fish and Wildlife through its wildlife inspection program. The program currently has 93 inspectors stationed at 30 ports of entry to inspect the more than 80,000 declared and the tremendous number of undeclared shipments. Additional resources would allow federal officers to detect illegal shipments and verify species identification and trade data. Detection of illegal harvest is shared depending on the area of jurisdiction between the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, and the National Park Service. Personnel and equipment are currently inadequate to address the vast U.S. coral reef areas.

Domestic Education, Outreach and Research

5. Work with various stakeholders to develop public education and awareness materials, raise domestic consumer awareness and encourage alternatives to wild collection of coral reef species.

Similar to the activity described above, the Trade Subgroup recommends that the United States work with its states and territories, non-governmental organizations, managers, scientists, and industries on a domestic level to educate the public and to encourage innovative solutions. Some specific activities include:

- Create education and awareness materials that emphasize issues regarding trade in coral reef species (see Appendix D for an example of consumer awareness materials).
- Encourage alternatives to wild collection of coral reef species: develop mechanisms to address destructive fishing, mortality of species in trade; explore certification or eco-labeling, encourage development of synthetics, and encourage sustainable captive-breeding or artificial culture programs.

6. Analyze and improve U.S. collection, reporting and monitoring of data for the

international trade in coral reef species

The Trade Subgroup proposes to analyze existing import data collected in the United States, and to revise and improve data gathering and reporting where feasible and appropriate. The United States should also improve the collection, reporting, and monitoring of global trade data for coral reef species not covered by existing international agreements, such as CITES, to identify possible trade impacts on the resource.

7. Develop additional measures as appropriate to ensure that U.S. consumer demand for marine aquarium organisms does not contribute to the decline and degradation of coral reef species and ecosystems.

In March 1999, the Task Force requested that the Council on Environmental Quality lead an accelerated interagency review of the advisability of pursuing legislation that addresses the trade in coral and coral species. Based on a preliminary analysis, the Trade Subgroup recognized that new legislative authorities may be necessary to help address the concerns relating to commerce in coral reef species and the United States' involvement in that trade as a major consumer of coral reef products. The Trade Subgroup proceeded to undertake an accelerated consultation with exporting and importing countries, states and territories, non-governmental organizations, industry, and the public to obtain all available information and to determine levels of support for national legislation and/or new regulations, and to obtain recommendations for the most effective solutions to the problems related to trade in coral reef species.

At this point in the consultative and review process, the Trade Subgroup does not recommend a complete restriction on all trade in marine aquarium organisms. However, there are major concerns about the unsustainable use of CITES-listed species, the use of destructive fishing practices, and the high mortality rates during handling and transportation. New measures may be needed to stem these adverse impacts of trade in coral and coral reef resources, ensure a more responsible trade, and encourage the conservation and sustainable management of coral reef ecosystems.

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 United States has a responsibility to address the degradation and loss of coral reef ecosystems that may arise from commerce in coral reefs species and products, and to encourage more responsible trade. The U.S. should not promote or encourage 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, particularly in developing countries. Rather, we should encourage responsible use of these precious resources.

Suggestions for New Authorities. Following are some measures that have been suggested to reduce the adverse impacts of trade and collection in coral and coral reef resources, encourage more responsible trade, and encourage the conservation and sustainable management of coral reef ecosystems both domestically and internationally.

- The United States should prohibit domestic harvest or collection and the import or export of coral reef species and products listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora 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.

- 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.
- 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.
- 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.
- 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 sustainable management of coral reef ecosystems in other parts of the world.

APPENDIX A
PRIMARY IMPORTERS AND EXPORTERS OF SOME CORAL REEF SPECIES
BASED ON CITES ANNUAL DATA FOR 1997³

Species	Primary Exporters	Primary Importers
Live Coral (Reported to genus)	Indonesia (71%) Solomon Islands (6%) Fiji (12%)	United States (78%) Germany (8%) Japan (7%) Others (7%)
Live Rock (reported as scleractinia)	Fiji (89% by weight) Indonesia (74% by piece)	United States (95% by weight) United States (95% by piece)
Coral Skeleton	Indonesia (12% by piece) Mozambique (35% by piece) Fiji (42% by piece) Indonesia (31% by weight) Vietnam (37% by weight) Solomon Islands (25% by weight)	United States (30% by piece) Spain (65% by piece) Italy (5% by piece) United States (65% by weight) Japan (33% by weight)
Worked Coral Skeleton Giant Clams (live) (Meat) (Shells)	Hong Kong (69% of stony corals) Korea (31% of stony corals) Hong Kong (95% of scleractinia) Taiwan (99% of antipatharians) Solomon Islands (41%) Philippines (32%) Tonga (11%) Philippines (64%) PG (36%) Mozambique (85% by kg, 61% by piece)	United States (99.5% of antipatharians) United States (95% of stony corals) United States (82%) Germany (12.4%) Japan (64%) Singapore (32%) United States (4%) Italy (61% by piece) Portugal (20% by piece) Spain (13% by piece) New Zealand (5% by piece) United States (<1% by piece) Italy (70% by weight) New Caledonia (16% by weight) Portugal (14% by weight)

³ Current (1999) data may differ slightly from listed values. For instance, Indonesia no longer allows the export of dead coral skeletons, Mozambique banned the export of all coral, and the volume of coral from Fiji has increased dramatically.

**APPENDIX B
FOREIGN NATIONAL LAWS PERTAINING TO CORAL HARVEST/TRADE
AND DESTRUCTIVE FISHING PRACTICES**

I. Pacific Countries

Country (Pacific)	Law/ Prohibition	Cite
Australia	<p><u>Coral Trade and Protection</u> Prohibits exports and imports of certain reef species except with a permit. Australian Minister shall not grant an import permit unless he makes certain determinations, depending on the species .</p> <p><u>Destructive Fishing Practices</u> Prohibits commercial fishing unless valid fishing license or permit; no license has been issued permitting the use of chemicals for taking fish</p> <p>Prohibits chemicals being added to water ways for the capture of fish, unless a permit has been issued</p>	<p>Wildlife Protection (regulation of exports and imports) Act 1982</p> <p>Fisheries Management Act 1991</p> <p>Each Australian State and Territory</p>
China	<p><u>Destructive Fishing Practices</u> Prohibits use of explosives, poisons and electric fishing and other behaviors destroying aquatic wildlife resources</p>	<p>Regulations on Breeding and Protection of Aquatic Products Resource, 1979, Art. II</p>
Indonesia	<p><u>Coral Trade and Protection</u> Export of recently dead coral prohibited. Export quota system for live coral: (1999 quota follows) Scleractinia substrate (soft corals with attached substrate) 675,000 pieces; Scleractinia base rock (live rock) 135,000 pieces; Live coral (broken down by genus, in some cases by species) 878,675 pieces. Prohibits harvest or sale of giant clams without permits; permits issued under extraordinary circumstances</p> <p><u>Destructive Fishing Practices</u> Prohibits catch and cultivation of fish using materials or tools that "may possibly endanger the fishery resource and its environment," and any activity "which leads to pollution and damages the fishery sources and their environment." Prohibits use of explosive materials, toxic substances, and electric current for fishing. Use of such substances for scientific research or other technical activities is regulated.</p>	<p>Indonesian Act No. 9/1985 on Fishery, Article 6 & 7</p> <p>Clarification of the Act of the Republic of Indonesia No. 9 of 1985, Art. 6</p>

Country (Pacific)	Law/ Prohibition	Cite
Fiji	<p><u>Coral Trade and Protection</u> Requires baseline survey before coral harvesting is allowed. Export of coral banned unless exporter supplies full listing of species exported. Moratorium on new entrants into coral export market. Maximum annual harvest quantities for 1999: up to 1,500,000 kgs of live base rock and up to 450,000 live coral pieces, up to 130,968 pieces of unworked coral (curio)</p>	
Japan	<p><u>Destructive Fishing Practices</u> Prohibits taking or gathering of any aquatic animal or plant by means of any explosive substance, excluding marine mammals; prohibits taking or gathering by poisons (except by permit); prohibits possession or sale of aquatic animals or plants taken in violation of above</p>	Fishery Resources Conservation Law, Art. 5, 6, 7
Kiribati	<p><u>Destructive Fishing Practices</u> Prohibits use of explosives, poison or other noxious substance for killing, stunning, disabling or catching fish</p>	Fisheries Ordinance, Sec. 14
Marshall Islands	<p><u>Coral Trade and Protection</u> Virtual ban on trade in live fish trade for Asian markets Fines exceeding \$200,000 have been imposed and confiscation of vessels for destructive practices</p> <p>Export license for exporting live coral & aquarium fish is \$2,000 per year</p> <p><u>Destructive Fishing Practices</u> fine up to \$20,000 and/or imprisonment for up to 6 months for improper fishery practices.</p>	Marshall Islands Marine Resources Act
Palau	<p><u>Coral Trade and Protection</u> Exports of sponges and marine rocks are prohibited, including four types of hard corals. No laws or regulations protecting the coral s from Palauians using corals to make lime</p> <p><u>Destructive Fishing Practices</u> Prohibits knowingly catching marine life with explosives, poisons, chemicals or other substances which kill marine life; prohibits possession or sale of marine life caught in violation of above</p>	24 PNCA 1301, 1302

Country (Pacific)	Law/ Prohibition	Cite
Philippines	<p><u>Coral Trade and Protection</u> Prohibits collection, sale and export of coral</p> <p><u>Destructive Fishing Practices</u> Prohibits catching, taking, or gathering of fish and fishery aquatic products in Philippine waters with the use of explosives, obnoxious or poisonous substance (unless by permit for scientific, research or educational purposes)</p> <p>Prohibits the knowing possession, sale, or disposal of, for profit, of any fish or fishery/aquatic products which have been illegally caught, taken or gathered.</p>	<p>Presidential Decree 1219, 1977</p> <p>Official Gazette Vol. 71, No. 28, July 14, Ch. VI sec. 33</p>
Singapore	<p><u>Coral Take, Harvest, or Trade</u> Prohibits imports, exports and re-exports of CITES-scheduled species without a permit</p> <p><u>Destructive Fishing Practices</u> Prohibits use of any poisonous or explosive substances with the intent to stupefy, poison or kill fish (unless issued a license)</p>	<p>The Endangered Species (Import and Export) Act 1989, sec. 4</p> <p>Fisheries Act, sec. 12</p>
Solomon Islands	<p><u>Coral Take, Harvest or Trade</u> Coral exporters must obtain a fisheries license for coral extraction which cites place where coral may be extracted and the quantity. An export permit must then be obtained.</p>	
Taiwan	<p><u>Destructive Fishing Practices</u> Prohibits use of poison, dynamite or other explosives, electric shots or anesthetic agents to catch living marine resources</p>	Taiwan Fishery Law Art 48
Thailand	<p><u>Coral Take, Harvest, or Trade</u> Prohibits coral collection.</p> <p><u>Destructive Fishing Practices</u> Prohibits pouring, throwing away, draining or laying in the fisheries such poisonous substances as determined by Notification of the Minister, or any act that stupefies the aquatic animals</p> <p>Prohibits the use of an electric current in fisheries, or use explosives in fisheries in any other way (except by permission or permit)</p> <p>Prohibits possession for commercial purposes of aquatic animals that one knows have been taken in contravention of above</p>	<p>Fisheries Act B.E. 24909, 1947, and amendments 1972</p> <p>Fisheries Act B.E. 2490, sec. 19</p> <p>sec. 20</p> <p>sec. 20 bis</p>
Tuvalu	<p><u>Coral Trade and Protection</u> Regulates sand and coral removal</p>	Wildlife Conservation Ordinance, 1975

Country (Pacific)	Law/ Prohibition	Cite
Vanuatu	<u>Coral Trade and Protection</u> Limits coral collection, requires permits for export of trochus, green snail, crustaceans, aquarium fish, coral and beche-de-mer	Fisheries Regulations, 1983
Vietnam	<u>Destructive Fishing Practices</u> Prohibits all activities listed that are detrimental to aquatic resources and cause pollution to the living environment of all aquatic species: using toxic, harmful substances, explosives, gun powder, electric currents to paralyze or kill aquatic stock, and releasing or leaking harmful toxic substances stronger than the allowable limitation	Law on the Conservation and Management of Living Aquatic Resources, art. 8
Western Samoa	<u>Destructive Fishing Practices</u> Prohibits use of explosives or poisons for fishing	Fisheries Regulation Order No. 83, 1965

II. *Caribbean/ Central American Countries*

Country (Caribbean)	Law/ Prohibition	Cite
Bahamas	<u>Coral Trade and Protection</u> Bans collecting of corals; bans export of marine products by non-Bahamanians Bans take of fish, turtle, crawfish, conch, and welks in national parks; or destruction or removal of any animals, including coral, bans removal of sand in national parks <u>Destructive Fishing Practices</u> Prohibits use of bleach, poisons or explosives	Fisheries Resources Regulations, 1986 Bahamas National Trust Act, 1959 Fisheries Resources Regulations, 1986
Belize	<u>Coral Trade and Protection</u> Protects coral reefs within areas designated as national parks	National Park System Act, 1981
Bermuda	<u>Coral Trade and Protection</u> Prohibits take of coral, flora and fauna in coral reef preserves; regulates take of spiny lobsters, fish, scallops, turtles <u>Destructive Fishing Practices</u> Prohibits use of explosives	Coral Reef Preserves Act, 1966; Fisheries Regulation 1972 Fisheries Regulations, 1972
British Virgin Islands	<u>Coral Trade and Protection</u> Provides for protection of coral reefs in marine parks and protected areas	Marine Parks and Protected Areas Ordinance, 1979

Draft Report to USCRTF

Country (Caribbean)	Law/ Prohibition	Cite
Cayman Islands	<u>Coral Trade and Protection</u> Controls take of spiny lobsters, conch, coral and shells	Marine Conservation Law, 1978
Cuba	<u>Coral Trade and Protection</u> Controls take of conch	Legislation, 1977
Dominican Republic	<u>Coral Trade and Protection</u> Controls take of coral	Ley 1728, 1976
Guadalupe	<u>Coral Trade and Protection</u> Controls take of turtles, spiny lobsters and corals	Legislation , 1979
Honduras	<u>Coral Trade and Protection</u> Declares coral reefs as protected areas	Ley de Pescar, 1959
Jamaica	<u>Coral Trade and Protection</u> Protects black coral, turtles and other marine species <u>Destructive Fishing Practices</u> Prohibits fishing with poison or explosives	Wildlife Protection Law, 1945
Mexico	<u>Coral Trade and Protection</u> Bans collection of <i>plexaura homomalla</i> Requires export and import permit for corals , issued by the National Institute of Ecology.	Decree 1974 Agreement Establishing the Classification and Codification of Goods Whose Importation and Exportation Are Subject to Regulation by the Secretariat of the Environment, Natural Resources and Fisheries (9/22/97).
Netherland Antilles	<u>Coral Trade and Protection</u> Controls take of spiny lobster, take of turtle eggs, and collection or destruction of coelenterates and crustose coralline algae Bans collection or destruction of coelenterates and crustose coralline algae Bans coral collection	Bonaire, the Marine Environment Ordinance, 1985 Curacao – the Reef Management Ordinance, 1976 Aruba
St. Lucia	<u>Coral Trade and Protection</u> Prohibits sale and export of aquarium fish ; protects turtles and corals, controls take of conch <u>Destructive Fishing Practices</u> Prohibits dynamiting of coral reefs	Fisheries legislation Wildlife Protection Ordinance, 1980

Country (Indian Ocean, Red Sea, Gulf)	Law/ Prohibition	Cite
Seychelles	<u>Destructive Fishing Practices</u> Prohibits dynamite	
Somalia	<u>Destructive Fishing Practices</u> Prohibits dynamite, electric current, chemical methods of fishing	Maritime Code – Decree 1, 31.2.59 amended by Decree 7, 1.11.66
South Yemen	<u>Destructive Fishing Practices</u> Prohibits use of toxic, explosive or chemical substances for fishing	Law 24, 1979
Sri Lanka	<u>Destructive Fishing Practices</u> Prohibits use of dynamite and possession of fish killed by dynamite or poison	Fisheries Amendments Law 20, 1973
Sudan	<u>Coral Trade and Protection</u> Prohibits collection of corals, shells and aquarium fish	Marine Fisheries Regulations, 1927, Amendments, 19754

Note: The above compilation of laws is a work in progress. Some of the references may be out of date. Please send any corrections to the International Trade Subgroup.

**APPENDIX C
FEDERAL, STATE AND TERRITORY LAWS RELATING TO
CORAL HARVEST/TRADE AND DESTRUCTIVE FISHING PRACTICES**

I. Western Atlantic, Gulf of Mexico and the Caribbean

A. Federal Waters (Caribbean, South Atlantic, Gulf of Mexico)

Federal Waters: S. Atlantic, Gulf, and the Caribbean	Law/ Prohibition	Cite
<p>FMPs for Coral and Coral Reefs of the Gulf of Mexico and South-Atlantic, April 1982, with Amendment 2 & 3 (1994-1995) and</p> <p>FMP for Corals and Reef Associated Plants and Invertebrates of Puerto Rico and the U.S. Virgin Islands, July 1994.</p> <p><i>Implemented at 50 C.F.R. Part 622</i></p>	<p>Regulations relating to Coral/ Live Rock</p> <p><u>Gulf of Mexico and South Atlantic EEZ</u></p> <p>Prohibits harvest or possession of wild live rock in the Gulf or South Atlantic EEZ after 1997, with an exception for aquacultured live rock if taken under permit.</p> <p>Prohibits harvest of Gulf and South Atlantic or Caribbean prohibited coral (listed in appendix, includes all corals in the Class Hydrozoa and Class Anthozoa), with an exception for scientific and educational purposes by permit.</p> <p>Foreign fishing of corals is prohibited. The direct take of stony corals and sea fans and the destruction of corals is prohibited. Corals taken incidentally in association with other fisheries must be returned to area of capture.</p> <p><u>Caribbean EEZ</u></p> <p>Prohibits take or possession of Caribbean prohibited coral (listed in Appendix) from the Caribbean EEZ Harvest and possession of stony corals, octorals, and live rock, whether dead or alive, are prohibited, except for the purpose of scientific research, education, and restoration.</p> <p>Prohibits sale or purchase of Caribbean prohibited coral harvested in the Caribbean EEZ. Items will be presumed to be harvested in the Caribbean EEZ unless accompanied by documentation showing it was harvested elsewhere.</p> <p>Harvest and possession of any species, if attached to live rock, is prohibited. Harvest or possession of reef-associated invertebrates requires a permit</p>	<p>50 C.F.R. §§ 622.42(b); 622.43(a)(2)(ii); 622.33(b)(4)(iv)</p> <p>50 C.F.R. § 622.4(a)(1),(3)</p> <p>50 C.F.R. § 622.32(b)(2)</p> <p>50 C.F.R. § 622.32(b)(1)</p> <p>50 C.F.R. § 622.45(a)</p>

Federal Waters: S. Atlantic, Gulf, and the Caribbean	Law/ Prohibition	Cite
FMPs for South Atlantic, Gulf and Caribbean EEZs (Cont'd)	<p>Regulations relating to Aquarium Marine Fish</p> <p><u>Caribbean EEZ</u> Prohibits fishing or possession of Caribbean prohibited coral (listed in appendix) and certain fish (four-eye, banded, and longsnout butterfly fish; jewfish; Nassau grouper; and seahorses).</p> <p>Authorizes harvest of marine aquarium fish in the Caribbean EEZ only by a hand-held dip net or a hand-held slurp gun</p> <p>Destructive Fishing Practices</p> <p><u>Caribbean, Gulf or South Atlantic EEZ</u> Prohibits use of explosive, poison or toxic chemicals for fishing in the Caribbean, Gulf, or South Atlantic EEZ</p>	<p>50 C.F.R. § 622.32(b)</p> <p>50 C.F.R. § 622.41(b)</p> <p>50 C.F.R. § 622.31(a),(b), (e)</p>

B. State and Territorial Waters (Caribbean, South Atlantic, Gulf of Mexico)

State/ Territory Waters: W. Atlantic, Gulf of Mexico, Caribbean	Law/ Prohibition	Cite
Puerto Rico	<p>Laws/ Regulations relating to Coral</p> <p>Prohibits harvest or take of corals or live rock for commercial purposes, except under permit.</p> <p>Laws/Regulations relating to Marine Fish</p> <p>Prohibits fishing by means of explosives in the maritime waters of Puerto Rico and adjacent islands, or in the lakes, lagoons, rivers, and other bodies of water, or to sell or possess fish caught by means of any kind of explosive</p> <p>Harvest of other invertebrates and fish is not regulated. Harvesters and exporters of invertebrates for the marine aquarium trade are not licensed, and their activities are not regulated; collectors are not recognized as commercial fishermen.</p> <p>Destructive Fishing Practices</p> <p>Prohibits the use of poisonous substances in Puerto Rican waters.</p>	<p>P.R. Law No. 83, Law No. 132</p> <p>12 L.P.R.A. § 57</p> <p>P.R. Law No. 83</p>

State/ Territory Waters: W. Atlantic, Gulf of Mexico, Caribbean	Law/ Prohibition	Cite
<p>Florida</p>	<p>Laws and Regulations relating to Coral/ Live Rock</p> <p>Prohibits taking, destruction, or sale of sea fans and certain corals (stony coral, fire coral), or possession of any fresh, uncleaned or uncured specimen . Exceptions are provided for specimens legally harvested outside of state waters or federal EEZ waters adjacent to state waters (but burden is on person possessing species to show legality), harvested under permit for scientific or educational purposes, or pursuant to permit for aquacultured live rock.</p> <p>Prohibits harvest or sale of live rock from any state waters.</p> <p>Prohibits transport, destruction, damage, removal, defacing, or take of any coral or other material from the subsoil or seabed of the John Pennekamp Coral Reef State Park which has been taken in violation of any law or regulation of the Federal Government.</p> <p>Laws/ Regs relating to Aquarium Marine Fish</p> <p>Designates certain marine fish, corals, and invertebrates as "restricted species." It is unlawful to sell restricted species to a licensed wholesale dealer; or for a licensed wholesale dealer to buy restricted species, unless there is a restricted species endorsement on the seller's saltwater products license.</p> <p>Requires persons harvesting any tropical ornamental marine life species and plants to land such organisms alive and to have systems aboard the vessel to maintain such organisms in a healthy condition.</p> <p>Sets forth size limits for certain marine fish (angelfish, butterflyfishes, gobies, jawfishes, hogfish).</p> <p>Sets forth bag limits for tropical ornamental marine life and plants (e.g., 20 individuals per day; 5 angelfish per day; 6 colonies of octorals). Sets forth commercial harvest limits (e.g. 75 angelfish per person per day or 150 angelfish per vessel per day, whichever is less; 75 butterflyfishes per vessel per day)</p>	<p>Fl. Admin. Code Ann. R. 46-42.009</p> <p>Fl. Admin. Code Ann. R.46-42.008</p> <p>Fla. Stat. Ann. § 258.083</p> <p>Fla. Stat. Ann. § 370.01(20), § 370.06 Fl. Admin. Code Ann. r. 46-42.001(b)</p> <p>Fl. Admin. Code Ann. r. 46-42.0035</p> <p>Fl. Admin. Code Ann. r. 46-42.004</p> <p>Fl. Admin. Code Ann. r. 46-42.005, 46-42.006</p>

State/ Territory Waters: W. Atlantic, Gulf of Mexico, Caribbean	Law/ Prohibition	Cite
U.S. Virgin Islands	<p>Laws relating to Coral/ Live Rock</p> <p>Unlawful to take, catch, possess, injure, harass, kill, or attempt to take, catch, possess, injure, harass or kill, or sell or offer for sale, or transport or export, whether or not for sale, any indigenous species, including live rock; exception for valid fishing or hunting licenses, scientific or aquarium collecting permits, or indigenous species retention permits.</p> <p>Harvest of live rock and all corals for commercial and recreational purposes is prohibited without a permit. Permits to collect specimens of marine life forms, including live rock, whether or not for sale, and whether or not intended for shipment or export, are authorized for:</p> <p>(A) A private aquarist collecting for a personal aquarium of not more than fifty (50) gallons capacity;</p> <p>(B) A person maintaining an aquarium of any size for a commercial purpose; and</p> <p>(C) A collector for shipment, export, and sale.</p> <p>Permits for coral and live rock are provided on a one-time, case-by-case basis, and require submission of species name and number, location of activity, capture methods, and holding facilities.</p> <p>A permit is required for the harvest and export of other invertebrates for the marine aquaria trade; 53 permits were issued between 1990-1994.</p> <p>Prohibits taking of sand, rock, mineral, marine growth and coral (including black coral), natural materials, or other natural products of the sea, excepting fish and wildlife, from the shorelines without first obtaining a coastal zone permit.</p>	<p>12 V.I.C. § 105 (a)</p> <p>12 V.I.C. § 106(c)(1)</p> <p>12 V.I.C. § 906(a)(7)</p>
North Carolina	<p>Laws relating to Coral/ Live Rock</p> <p>Prohibits harvest or possession aboard a vessel of coral or live rock . Requires that live rock and coral shall be returned immediately to the waters where taken.</p>	<p>N.C. Admin. Code tit. 15A, r. 31.0116</p>

II. Pacific Region

A. Federal Waters (Indo Pacific Region)

FMPs for Federal Waters (Pacific)	Law/ Prohibition	Cite
<p>Fishery Management Plans (FMP) for the Western Pacific</p> <p><i>Implemented at 50 C.F.R. Part 660</i></p>	<p>Regulations relating to Coral/Live Rock</p> <p>Managed species in the Western Pacific region include commercially important fish (bottomfish and pelagic fish) and crustaceans and precious corals.</p> <p>Precious coral beds are treated as distinct management units because of their widely separated and patchy distribution. The beds are classified as Established, Conditional, Refugia, or Exploratory. Quotas are established for pink, gold, and bamboo coral in the one Established bed and in the Conditional beds. Use of selective and non-selective gear (tangle net dredges) is permitted at Conditional beds of Brooks Bank and the Exploratory beds. A minimum height of 10 inches is set for pink coral. No harvest is permitted at Refugia beds.</p> <p>Regulations relating to Aquarium Marine Fish</p> <p>Coral reef species for the aquaria trade are not regulated, however federal waters are unlikely to be a source of these types of animals due to their considerable depth</p>	<p>50 C.F.R. § 660</p> <p>50 C.F.R. § 660.82</p>

B. State/ Territorial Waters (Pacific/ Indo Pacific Region)

State/Territory Waters (Pacific region)	Law/ Prohibition	Cite
<p>California</p>	<p>Law relating to Coral/ Live Rock</p> <p>Prohibits take or possession for commercial purposes of sea fans, all species of coral and anemone, and live rock (exception for aquacultured live rock). Prohibits collection under marine aquarium collectors permits for certain specified areas.</p>	<p>Cal. Fish & G. Code § 8598</p>

Hawaii	<p>Laws relating to Coral/ Live Rock</p> <p>Prohibits taking, breaking or damaging of live stony corals from waters of Hawaii, including any live reef or mushroom coral. (Exception for scientific collection under permit). Prohibits taking any rock to which marine life of any kind is visibly attached or affixed.</p> <p>Collection of soft corals is allowed only when not attached to reef substrate.</p> <p>Prohibits sale of any stony coral as souvenirs (including rice coral, mushroom coral, lace coral, cauliflower coral, elkhorn coral, finger coral, lobe coral, and orange flower coral; does not include coral rubble pieces or fragments imported for the manufacture and sale of coral jewelry or obtained through dredging operations in Hawaii for agricultural or other industrial uses)</p> <p>Prohibits removal of sand, dead coral, or coral rubble seaward from shoreline with certain exceptions (one gallon per person per day for personal, noncommercial uses; for replenishment of public shoreline areas or construction of state-approved projects with permit, and cleaning activities)</p> <p>Laws relating to Marine Aquarium Fish</p> <p>Collectors must have an aquarium fish catch permit, and commercial collectors must obtain a commercial fishing permit to sell their catch. Permits, issued by DLNR's Div. of Aquatic Resources, allow take of live fish with nets and traps (plan to change regulations & limit net size) – DLNR has no authority to limit the #s of permits; #s increased from 167 to 274 between 1995 and 1998 – DLNR required to report monthly count of the quantities taken of each individual species of aquarium fish exported.</p> <p>Created a West Hawaii Regional Fishery Management Area that will designate 30% of West Hawaii's coastal waters (51.8 miles) as Fish Replenishment Areas in which aquarium fish collection is prohibited.</p> <p>Destructive Fishing Practices Possession or use of explosives, electrofishing devices, and poisonous substances is prohibited in State waters.</p>	<p>H.R.S. § 188-68(a)</p> <p>H.R.S. § 188-68(b)</p> <p>H.R.S. § 171-58.5</p> <p>H.R.S. § 188-31</p> <p>H.R.S. § 188-31.5</p> <p>H.R.S. § 188F-4</p> <p>H.R.S. § 188-23</p>

Draft Report to USCRTF

State/Territory Waters (Pacific region)	Law/ Prohibition	Cite
Guam	<p>Laws relating to Coral/ Live Rock</p> <p>Bans harvest of live coral except with under a license from the Director of Agriculture.</p> <p>Permits commercial taking of coral by permit issued from the Director of Agriculture. Permit may limit amount of coral to be taken, taking into account the location from which the coral is to be taken, the amount of living coral remaining and the likelihood of damage caused to the reef area by the taking of the coral.</p> <p>Bans willful destruction of coral growth for purposes of flushing fish from their habitat or for clearing an area for net fishing.</p> <p>Authorizes the Department of Public Works to distribute for non-commercial use government-owned coral mined from government-owned coral pits at the request and certification of need of the village commissioner or the assistant commissioner of the village where the coral is to be delivered.</p> <p>Destructive Fishing Practices</p> <p>Authorizes issuance of permits for the use of poison, electrical devices or small mesh nets for the purpose of bona fide scientific research.</p>	<p>5 G.C.A. § 63602</p> <p>5 G.C.A. § 63603</p> <p>5 G.C.A. § 63113</p> <p>5 G.C.A. § 54201</p> <p>5 U.S.C. § 63609</p>

THE MARINE AQUARIUM TRADE AND THE ENVIRONMENT: WHAT YOU CAN DO TO HELP PROTECT CORAL REEFS

Did You Know?

Coral reefs are in serious trouble worldwide.

- Coral reefs around the world are facing a powerful combination of stresses that are threatening their survival, such as increased input of nutrients, sewage and sediment, overexploitation of resources, and destructive fishing practices.
- Unprecedented levels of coral bleaching and mortality associated with abnormally high sea temperatures were reported in 1998. On some shallow Indo-Pacific reefs, 70 to 90% of the corals died as a result of the largest ever recorded bleaching event.
- A 1998 World Resources Institute study concluded that nearly 58% of the world's reefs are at risk from human impacts, and many have been degraded beyond recovery.

The trade in coral reef species for the aquarium and curio trade may be contributing to the worldwide decline and degradation of reefs.

- Although illegal in most countries, the use of cyanide to capture reef fish for the live food fish and the aquarium trade is widespread. Cyanide kills non-target marine organisms including small fish and coral.
- The mortality rate of some of the most popular species of coral from source reefs to home aquaria is estimated to be as high as 90%. The mortality is partially related to capture techniques and handling and transport techniques.
- Nine of the ten dominant taxa for the aquarium trade consist of large-polyp corals that are slow-growing, long-lived, and often rare. Overexploitation of these species could result in severe localized depletions, increased erosion and loss of important fishery habitat.
- 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.
- Many of the aquarium fish are herbivores, so their removal may alter ecosystem function through a reduction in herbivory, thereby increasing macroalgae that is harmful to corals.

American consumers of coral reef products may inadvertently contribute to the problem.

- The United States is a major global importer of coral reef species for the marine aquarium industry. There are approximately 1 million hobbyists in the United States out of about 1.5 million worldwide. American consumers buy approximately 80% of the live and dead coral and more than 50% of the marine aquarium fish that are traded worldwide.
- The United States strictly regulates or prohibits the domestic harvest of live rock and hard corals in most federal, state and territorial waters. The domestic market for these items is supplied primarily through imports from other countries.

What Is Being Done.

An international treaty aims to protect some coral species.

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) aims to protect species from overexploitation through international trade. Over 2000 species of hard coral, giant clam, and queen conch are currently listed under CITES, but aquarium fish, soft corals, anemones and other invertebrates are not.

The U.S. Government is working to address some of these concerns.

- The United States is examining the issues relating to the trade in coral reef species through the U.S. Coral Reef Task Force, which is an interagency task force composed of federal agencies as well as representatives from States and territories with coral reefs in their jurisdiction.
- The federal government participates in a number of international agreements (such as CITES), organizations, and other activities aimed at protecting coral reefs around the world; providing technical and financial assistance to developing countries, including programs to retrain local fishers in less destructive fishing methods and the promotion of environmentally sustainable aquaculture techniques to propagate coral and reef fish for the aquarium industry.
- The U.S. Coral Reef Task Force has recommended the development of guidelines on sustainable aquaculture of coral reef species. Environmentally sustainable aquaculture includes minimizing potential impacts on native species, such as accidental introduction of alien species, diseases or viruses, and complying with all applicable federal, state, and local laws.

What You Can Do.

Become an informed consumer.

- Inform yourself about the threats facing coral reefs around the world.
- When purchasing corals, live rock, fish, and other organisms, ask your store for information about the origin of the items and methods of collection used in harvest. Encourage stores to obtain this information if they do not have it.
- Educate yourself about the species you are purchasing and about maintaining a healthy marine aquarium. Learn about the difficulty or ease of keeping particular species to avoid buying fish or coral that are difficult to maintain in captivity.

Choose responsibly aquacultured species or synthetic corals where possible.

- Consider buying synthetic corals or captive-reared coral from a facility certified to have raised the coral in an environmentally sustainable manner. Consider buying reef fish that are certified as cyanide-free or aquacultured in an environmentally sustainable manner.

For More Information.

Check out the U.S. Coral Reef Task Force website at <http://coralreef.gov>.

APPENDIX E

**MEMBERS OF TRADE SUBGROUP
OF INTERNATIONAL WORKING GROUP**

<u>Name</u>	<u>Agency</u>	<u>Phone</u>	<u>Fax</u>	<u>Email</u>
Sheila Einsweiler	DOI/USFWS	(703) 358-1949	(703) 358-2271	sheila_einsweiler@fws.gov
Bruce Weissgold	DOI/USFWS	(703) 358-2095	(703) 358-2298	bruce_weissgold@fws.gov
John Field	DOI/USFWS	(703) 358-1708	(703) 358-2276	john_field@fws.gov
Mary Jane Lavin	DOI/USFWS	(703) 358-1707	(703) 358-1947	maryjane_lavin@fws.gov
Barbara Best	USAID	(202) 712-0553	(202) 216-3174	bbest@usaid.gov
Leslie Johnston	USAID	(202) 712-5808	(202) 216-3122	ljohnston@usaid.gov
Roberta Chew	STATE	(202) 647-4683	(202) 736-7351	rchew@state.gov
Sylvia Quast	DOJ/ENRD	(202) 514-1806	(202) 514-4231	sylvia.quast@usdoj.gov
Sylvia Liu	DOJ/ENRD	(202) 305-0639	(202) 514-4231	sylvia.liu@usdoj.gov
JC Williams	DOJ/ENRD	(202) 514-5313	(202) 514-4231	jcarol.williams@usdoj.gov
Jonathan Blackmer	DOJ/ENRD	(202) 305-0201	(202) 305-0275	jonathan.blackmer@usdoj.gov
Nancy Daves	NOAA/NMFS	(301) 713-2319	(301) 713-0376	nancy.daves@noaa.gov
Andy Bruckner	NOAA/NMFS	(301) 713-2319	(301) 713-0376	andy.bruckner@noaa.gov
Tom Hourigan	NOAA/NMFS	(301) 713-2319	(301) 713-3076	tom.hourigan@noaa.gov
Roger Griffis	NOAA	(202) 482-5034	(202) 501-3024	roger.b.griffis@hdq.noaa.gov
Alice Mattice	USTR	(202) 395-3581	(202) 395-3640	Amattice@ustr.gov
Dan Mullaney	USTR	(202) 395-3581	(202) 395-3640	Dmullaney@ustr.gov
Allison Areias	USTR			Aarcias@ustr.gov
Peter Lallas	EPA	(202) 260-8881	(202) 260-3828	lallas.peter@epa.gov
Tiffany Prather	EPA	(202) 564-6478	(202) 565-2918	Prather.tiffany@epa.gov

APPENDIX F

REFERENCES

- Aquarium Fish and Coral Fisheries Working Group. 1999. Queensland marine aquarium fish and coral collecting fisheries. Queensland Fisheries Management Authority Discussion paper No. 10. 83 pp.
- Barber, C.V. and V.R. Pratt, 1997, *Sullied Seas: Strategies for Combatting Cyanide Fishing in Southeast Asia and Beyond*, World Resources Institute. 57 pp.
- Barber, C.V. and V.R. Pratt, 1998. Poison and Profits: Cyanide Fishing in the Indo-Pacific. *Environment*, v.40(8):5-9,28-34.
- Brown, B.E. and R.P. Dunne. 1988. The environmental impact of coral mining on coral reefs in the Maldives. *Environmental Conservation*. 15: 159-166.
- Byrant, D., L. Burke, J. McManus and M. Spalding. 1998. Reefs at Risk. A map-based indicator of threats to the world's coral reefs. World Resources Institute, Washington D.C. 56 pages.
- Cesar, H., 1996. *The Economic Value of Indonesian Coral Reefs*. World Bank. Agricultural Operations Division CDIII, East Asia and Pacific Region, Environment Department.
- Cesar, H. 1997. Indonesian coral reefs: a precious but threatened resource. In *M.E. Hatzilolis, A.J. Hooten and M. Fodor* (eds.) *Coral Reefs: Challenges and opportunities for sustainable management*. World Bank, Washington DC pp.163-171.
- Clark, A. M. and D. Gulko. 1999. Hawaii's State of the Reefs Report, 1998. Department of Land and Natural Resources, Honolulu, Hawaii. 41pp.
- Couchman, D. and J.P. Beumer. 1992. The commercial fishery for the collection of marine aquarium fishes in Queensland – status management plan. Queensland Department of Primary Industries: Brisbane. 15 pp.
- Green, A. 1997. An assessment of the status of the coral reef resources, and their pattern of use, in the U.S. Pacific Islands. NOAA Cooperative Agreement No. NA67AC0940. Western Pacific Regional Fisheries Management Council. 279 pp.
- Green, E. and F. Shirley, 1999. *The Global Trade in Coral*. World Conservation Monitoring Centre Biodiversity Series No. 9. WCMC – World Conservation Press, 70pp.
- Hodgson, G., 1999. A Global Assessment of Human Effects on Coral Reefs. *Marine Pollution Bulletin*. 38(5):345-355.
- Holthus, P., 1999. Conservation, Culture and Certification: The Future of Marine Ornamentals. Marine Ornamentals '99: First International Conference on Marine Ornamentals, Hawaii, U.S. (Addendum to Abstracts.)
- Johannes, R.E. and M. Riepen, 1995. *Environmental, Economic and Social Implications of the Live Reef Fish Trade in Asia and the Western Pacific*. Report to the Nature Conservancy and the South Pacific Commission. 83 pp.

- Jones, R.J. and A.L. Stevens, 1997. Effects on Cyanide on Corals in Relation to Cyanide Fishing on Reefs. *Mar. Freshwater Res.* 48:517-522.
- Jaubert, J., Marchioretti, M., Ounais, N., Gilles, P., Priouzeau, F and E. Tambutte (1996): Potential use of cultured Coral Transplants in Aquarium Stocking and Reef Restoration, 4th International Aquariology Congress, Tokyo.
- Jennings, S. and Polunin, N.V.C. (1996) Impacts of fishing on tropical reef ecosystems. *Ambio* 25, 44-49.
- Lathrop, C and Hourigan, T (1998) The United States and the live reef fish trade: trade-based solutions to cyanide fishing in the Asia-Pacific Region. In Asia-Pacific Economic Cooperation Marine Resources Conservation Working Group ed., *Proceedings of the Workshop on the Impacts of Destructive Fishing Practices on the Marine Environment 16-18 December 1997*. Hong Kong, China: Agriculture and Fisheries Department, 315 pp.
- Lau, P.P.F. and R. Parry-Jones. 1999. The Hong Kong trade in live reef fish for food. Traffic East Asia and the World Wildlife Fund for Nature Hong Kong, Hong Kong.
- Lau, P and R.P. Jones. 1999. The Hong Kong trade in live reef fish for food. SPC Live Reef Fish Information Bulletin. 6:27-30.
- McAllister, D.E., Cahoon, N.L. and C T. Shih. 1999. Cyanide fisheries: where did they start. SPC Live Reef Fish Information Bulletin. 5:18-21.
- Moe, M. 1999. Marine Ornamental Aquaculture: Past, Present, and Future. Marine Ornamentals '99: First International Conference on Marine Ornamentals, Hawaii, U.S. p.63.
- Moss, S.M. and Van Der Wal, M. (1998) Rape and run in Maluku: exploitation of living marine resources in eastern Indonesia. *Cakelele* 9, 85-97.
- Mulliken, T.A. and S.V. Nash. 1993. The recent trade in Philippine corals. TRAFFIC Bulletin. 13:97-105.
- Oliver, J. and P. McGinnity. 1985. Commercial coral collecting on the Great Barrier reef. Proc. 5th Intern. Coral reef Congress. 5:563-568.
- Pajaro, M.G. 1992. Alternatives to sodium cyanide use on aquarium fish collection: a community-based approach. *Sea Wind*. 6: 2-17.
- Roberts, C.. 1995. Effects of fishing on the ecosystem structure of coral reefs. *Conservation Biology*. 9(5):989-92.
- Ross, M.A. 1984. A quantitative study of the stony coral fishery in Cebu, Philippines. *Marine ecology*. 5:75-91.
- Rubec, P.J. 1986. The effect of sodium cyanide on coral reefs and marine fish in the Philippines. Pp. 297-302. In: J.L. Maclean, L.B. Dizon, and L.V. Hosillos (ed.) *The First Asian Fish Forum*, Asian Fisheries Society, Manila.
- Rubec, P.J. (1988) The need for conservation and management of Philippine coral reefs. *Environ Biol Fishes* 23, 141-154.

- Stime, J. 1999. Hobbyist Perspectives, Uninformed or Blissfully Naïve? *Marine Ornamentals '99: First International Conference on Marine Ornamentals, Hawaii, U.S.* p77-78.
- Tissot, B.N. 1999. Adaptive management of aquarium fish collecting in Hawaii. *SPC Live Reef Fish Information Bulletin*. 6:16-19.
- Tissot, B.N. and L.E. Hallacher. 1999. Impacts of aquarium collectors on reef fishes in Kona, Hawaii. Final report, Dept. of Land and Natural resources, Honolulu HI. 32 pp.
- Vincent, A.C.J. 1996. The international trade in seahorses. *TRAFFIC International* . 162 pp.
- Vincent, A.C. J. 1997. Sea farming not a quick fix. *Newsletter of the Marine and Coastal Community Network*. Vol. 4, No. 3.
- Wells, S.M. 1997. Giant clams: status, trade and mariculture, and the role of CITES management. *IUCN, The World Conservation Union* 77 pp.
- Wilkerson, J. 1999. Status of Commercial Marine Culture, Marketing, and Future Trends. *Marine Ornamentals '99: First International Conference on Marine Ornamentals, Hawaii, U.S.* p86.
- Wood, E. (1999) Global advances in conservation and management of marine ornamental resources. *Marine Ornamentals 99, First Int. Conf. on Marine Ornamentals "Collection, Culture and Conservation"*. Addendum to Program & Abstracts.