

March 20, 2006

Mr. Robert R. Gabel
Division of Scientific Authority
U.S. Fish and Wildlife Service 4401 North Fairfax Drive, Room 750
Arlington, Virginia 22203
Via email: scientificauthority@fws.gov

Dear Mr. Gabel:

SeaWeb, a Washington, DC based ocean conservation organization, requests that the United States submit a proposal to include *Corallium spp.* in Appendix II of the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES). We believe that species in this taxon qualify for inclusion in CITES Appendix II, pursuant to Article II of the CITES Convention, and Resolution Conf. 9.24 (Rev. CoP12).

The U.S. is a Range State for *Corallium* species as well as a significant importer of *Corallium* products from abroad. There is clear evidence, especially in the Mediterranean, that trade has a significant, negative impact on *Corallium* populations. Throughout the world there are repeated examples of species discovery, initiation of commercial extraction, large increase in commercial participation, followed by a precipitous decline in take as the size of remaining populations or cost of extraction can no longer support commercial activities.

We are also pleased to inform you that two National Marine Fisheries Service coral experts have expressed their interest in providing information to support this proposal. Dr. Andrew Bruckner has provided technical support to assist our preparation of this document and will continue this participation in the future. Additionally, Dr. Bruckner and Dr. Frank Parrish have expressed their willingness to review documents and comment on the accuracy of the science cited in documents that are prepared for a final proposal.

We also would like to express our interest in working with you on this proposal and are happy to share additional information with you that we identify in the future. For example, we are currently compiling more trade data to provide a more in-depth characterization of trade volume and value. We look forward to working with you on this proposal.

Thank you for your attention. We look forward to working with you on this important project.

Sincerely,

Dawn Martin
Executive Director
SeaWeb

Proposal to List Red and Pink Coral (*Corallium* spp.) on Appendix II of the Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora

Overview and Rationale for Requested Listing

This document presents information to request that the U.S. Fish and Wildlife Service submit a proposal to include red and pink corals (*Corallium* sp.) in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This taxon¹ comprises 26 closely-related species commonly known as red and pink precious corals. Worldwide, there are approximately six *Corallium* species that support a large, lucrative, and largely unregulated fishery.

As their name indicates, precious corals such as red and pink coral are highly valued, primarily for their use in jewelry. Decorative use of carved and polished *Corallium* skeletons dates back to some of the earliest human settlements and continues today as a highly popular consumer trend in the U.S. and around the world. While trade statistics are not widely available, and the black market is considerable, best estimates place the value of coral exports from the Naples region of Italy alone at roughly US\$30 million per year. Italian artisans using Mediterranean red coral (*Corallium rubrum*) are known to produce the finest coral jewelry in the world. Superior beads can fetch prices of up to US\$50 per gram—necklaces can run to \$25,000.

Species in this taxon are found domestically in Hawaii and Pacific territories. Outside the U.S., *Corallium* sp. are found throughout the world but primarily in the Mediterranean and Asia. The U.S. is a large importer of *Corallium* products. At present the U.S. does not export products made from *Corallium* species, in large part because the current required method of harvest of *Corallium* populations found in U.S. waters can not support commercial trade.

Deep-sea coral species exhibit life history characteristics that make them particularly vulnerable to overexploitation. *Corallium* are long-lived species (to 75 years or more) with slow growth rates (less than 1mm/year), low dispersal ability, and low recruitment rates (~95% larval mortality). Local populations are self-seeding and genetically distinct, and therefore even less resilient to fishing pressure.

Today, overfishing has depleted Mediterranean populations to the point that Italian jewelers are now sourcing 70% of their raw materials from Pacific species harvested by Japan and Taiwan. Food and Agriculture Organizations (FAO)

¹ Species in the *Corallium* genus have recently been re-assigned so that they are now known as Corallidae. For purposes of this proposal, we will use the more commonly recognized name of *Corallium*.

harvest data for the best-studied species, *C. rubrum*, indicates a 66% decrease in harvest in the period 1985-2001.

The U.S. fishery has a Fishery Management Plan in place and requires harvest by using selective gear that will not cause severe habitat damage. The Mediterranean fishery also banned the use of non-selective gear. However, in all other parts of the world, fishers use highly destructive trawl gear to take coral species. As a result, there is a trend that coral fisheries existing without proper management plans ultimately lead to dramatic population declines.

Pursuant to Article II paragraph 2 of the CITES Convention (both 2a and 2b) and Resolution Conf. 9.24 (CoP13. Annex 2.b.A) it is important to request an Appendix II listing for the entire *Corallium* genus and not individual species. It is nearly impossible to view a dead *Corallium* product and distinguish individual species. In fact, expert taxonomic identification of octocorals is primarily conducted by microscopic analysis of sclerite structure. These tiny calcium skeletal elements are found primarily in living tissue, which is completely removed when colonies are processed for jewelry and decorative purposes. While gross morphological characters and color easily distinguish species of the family *Coralliidae* apart from other families, there are no features sufficient for reliable resolution to the species level within the family.

In addition, anecdotal evidence correlating trends in bead color supports a supposition that as once a specific *Corallium* species is overexploited, fishers shift to a new species in a typical progression of resource exploitation.

This document presents the current information available on *Corallium sp.* biology, management programs, trade data, and the manner in which trade is detrimental to species survival. The demand for *Corallium* products has created a consumer market which combined with anthropogenic habitat destruction, and climate change threatens population persistence. As a result it is clear that trade in *Corallium species*, particularly from locations that do not have proper management plans in place, threatens the existence of these species. Finally, inclusion of the species in this taxon in CITES Appendix II will assist the United States in enforcing its domestic (federal and state) laws and regulations pursuant to conservation and protection of these species.

Species Characteristics

Scientific Name

Kingdom Animalia
Phylum Cnidaria (Coelenterata)
Class Anthozoa
Subclass Octocorallia
Order Gorgonacea (Alcyonacea)
Suborder: Scleraxonia

Family Coralliidae
Genus *Corallium*, *Paracorallium*

Common Name
Red Coral
Pink Coral

Species description

The corals are marine invertebrates that collectively belong to the phylum Cnidaria (Coelenterata), class Anthozoa. Animals of this class have a simple cup shaped body that consists of two layers of cells, and the presence of unique stinging cells, or cnidocytes, that are used both to capture prey and for defense. These species feed on small zooplankton and microplankton that are passively filtered from the water by the tentacles. Corals are often colonial organisms in which branches or bushes are formed by groups of tiny polyps interconnected by living tissue.

Precious red and pink corals are solid, longitudinally striated calcitic corals that are branched and may be fan-like or bushy shaped. Colonies range in color from bright red to pale pink or white and have white polyps. The endoskeleton of this coral is composed of tiny stick-like calcium carbonate rods that have been fused together to form a rigid structure which may be colored red, pink or white (reviewed in Bayer & Cairns, 2003).

Distribution and Habitat

Corallium species are found throughout the world at depths ranging from 20 meters to 400 meters (Bayer & Cairns, 2003; Grigg, 1974). Although the full extent of *Corallium* distribution has not been described, the range of the genus appears to be in all tropical, subtropical, and temperate oceans. Red coral grows on hard substrates and shows a preference for dark environments where there is little sedimentation.

Known distribution of *Corallium spp.* in U.S waters includes Florida, California, Alaska, Hawaii, and Guam (DeVogelaere et al., 2005; Etnoyer and Morgan, 2005; Grigg, 1974; Tiffin, 1990). In 1965, Japanese coral fishermen discovered a large pink coral bed (*Corallium spp*) near the northwestern end of the Hawaiian Archipelago. By 1980 this fishery has ceased because remaining populations could not sustain an economically viable fishery (Western Pacific Regional Fishery Management Council 2001).

New coral beds continue to be discovered in the Hawaiian Islands including discoveries in 2002 and 2003 (Simonds, 2003). It is also likely with further exploration, scientists will identify additional *Corallium* populations in U.S. territory waters, such as Samoa and the U.S. Marshall Islands.

Corallium sp biogeography is best described in the Mediterranean. *Corallium*

rubrum is endemic to the Mediterranean and neighboring Atlantic rocky shores (Garrabou et al. 2001). Mediterranean populations are found at depths between 20 and 200m where it is often found in caves and crevices. (Santangelo et al 2004). The red and pink corals of the west Pacific (e.g. *Corallium secundum*, *C. regale*, *C. laauense*, and *Corallium sp. nov.*) are found at greater depths of 90 - 400 m and occur mostly in areas with moderate to strong water currents (Grigg 1974).

Growth

Corallium sp are very slow growing. Mediterranean red coral may grow less than 1mm in diameter per year and Pacific species grow at a rate of up to 8mm per year. They are also relatively long lived, attaining ages of up to 75 years old, and heights of up to 1 meter (Lacaze-Duthiers 1864, Harmelin 1984, Garcia-Rodriguez & Masso 1986a, Abbiati et al. 1992, Allemand 1993).

Reproduction and Dispersal

Santangelo et al (2003) and references therein identify that red coral is iteroparous, undergoes internal fertilization, and broods larvae internally. The embryonic period lasts about 30 days, and planulae larvae, which are released during summer (Todd 1998), survive a few days suggesting a limited dispersal from the parent colonies. Molecular evidence supports the assumption that offspring have only limited dispersal from the parent colonies (Santangelo and Abbiati, 2001). These data support the hypothesis that *Corallium sp.* exist in genetically distinct subpopulations that are highly vulnerable to overexploitation on a localized level.

The sexes are separate in these species, however Santangelo (et al 2004 a) identified a sex ratio bias of (1.37:1) skewed toward females. There is also a positive correlation between colony size and reproductive output. *C. rubrum* reaches sexual maturity quite rapidly (2-3 years) and recruitment appears to be density-limited (Santangelo and Abbiati, 2001), making it 'weedier' than other deep sea coral species. However, fully two-thirds of a well-studied population off the Calafuna coast near Leghorn, Italy was non-reproductive, due to high mortality of larger colonies due to harvesting by divers (Santangelo et al., 2003). According to the authors, despite early sexual maturity, earlier overestimations of fecundity and low numbers of reproductive colonies increase the risk of local extinction, and, "It seems reasonable to assume that red coral populations showing such a size/age structure are above an optimal harvesting/recovery equilibrium threshold, which would be reached only if larger/older colonies survived."

Population Data

It is possible to deduce population sizes from commercial harvest data. Yields from the Mediterranean alone have fallen by 66 percent between 1985-2001 (Santangelo and Abbiati, 2001). Figure 1 represents global harvest statistics for *Corallium sp.* from the UN Food and Agriculture Organization Global System

database (FAO 2006). The data show a trend that is evident for both Mediterranean and Pacific species—discovery, inception of commercial fishing, growth in landings, overexploitation, and ultimately dramatic population decline.

Science needed
There is a need for

increased collaboration among scientists, resource

managers, and coral fishers to improve our understanding of the biology of deep-water corals including growth, recruitment, habitat requirements, environmental processes, and disturbance on their life history. It is also necessary to place a greater emphasis on field monitoring to determine sustainable levels of harvest of individual species in order to quantify and mitigate potential harvest impacts. This could be greatly assisted by a CITES Appendix II listing.

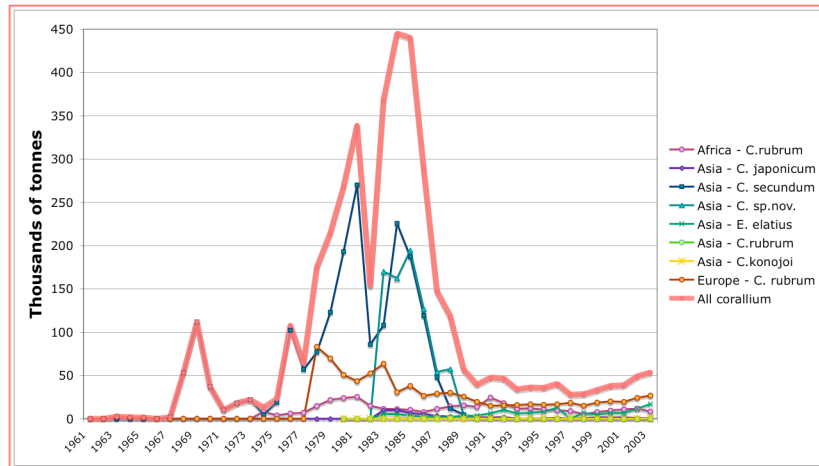


Figure 1: FAO *Corallium* harvest data (1950 - 2001)

An examination of growth rates of different species under different environmental conditions is necessary to begin filling gaps in our understanding of the biology of different coral taxa. Other aspects related to the biology of corals, such as recruitment and mortality rates, and the resilience of species to natural or anthropogenic disturbances, are also key components that can help provide managers with information needed to determine how much coral can be sustainably harvested. These factors will also vary depending on location, depth, and environmental parameters and should be considered in a long-term monitoring protocol.

Impacts to Species other than Trade

Bottom trawling describes a specific type of commercial fishing gear used to catch marine life on or near the seafloor. There is a large body of data that document how bottom trawling is a highly destructive method of fishing. More specifically data indicate that bottom trawling is wiping out large populations of deep water coral species such as *Lophelia pertusa*. To date there is no information documenting the impact of bottom trawling on *Corallium* species. However, it is likely that if bottom trawling occurs for non-*Corallium* species in the areas of *Corallium* distribution, *Corallium* will also be caught and destroyed in the nets. Anecdotal reports attribute nearly all of Japan and Taiwan’s *Corallium* harvest to bottom-trawling bycatch (S. Torntore, pers. comm.).

On a recent NOAA cruise to the Northwest Hawaiian Islands in 2003, Dr. Amy Baco-Taylor reported seeing evidence of damage to the deep coral beds due to the discarded longlining gear. She explains, "Damage done by trawling is well documented because pieces of coral trees literally come up with the net, but longlines only bring up what's on the hooks; thus, it is more difficult to document the destructive effects of longlining on sea life" (Baco-Taylor, 2003).

In 1999 there was a mass mortality event of red coral in the Mediterranean in shallow local populations (Garrabou et al., 2001). This unusual die-off was attributed to a disease titled "Fungal-Protozoan Syndrome" (Sutherland et al., 2004) and linked to a temperature anomaly reported in the NW Mediterranean (Cerrano et al., 2000; Perez et al., 2000; Romano et al., 2000). Losses of gorgonian corals were estimated to be in the millions (Cerrano et al., 2000). Under the global change scenario the repetition of this kind of disturbance is predictable in future decades in shallow-water habitats (Garrabou et al., 2001; Hughes, 2000). Recovery from such events seems uncertain considering the slow dynamics and recruitment limitation, and the low rate of exchange among local populations (Abbiati et al., 1992), particularly if source populations for replenishment are in deep-water habitats (Garrabou and Harmelin, 2002).

Conservation and Management of the Species

Existing management plans in both the Mediterranean and West Pacific aim to promote sustainable harvest by using measures such as calculating maximum sustainable yields and limiting the size and number of colonies collected. In other parts of the world, such as Asia, there are few management measures related to red coral species. Inclusion in Appendix II would provide incentives to countries and regions of the world that do not currently have management measures in place, but are commercially harvesting *Corallium*.

Management of Corallium spp. in the U.S.

1965 marked the first discovery of pink coral in U.S. waters. By 1969 Hawaii's precious corals industry was producing approximately \$2 million in retail sales in part from domestic harvest and in part from imports coming from Taiwan and Japan (Grigg 1993, Simonds, 2003). From 1960 to the mid 1980 there were several cycles of new coral bed discovery followed by cessation of harvesting. During the late 1980s, 450kg of pink coral was harvested of the Northwest Hawaiian Islands, but most colonies were dead and of poor quality.

The Western Pacific Council's Precious Corals Fisheries Management Plan (FMP) was approved in 1980 and regulations for the fishery were promulgated in 1983. The plan established the following management measures: permit requirements, harvest quotas for separate beds, a minimum size limit for pink coral, gear restrictions, area restrictions, and fishing seasons. In 1991 an amendment to the FMP defined that a bed is overfished with respect to recruitment when the total spawning biomass (all species combined) has been reduced to 20 percent of its un-fished condition.

Coral beds are split into established beds, conditional beds, exploratory beds and refugia. An amendment in 1999 to the FMP established a 1,000 kg quota for any precious coral bed in the exploratory areas (all species combined except black coral). In one established bed (Makapuu Bed), harvest quota of pink coral is set at 200kg. Quotas are also set for pink coral in four conditional beds (Ke-ahole point, 67kg; Kaena Point, 67 kg; Brooks Bank, 444 kg; 180 Fathom Bank, 222 kg.) This amendment also prohibits non-selective harvesting (collection can only be done with a Remotely Operated Vehicle (ROV) or submersible. Pink coral must have attained a minimum size of 10 inches to be legally harvested.

The recently established Northwest Hawaiian Islands (NWHI) Coral Reef Ecosystem Reserve prohibits precious coral (including pink and red coral) fishing within the Reserve boundary. The process to establish a proposed NWHI Coral Reef Ecosystem Sanctuary is underway and will consider a range of reasonable management alternatives related to precious coral fishing.

Additionally, foreign poaching in US waters has been a problem in the past. For instance, in 1985 Taiwanese coral draggers poached approximately 100 tons of *Corallium* from seamounts within the Exclusive Economic Zone (EEZ) north of Gardner Pinnacles and Laysan Island (Grigg 1993).

There is uncertainty over to what degree a NWHI precious coral fishery would have adverse effects on populations of endangered Hawaiian monk seal. Monk seals have been observed preying on eels found among precious coral colonies and subsequently damaging coral colonies. The impact of monk seal predation on pink and red coral colonies is poorly understood.

Management of Corallium spp. in the Mediterranean

Corallium rubrum is listed in Annex V of the European Union Habitats Directive. In addition, the Spanish government has established reserves for the protection of *C. rubrum* in the Mediterranean Sea (Hunnam, 1980). Spain also employs limited entry management strategies (Hunnam, 1980).

The use of the most destructive type of dredging equipment used in the Mediterranean, (known as the *ingegno* or St. Andrews Cross), has now been banned throughout the Mediterranean Sea. This piece of gear *St Andrew Cross* is an iron bar cross hung with chains that is used for harvesting coral by dragging it across the substrate. It was used for hundred of years. This technology is known to be highly destructive on rocky bottoms. In 1994 the European Union banned use of the St. Andrew's Cross in EU waters (Council of the European Union, 1994). In many places divers will now collect red coral and will subsequently cause more localized impact (Caddy, 1993; Caddy 2000)

Management of Corallium spp. in Asia

Through Presidential Decree 1219, in 1977 the Philippines implemented a total ban on trade of all coral products after studies found that areas of intensive coral harvest exhibited a reduced abundance and altered size distribution of commercially collected coral species (Mulliken and Nash 1993). However, due to a lack of environmental law enforcement, the Philippines have continued to export coral products. USAID is actively investing in efforts to strengthen the ability of national and local government units and communities to address threats to the country's natural resources (US Dept of Interior). There are very few additional management measures related to red coral in other Asian countries.

Trade of *Corallium* spp.

Approximately 2000 species of coral are listed in Appendix II of CITES. With regards to red coral, twenty-five species of *Corallium* have been named, and six species are commonly traded (see Table 1). Figure 1 represents *Corallium* spp. catch data and therefore indirectly represents relative trade volume of six *Corallium* species. However these data do not delineate export countries and destination of the coral products.

In many parts of the world, the precious coral industry has been characterized by periods of boom and bust cycles. Subsequently, intensive harvesting has caused a severe depletion of most commercial red coral stocks (Garrabou et al 2001, Santangelo et al. 1993). In the Mediterranean Sea, a discovery of large beds between Sicily and Tunis in the 1880's led to an unprecedented rush of almost 2,000 vessels, which rapidly depleted the grounds (Tescione, 1968). A similar phenomenon occurred near Okinawa and the Miyako grounds in 1963 but on a smaller scale (Morita, 1970). In 1965 another discovery on the Milwaukee Banks in the Emperor Seamounts led to a temporary coral glut in the late 1960's. This was followed by yet another period of over-supply in 1980-81 due to the discovery of Midway deep-sea coral at depths of 1.0 to 1.5 km (Grigg, 1982a). During the peak years of the fishery, over 100 coral boats from Japan and Taiwan harvested up to 200,000 kg of *Corallium* annually from these seamounts (Grigg 2002).

U.S. Trade

Although an active management plan and a quota for pink coral exists, the U.S. domestic harvest is dormant because it is not economically viable to take pink coral with submersible gear. Recent information suggests that certain beds could support a small fishery, and there is some interest in reestablishing this fishery.

Laura Noguchi with the U.S. Fish and Wildlife Service quantified that in 2002 there were 33,000 coral records—30,000 that were *Scleractinia*, or stony corals. *Corallium* made up the largest proportion of the remaining 3,000 records. However, record keeping (and declaration) for specimens of non-CITES-listed species and taxa is limited, and any data are known to be a significant underestimate (Noguchi, 2004).

In 1999, the ex-vessel price of *C. regale* was approximately \$600/kg. The potential annual gross revenue obtained from harvesting the quota of 444 kg from Brooks Bank would be \$226,400. These figures are based on 1999 values and assume that the species is not overfished. Between 1966-1978 about 32% of the standing stock of *Corallium* was harvested from Makapu'u bed. The average annual harvest was 685 kg (which is less than the estimated MSY of 1000 kg). Surveys done in 1983 and 1985 showed recovery in agreement with model predictions. Recent surveys (1997) suggest the bed is 15% larger than previous surveys and recovery is estimated at 74-90% of the virgin biomass. Thus, this bed may be exploited once again in the near future.

During the 1999–2000 season, the American Deepwater Engineering (ADE) company harvested 1,216 kg of *C. secundum* from the Makapuu Bed and 61 kg of *C. regale* from exploratory areas off Kailua, Kona. The average prices obtained at auction for these species were \$187/kg for *C. secundum* and \$880/kg for *C. regale*, respectively. In years when supply has been excessive, the price of raw material fell below the break-even level. This occurred in 1982 and caused fishing effort in the Emperor Seamounts to fall by a factor of three (Grigg, 1984).

Table 1: *Corallium* species. Species with * have been recently reassigned to a new genus, *Paracorallium*. The two genera are so close to each other and so different from everything else that they constitute their own family, *Coralliidae*.

SPECIES	DISTRIBUTION	CITATION
<i>C. abyssale</i>	Hawaii	Bayer 1956
<i>C. borneense</i>	Borneo	Bayer 1950
<i>C. ducale</i>	Eastern Pacific Mexico	Bayer 1955
<i>C. elatius</i>	Pacific waters around islands of Japan and Taiwan; Mauritius	Ridley 1882
<i>C. halmaheirensis</i>	Indonesia	Hickson 1907
<i>C. imperiale</i>	Eastern Pacific Mexico	Bayer 1955
<i>C. inutile</i> *	Japan	Kishinouye 1903
<i>C. japonicum</i> *	Pacific waters around islands of Japan and Taiwan;	Kishinouye 1903
<i>C. johnsoni</i>		Gray, 1860
<i>C. kishinouyei</i>	South of Hawaii	Bayer 1996
<i>C. konjoi</i>	Pacific waters around islands of Japan and Taiwan;	Kishinouye 1903
<i>C. laauense</i>	Hawaii (very abundant)	Bayer 1956
<i>C. maderense</i>	Eastern Atlantic	Johnson 1899
<i>C. medea</i>	Straits of Florida to Rio de Janeiro, Brazil	Bayer, 1964, Castro et al. 2003
<i>C. niobe</i>	Western Atlantic	Bayer, 1964
<i>C. nix</i> *	New Caledonia	Bayer 1996

<i>C. regale</i>	Hawaii	Bayer 1956
<i>C. reginae</i>	Indonesia	Hickson 1905
<i>C. rubrum</i>	Mediterranean: from Greece and Tunisia to the Straits of Gibraltar including Corsica, Sardinia and Sicily. Eastern Atlantic: Portugal, Morocco, Canary and Cape Verde Islands.	Linnaeus, 1758
<i>C. salomonense</i> *	Indian Ocean	Bayer 1993
<i>C. secundum</i>	Hawaii, Pacific waters around islands of Japan, Taiwan, Hainan, in 'straights' of Hong Kong	Dana 1846
<i>C. stylasteroides</i> *	New Caledonia	Ridley 1882
<i>C. sulcatum</i>	Japan	Kishinouye 1903
<i>C. thrinax</i> *	New Caledonia	Bayer & Stefani 1996
<i>C. tortuosum</i> *	Hawaii	Bayer 1956
<i>C. tricolor</i>	Eastern Atlantic	Johnson 1898

Mediterranean Trade

Mediterranean *Corallium rubrum* has been drastically under-regulated and over-harvested and dramatically reduced output compared to the ancient and historical fisheries (Torntore, 2002). *Corallium rubrum*'s rarity, the high costs of dangerous and labor-intensive harvesting, the long time required for coral to grow to usable size, and the fact that ninety percent of the harvested coral is considered waste, all create a valuable material that compares to the value of gold or diamonds in markets today as well as historically (Liverino, 1989, 1998; Webster, 1975; Yogev, 1978).

Analysis of GFCM figures from 1988 indicate that the Mediterranean yields about 72.6 tons of coral a year (Cattaneo-Vietti and Cicogna, 1993). Torre del Greco, Italy, the traditional 'world capital' for coral artisan products, is currently estimated to be sourcing only 30% of their raw material from the Mediterranean with the remaining 70% coming from Japan and Taiwan's fisheries (Castiligliano and Liverino, 2004). Working with trade data from by (Stampacchia and De Chiara, 2000), Dr. Susan Torntore calculated that the average annual value of coral exports from the Torre del Greco region alone amounted to nearly \$30 million USD (Torntore, 2002).

Corallium Trade in Asia

As was stated above, in 1982 the value of the pink coral industry in Taiwan and Japan was about \$50 million. Until 1965 the Pacific fishery for *Corallium* was centered on grounds off Japan, Okinawa, the Bonin Islands, and Taiwan. Additional information on the precious coral trade in Asia is available in the primary literature that is mostly written in Japanese and other Asian languages. We hope to get additional access to this information in the future.

Impact of *Corallium* Trade

Garrabou and Harmelin (2002) state that intensive harvesting is the major and oldest source of disturbance in red coral populations. Although partial, data on fisheries attest that harvesting has driven a dramatic shift in the size structure of red coral populations in the Mediterranean, i.e. from virgin mature populations comprising large-sized colonies to populations only composed of colonies below the smallest commercial size.

In general, unregulated, unsustainable collection of corals may

- 1) lead to overexploitation, localized extinctions, and reduced coral diversity;
- 2) result in reduced recruitment potential of that species;
- 3) cause loss or destruction habitat for fish and other animals.
- 4) harm local communities who benefit from commercial and subsistence harvest of fish and other animals (including for basic food security)

Unsustainable coral harvest to supply international markets can contribute to changes in species composition and abundance, and may lead to severe localized depletions. In addition, coral collection may cause reductions of live coral cover and loss of rugosity, with cascading impacts on fish and invertebrate abundance and diversity (Dulvy et al. 1995).

The Mediterranean red coral, *Corallium rubrum* can reach 50 cm in height and have a mass greater than 2kg. However, colonies taller than 20 cm and thicker than 2 cm in basal diameter are very rare because of the fact that commercial take has removed most of the larger individuals (Barletta, Marchetti & Vighi 1968; Liverino 1989). Therefore commercial take has been shown to significantly alter the size and age structure of coral populations and subsequent reproductive output.

Garrabou and Harmelin (2002) measured (basal diameter and height) of 400 colonies. They compared results from 10 currently harvested populations and two non-harvested populations to analyze population recovery and potential maximum size of colonies. Harvested populations showed values that were about twice as low on average and up to four times lower for maximum values in colony size than in the nonharvested populations. The study showed that current populations have shown a dramatic shift in their size structures characterized by the absence of large colonies. From this work, Garrabou and Harmelin (2002) conclude that full recovery time of shallow-water harvested populations of red coral may be measured by several decades or even centuries.

There is also indirect evidence from other deep water coral species that indicates red coral harvest techniques can have negative impacts on the surrounding habitat. Corals are important natural resources that provide valuable habitat for a large number of associated organisms. This includes sites for the attachment of

sessile invertebrates and structural relief that shelters fishes and motile invertebrates. The harvest of corals has potential long-lasting effects on the structure and function of coral ecosystems due to their vulnerability to overexploitation, slow rates of growth, and irregular recruitment.

Red corals were traditionally harvested using dredging equipment, which is non-selective and can cause widespread damage. The use of the most destructive type of dredging equipment used in the Mediterranean, (known as the *ingegno*), has now been banned throughout the Mediterranean Sea. All non-selective fishing methods have also been banned in some parts of the Pacific, such as Hawaii. However, in many parts of the world, coral continues to be harvested with non-selective gear that causes widespread damage to surrounding seafloor habitat.

Summary

This document presents information to request that the U.S. Fish and Wildlife Service submit a proposal to include red and pink corals (*Corallium sp.*) in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Deep-sea coral species exhibit life history characteristics that make them particularly vulnerable to overexploitation.

This document presents the current information available on *Corallium sp.* biology, management programs, trade data, and the manner in which trade is detrimental to species survival. The demand for *Corallium* products has created a consumer market which combined with anthropogenic habitat destruction, and climate change threatens population persistence. As a result it is clear that trade in *Corallium species*, particularly from locations that do not have proper management plans in place, threatens the existence of these species. Finally, inclusion of the species in this taxon in CITES Appendix II will assist the United States in enforcing its domestic (federal and state) laws and regulations pursuant to conservation and protection of these species.

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