Sustain Fish

Proceedings of the International symposium on
"Improved sustainability of fish production systems
and appropriate technologies for utilization"
held during 16-18 March, 2005
Cochin, India

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A critique towards the development of a Marine Ornamental Industry in India

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Abstract

The marine ornamental industry has been expanding rapidly in recent years and the global annual marine ornamental trade is estimated at US$ 200 – 330 million. Nearly 98 % of the marine ornamental species marketed are wild collected mainly from coral reefs of tropical developing countries. This has been threatening the long term sustainability of marine ornamentals due to the indiscriminate exploitation of coral reef area by the use of explosives, electro fishing devices, chemical poisons and intoxicants. In addition to damaging techniques of collection, the over harvesting of target organisms and the high level mortality associated with insensitive shipping and poor husbandry practices also lead to depletion of wild stocks. This calls for an urgent need to evolve biologically sustainable management measures for marine ornamentals. The general strategies of conservation which can be advocated include limited access to fishery, fixing quotas, size limits, creation of marine reserves and temporary closures. India is bestowed with vast marine ornamental resource and even though a good deal of collection of marine ornamentals is in vogue in many of the Indian reef areas, till date no marine ornamental fisheries policies have been formulated. It is time to develop an organized marine ornamental fishery in India by formulating proper policies and management measures to ensure its sustainability. The Central Marine Fisheries Research Institute and National Bureau of Fish Genetic Resources can jointly develop a certification system on similar lines with the standards developed by the Marine Aquarium Council (MAC). A few entrepreneurs can be licensed to collect suitable species from selected areas by ecofriendly collection methods. Availability of necessary infrastructure for conditioning and maintaining of the harvested species should be one of the prerequisites for issuing license for an entrepreneur. The species thus collected and maintained by entrepreneurs can be certified and an export trade for the same could be developed by the Marine Products Export Development Authority. The impact of exploitation should be closely monitored by scientific institutions and the necessary management measures have to be recommended as and when required. Another option to promote the marine ornamental industry is to develop and improve technologies for culture of desired species for the trade. The sustainable exploitation of wild collected and certified varieties for trade coupled with tank reared species can lead to a long term sustainable marine ornamental industry in India.

Keywords: *Global trade, Wild collection, Coral reef habitats, Finfish, Corals, Live rocks, Culture of ornamentals, Management strategies*

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1. Introduction

It is well understood that India has a wealth of marine ornamental animals in our island ecosystems of Lakshadweep and Andaman-Nicobar, besides many areas of mainland. In the context of the expanding global marine ornamental fish trade in recent years it appears that India has the potential to develop a lucrative marine ornamental fish trade. A critical assessment of the current global scenario of marine ornamental trade can provide much insight into the complexities and conservational issues associated with trade, which will be of much relevance while formulating policies for the development of a marine ornamental industry in India.

2. Global scenario

A detailed compilation of the global trade on marine ornamental species has been given by Colette *et al.*, (2003). It is estimated that 1.5 – 2.0 million people worldwide keep marine aquaria (Green, 2003), and the value of annual marine ornamental trade is estimated to range between US$ 200 – 330 million (Chapman and Fitz-coy, 1997; Larkin and Degener, 2001). Almost the entire trade is contributed by collections from coral reef habitats which raises doubts regarding its sustainability (Inskipp, 2003). The damaging techniques such the use of Sodium cyanide are non selective methods used to capture fish and they adversely affect the health of the fish and kill the non target organisms (Erdmann, *et al.*, 2000). The over harvesting of target organisms is another aspect of concern (Moore and Best, 2001). In addition there are high levels of mortality associated with insensitive shipping and poor husbandry practices (Oliver, 2003; Balboa, 2003).

Based on Global Marine Aquarium Data Base (GMAD) the annual global trade is between 20-22 million numbers for marine ornamental fish, 11-12 million for corals and 9 – 10 million for marine ornamental invertebrates. A total of 1,471 species of fish are traded globally. (Colette *et al.*, 2003)Most of these species are associated with coral reefs. According to the data provided by the exporters, the Philippines, Indonesia, the Solomon Islands, Sri Lanka, Australia, Fiji, the Maldives and Palau together supplied more than 98 % of the total number of fish exported. According to GMAD trade records from importers for the years 1997 – 2002, the United States, the United Kingdom, the Netherlands, France and Germany were the most important countries of destinations comprising 99 % of the all important of ornamental fish.

3. Ornamentals

3.1 Finfish

The most commonly traded family of marine fish was Pomacentridae, which accounted for 43 % of all fish traded. This is followed by species belonging to Pomacanthidae (8 %), Acanthuridae (8 %), Labridae (6 %), Gobidae(5 %), Cheatodontidae (4 %), Callionymidae (3 %), Microdesmidae

(2 %), Serranidae(2 %) and Blennidae (2 %). During the years 1997-2002, the blue green damsel fish (Chromis *viridis*), the clown anemone fish (Amphiprion *ocellarius*), the white tailed Dascyllus (Dascyllus *aruanus*), the sapphire devil (*Chrysiptera cyanea*) and three spot damsel (*Dascyllus trimaculatus*) were the most commonly traded species.

GMAD data showed that during 1988- 2002, the United States imported a total of 67,998 seahorses. The main exporters were Sri Lanka, Brazil, Indonesia and Philippines. *Hippocampus erectus* and *H.kuda* are the most commonly traded species and a large number of individuals are being traded as *Hippocampus spp.*

3.2 Corals

Corals include stony corals, soft corals and sea fans. According to GMAD, there are 61 species of soft corals and 140 species of stony corals in the trade.

3.3 Stony corals

According to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) data, (Colette *et al.*, 2003) the global live coral trade rose steadily from 1997 – 1999 with 934,463 live pieces and 11,402,242 live pieces being traded worldwide respectively in those years. The trade decreased to 942,661 pieces in 2001. Since the late 1980 Indonesia has become the largest coral exporting country. Data from 1997-2001 show Indonesia, Fiji, the Solomon Islands and Tonga together supplying more than 85 % of the live coral exports. The major importers of the stony corals are the United States, Japan, Germany, France, China, Canada, Netherlands and the United Kingdom together importing 95 % of the total live coral being traded worldwide.

The commonly traded genera include *Acropora* (Staghorn, cluster, Bluetip, Bush, Cat's paw or bottle brush coral), *Catalaphyllia* (Elegance corals), *Euphyllia* (Anchor/ Hammer coral), *Galaxea* (Galaxy coral), *Goniopora* (Flower pot coral), *Heliofungia* (mushroom Coral), *Lobophyllia* (Lobed brain coral), *Pterogyra* (Bubble/Grape coral), *Turbinaria* (Cup Coral),and Scleractinia . In addition GMAD also lists *Favia*, and *Porites* as common in trade. With exception of *Acropora* most other genera are slow growing and some occur in low densities. (Colette *et al.*, 2003)

3.4 Soft Coral

Most of the soft corals in trade originate from Indo Pacific Ocean. Although soft coral farming is simple, very few specimens are of cultured origin. GMAD data indicate that a total of 3, 86,849 species of live soft corals were traded between 1998 and 2002. The United States is the world's largest soft coral importers recording 67 % of the total trade of soft corals. Indonesia is the largest exporting country for soft corals. The most commonly traded soft coral genera are *Sarcophyton* (Leather/mushroom/Toad Stool coral), *Sinularia* (Finger / leather/ soft

finger/ Digitate leather coral), *Xenia* (Pulse coral), *Cladiella* (Cauliflower / finger / blushing / colt coral), *Clavularia* (Clove polyp), *Anthelia* (Waving hand polyp), *Lobophytum* (Finger leather coral), *Nephthea* (Broccoli Coral), *Dendronephthya* (Carnation / strawberry coral) and *Cespitularia* (Blue xenia).

3.5 Sea fans

Eight genera of sea fans appear in GMAD trade records – *Ctenocella*, *Echinogorgia*, *Ellisella*, *Euplexaura*, *Gorgonia*, *Lophogorgia*, *Pseudopterogorgia*, and *Rumphella*. The genus *Gorgonia* is the most well known and commonly traded sea fan.

3.6 Other ornamental invertebrates

Many invertebrates other than corals are popular in aquarium trade. According to GMAD, 516 species of invertebrates are being traded for aquarium trade. Between1998 – 2003, a total of 1,271,547 invertebrates are traded as per the records of GMAD. Mexico, Indonesia, Singapore, Fiji, Srilanka, the Philippines and Vanuatu were the main exporters. The main importers were United States, United Kingdom, the Netherlands, France, Germany, Italy and Canada. The main species in the trade were *Lysmata* spp., *Heteractis spp., Stenopus spp.,Turbo spp., Tridacna spp.,* and *Trcohus spp.*. Giant clams represent an increasingly large proportion of the export of live invertebrates for aquarium trade. Belonging to the family *Tridacnidae* and composed of two genera, of *Tridacna* (7 Species) and *Hippopus*(2 species), the giant clams are the largest bivalves in the world. The more brightly coloured *T.maxima*, *T.crocia* and *T.derasa* are the most popular in the marine aquarium trade. Unsustainable exploitation of giant calm species has led to the local extinctions of some species such as *T.gigas* in some areas (Hestinga, *et al.*, 1984).

3.7 Live rocks

Live rocks are pieces of coral rocks to which live specimens of invertebrates species and coralline algae are attached. Typical inhabitants of live rocks are anemones, tunicates, bryozoans, octocorals, sponges, echinoids, mollusks, sebellarids and serpulid tube worms and calcareous algae. According to CITES importers data the United States, the EEU, the Republic of Korea, Congo and Canada imported total of 3,897,664 pieces of live *Scleractina* spp. in which the large component was live rock. Fiji is the world primary supplier of live rock, and data shows that in 2001 more than 800 tonnes of live rocks were harvested from its reef. It is evident that the large scale removal of live rock, the result of hundreds of years of accretion can destroy a reef habitat, undermining the structure of coral reefs and leading to increased erosion as well as reduced biodiversity.

4. Issues associated with trade

4.1 Destructive collection practices

Since the trade is depended upon wild collection, the destructive collection practices, the introduction of alien species, over exploitation, the lack of scientific information on many species collected and threat to extinction of target species are the major problems. Destructive collection practices such as the use of sodium cyanide may destroy the coral reef habitat by poisoning and killing non target animals, including corals. During collection, many colonies of the branched corals are also broken for easy access to capture fish which take refuge in coral colonies. Collection of live rock is considered as potentially destructive as it may lead to increase erosion and loss of important fisheries habitat.

5. Impact on populations

When exploitation is at lower level in comparison with resource available there will not be any negative impact on reef populations. But it is a fact that all fishes are not equally attracted to industry and there will be selective exploitation for the most favoured species. The only systematic study assessing the effect of harvesting fish for the aquarium trade on resource populations was carried out in Hawaii (Tissot, 1999). The study reported that 8 of the 10 species most targeted by collectors showed decline in abundance at exploited sites relative to control sites. The selective harvesting of larger fish or juveniles due to their distinctive coloration and attractiveness can make the population vulnerable to over fishing.

6. Management strategies for a sustainable ornamental fish trade

Management of marine ornamental fisheries has to be implemented in such a way that they are biologically sustainable, do not conflict with other resource uses and keep post harvest mortalities to the minimum. Habitat damage and negative impact to the ecosystem have to be avoided. Species that are unsuitable to aquaria should not be collected. The establishment of marine reserves where the collection of marine ornamentals are made illegal, setting up of quotas and size limits, temporary closures and restricting access to the ornamental fishery through the use of permits can also reduce exploitation pressure. Governments and industry itself can play an important role in promoting best practice for a sustainable marine ornamental fish trade. In this context the core standards developed by the Marine Aquarium Council (MAC) deserves special mention (MAC, 2001). With a network of 2600 stake holders in more than 60 countries, MAC is recognized as a lead organisation for developing and coordinating efforts to ensure that the international trade in marine ornamental organisms is sustainable. Industry operators are certified through an evaluation for compliance with the appropriate MAC

standards for certification of practices and MAC certified bear the "MAC Certified" label on the tanks and boxes in which they are kept and shipped.

7. Culture of marine ornamentals

The ultimate answer to a long term sustainable trade of marine ornamentals can be achieved only through the development of culture technologies. It is well accepted as an environmentally sound way to increase the supply of marine ornamentals by reducing the pressure on wild population and producing juvenile and market sized fish of wide variety of fish year round. In addition hatchery produced fish are hardier and fair better in captivity and survive longer (Oliver, 2003). Eventhough techniques are available for culture of corals, according to CITES data only 0.3 % of the total global trade in live coral is from mariculture. Most branching corals can be easily propagated from small trimmings clipped from a parent colony and in about a year a five to ten fold increase in biomass can be obtained. Soft coral fragments can grow to marketable size within 4 – 12 months and stony corals like *Acropora* within 4 – 6 months. More than 75 species corals are bred under captivity, but fast growing corals appeared to be economically profitable.

The list of marine ornamental fishes reared in captivity today contains more than 84 species. The maximum number of species reared are from the family *Pomacentridae*. Attempts for spawning and rearing in closed systems have proved technically challenging for most species except Pomacentrids like *Amphiprion spp.* and the existing mariculture projects have been developed on a relatively small scale. The great obstacle to successful tank breeding of ornamental reef fish is rearing larvae beyond the 6^{th} to 8^{th} day of development, a time typically associated with failure to initiate larval feeding.

Artificial seed production techniques are available for giant clams and hence giant clam culture has increased considerably. Now there are successful giant calm hatcheries for aquarium trade, in most tropical pacific nations and island groups. The culture of ornamental invertebrates other than giant clams and cleaner shrimps is constrained due to lack of informations on key life history characteristics.

8. Indian Scenario

It is evident from the global scenario of the ornamental trade that eventhough the trade is very lucrative and is expanding rapidly the problems involved are complex and requires appropriate management strategies. If managed properly, the aquarium industry could support long term conservation and sustainable use of coral reefs.

In India, till date no organized trade of marine ornamentals has been initiated. But it is a fact that a great deal of illegal collection of marine ornamentals is in vague in many parts of our reef ecosystem and this is a matter of great concern due to the indiscriminate nature of exploitation and ecohostile methods of collection which damage the reef ecosystem. In addition to this, lack of knowledge on appropriate post harvest husbandry practices leads to large scale mortality of the collected animals. It is time to evolve a marine ornamental fisheries policy in the country for developing an organized trade of marine ornamentals. It is felt that eventhough the ideal situation is to develop a sustainable trade of marine ornamentals through tank reared species, it has to be admitted that development of commercial level breeding technologies of all the species of demand will take a very long time and if you have to wait till then, we may fail to enter into this lucrative global trade in the near future.

A critical analysis of current global trade of the marine ornamentals from wild collections reveals many ecological concerns which require policy interventions. The major aspect that should receive top most priority is for taking appropriate action to ensure that the development of the trade should not threaten the sustainability of the coral reef ecosystem. The destructive collection practices such as use of cyanide should be banned by legislation and enforced. Results from a recent study demonstrated that colonies of commonly traded species of corals and soft corals to varying concentrations of cyanide over different periods of time caused mortality in all corals. *Acropora*, the genus which is specifically targeted by fishers for collection of fish as they tend to hide amongst its braches is most vulnerable to cyanide exposure, showing rapid signs of stress and bleaching (Cervino, *et al.*, 2003). Another aspect of concern is the impact of exploitation on population due to selective harvesting of species which are of high demand in the trade. Here also policy intervention through legislation has to play a key role. Several countries in Asia and South America have begun to implement collection restrictions on certain ornamental fish species (Corbin and Young, 1995; Friedlander, 2001; Ogawa and Brown, 2001). Although no marine species collected for the aquarium trade have been driven to global extinction, studies carried out in SriLanka, Kenya, the Philippines, Indonesia, Hawaii and Australia have reported localized depletion of a number of targeted aquarium species due to heavy collection pressure. Studies have also shown that removal of larger quantities of cleaner wrasses and cleaner shrimps which play key roles in reef health creates negative impacts on reef diversity. The third aspect of concern is the exploitation of species which are not suited for aquarium. This also needs to be avoided by legislation. The fourth aspect which demands regulations is regarding the post harvest mortality. Research on marine ornamental trade between SriLanka and the United Kingdom demonstrated that in mid 1980's about 50 % fish died during and immediately after collection another 10 % during transport and 5 % in holding facilities (Wood,

1985). As a result of such mortally more fish often need to be collected for meeting the market demand. Where organisms are collected, stored and handled by adequately trained individuals and transported in suitable containers fish mortality have been very low. The post harvest conditioning facilities should include modern gadgets such as UV lighting system, protein skimmers and carbon filters.

In the light of the above it is evident that while developing a marine ornamental industry in India it is inevitable to formulate legislations on these issues which are of vital concern to the sustainability of the trade. It is suggested that a few number of entrepreneurs can be licensed to collect suitable species from selected areas using ecofriendly collection methods. Availability of necessary infrastructure and technical know how for conditioning and maintaining of harvested species should be one of the prerequisites for issuing license to an entrepreneur. The Central Marine Fisheries Research Institute (CMFRI) and the National Bureau of Fish Genetic Resources (NBFGR) can combine to develop a certification system on line with standards developed by the Marine Aquarium Council (MAC). The Marine Products Exports Development Authority (MPEDA) can take the lead to develop an export market for the certified varieties. The impact of exploitation has to be closely monitored by scientific agencies at periodic intervals and required management measures have to be implemented as and when required.

It is well accepted that the trade developed from tank reared fish and other ornamentals is the final solution for a long term sustainable trade. During the past few years, the Central Marine Fisheries Research Institute and Fisheries Division of Central Agriculture Research Institute (ICAR) have intensified research activities on breeding and culture of marine ornamental fishes. One of the recent achievements is the success in the hatchery production of clown fish and few damsel fishes (Gopakumar *et al.*, 2001; 2002, Ignatius *et al.*, 2001, Madhu and Rema, 2002). Research and development in the breeding and culture of marine ornamentals is a priority area which has to be intensified in the coming years. The high unit value of ornamentals makes them more commercially viable than marine food fish culture. In the immediate future India can emerge as one of the major source countries for a sustainable marine ornamental trade by formulating appropriate policy regulations for wild collection of species and also by commercial production of suitable species though the development of hatchery technologies for selected species.

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