

## Marine ornamental resources and management strategies

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Coral reefs form a very dynamic and productive ecosystem of the oceans. Marine ornamentals as well as a wide variety of invertebrates thrive in coral reefs making it a virtual paradise. The art of rearing and keeping fishes as well as invertebrates in aquaria has become a major hobby in recent times. The hobby had its origin in China and has spread all through the World. Even though majority of domestic aquaria are fresh water, in recent times there is an increase in keeping and maintaining marine aquaria. It is estimated that around 1.5 to 2.0 million people worldwide are keeping marine aquaria and nearly half of them are in US alone. Reef aquaria with marine corals and a variety of ornamentals is the trend of the 21<sup>st</sup> Century. The fascinatingly varied shapes and the brilliant and varying colours of the marine ornamental fishes, make them extremely fascinating pets worth spending time and caring in aquaria of a wide variety of shapes and materials. These multicolored pets in their naturally simulated closed environment of the aquaria are also said to have a therapeutic value in reducing stress in humans and this has increased the maintaining of aquaria in the corporate sector also. This has made marine ornamental fishes and other invertebrates living along with them in the coral ecosystem products of high value among the ocean resources.

The trade of marine ornamentals and the hobby of marine aquarium keeping has been expanding tremendously and has in recent times grown to a multimillion dollar enterprise mainly due to the following reasons-

1. Availability of glass aquaria of different shapes which are easy to clean and maintain
2. Water filtration gadgets of many varieties which lessens the maintenance time
3. Understanding of the new aquarium syndrome
4. Availability of a variety of live feed organisms and pelleted feeds of varying shapes and sizes
5. Availability of synthetic sea water
6. Proper lighting systems
7. Improved knowledge about the care of reef based organisms.
8. Availability of enough information through the internet.

### GLOBAL SCENARIO

The annual global marine ornamental trade is estimated around US \$ 200 to 330 million. In 2003, Asian countries had a major share of 56.3% with an export value of US \$ 123.92 million. The estimated whole sale value of the ornamental fish trade is around US \$ 1billion, while the retail value is around US \$ 6 billion. The entire industry, including accessories and fish feed is estimated to be worth more than US \$ 14 billion.

The aquarium industry has more than 1200 species of fish and 300 species of invertebrates in the trade with more than 45 countries. Knowledge base on these is very little.. Knowledge on life history, such as reproduction, larval dispersal, age at collection are important but are scanty. The ten species of fish that constitutes (account to 83% of international trade in aquarium marine fish) the greatest portion of the exports from the Western Pacific are *Zebrosoma flavescens*, *A. ocellaris*, *C. taupou*, *D. aruanus*, *C. viridis*, *A. percula*, *D. albisella*, *D. trimaculatus*, *Centropyge bicolor* and *C. bispinosus*. In the global trade, species of Pomacentridae dominate. They contain the clowns. This group is popular because of the combination of small fishes with varied colours and ease of care. Acanthuridae (sturgeon fishes), Pomacanthidae (angelfish) and Labridae (Wrasses) are also very popular (Edmund, 2003).

Indonesia and Philippines are the centre of fish diversity and as expected more species are exported from these two countries than any others. A survey of wholesale exporters and importers based on the membership of trade organizations found 276 companies in operation of which 144

are exporters and 132 are importers. Asia contributes more than 50% of the World supply of ornamental fish. Singapore by far is the largest exporter followed by Hong Kong, Indonesia, Malaysia and the Czech Republic (Katia Olivier, 2003). According to another estimate, in World export Singapore is followed by Malaysia, Czech Republic, Spain, Indonesia and Japan followed by China, (Hong Kong), USA, Israel, Thailand, Philippines and Sri Lanka (Tarlochan Singh & Dey, 2007). Compared to this India's share in export among the Asian countries is hardly 2.0%. However India is now among the top ten ornamental exporters in Asia. In international trade freshwater species account for 90% of the market value compared to 10% for the marine species. An estimate says that in the freshwater sector 90% are farmed and 10% are caught from wild whereas in marine sector 99% are collected from wild and nearly 1% is farmed. The importance of the marine ornamental fish trade goes far beyond its share in international trade; the sector is an important source of income for rural, coastal and insular communities in developing countries and is a very good provider of employment opportunities.

### **PROBLEMS IN THE ORNAMENTAL FISH TRADE**

Collecting ornamental fishes from wild can have very negative outcomes especially on the environment and the resource. Overexploitation and destruction to the natural habitat can cause irreversible changes in natural cycles. Over a period of time nothing can be done to rectify the damage and contribute to real waste of resources. Controlled breeding and rearing can contribute a lot in solving some of the problems.

#### ***Conservation and sustainability :***

The interrelationships between corals and marine ornamentals are not properly understood. Unless this is understood it is going to cause havoc since both these are having a symbiotic relationship. So the conservation and maintenance of this ecosystem is very important to all countries especially the developing nations. It is said that one km<sup>2</sup> of coral reef can produce up to 37 metric tones of fish. Most reefs are located in developing countries and occupy less than one quarter of 1% of marine environment. Direct and indirect benefits of reefs have an estimated value of US \$ 375 billion each year.

The positive impacts are socioeconomic benefits for the local people, and the indirect genesis of conservation tactics to keep the socioeconomic benefits of the people in control. Aquarium keeping also helps in appreciating nature and the coral ecosystem and an awareness of environmental conservation and hygiene. Aquarium keepers have made significant advances in our knowledge of understanding fish behavior, reproduction, feeding strategies and their growth and sustenance

#### ***Live rock :***

Live rock is any type of rock that contains organisms attached to it so that it can be used in a reef aquarium. Traditionally live rock was removed from the wild and sold. But now many countries have banned the harvest of live rock and this has initiated aqua cultured live rock in the trade. Live rock is also the habitat for a variety of organisms such as anemones, tunicates, bryozoans, sponges, echinoids, mollusks, tubeworms and calcareous algae. Survival of live rock in aquaria depends on high intensity lighting, effective protein skimming, good water movements etc. Live rock helps in keeping of the marine aquarium contributing to control of excess nitrogen levels. Live rocks act as natural bio-filters and provides habitat for motile fish and invertebrates. Aquaculture of live rocks is done at sea bottom or in tanks with re-circulating sea water especially in places like Florida

#### ***Live sand :***

Another component along with the ongoing evolution of the marine aquarium hobby is the use of live sand. As a substrate in the bottom of the aquarium, live sand is beneficial for the nitrification processes. The addition of live sand in marine aquaria helps improve the ability to maintain proper water chemistry and thereby a healthier marine life. Aquaculture of live sand in tanks is also a growing industry

### **HATCHERY PRODUCTION OF ORNAMENTALS AND CONSTRAINTS**

The future of marine ornamental fish farming depends on the ability to reliably produce



eggs, raise large numbers of larvae and grow them to juveniles. A large number of marine ornamentals (more than 110) have been spawned in captivity. However the early life stages remain a critical bottleneck in the mass scale production of marine ornamentals. Among the priorities are designing rearing systems that provide acceptable environmental conditions and identifying suitable live feed organisms for the different larval stages.

#### **Constraints in breeding :**

Complex patterns of sex change, which are determined by complex social structure of the fish colony - Small size of larvae, small amount of reserve yolk, smaller mouth gape of larvae, lack of needed types of live fed organisms and problems in mass rearing of these (eg. copepods). In the four types of reproduction patterns observed among marine fishes, the ornamentals can be categorized under the following -

- Producing floating pelagic eggs with complete lack of parental care, eg. Angel fish, butterfly fish, groupers, snappers, wrasses and parrot fishes.
- Egg attachers - showing nesting behavior, eg. Clown fishes, damselfishes.
- Oral egg incubators, eg. Cardinal fishes.
- Live bearers, eg. Sea horses.

### **INDIAN SCENARIO**

In India marine ornamentals are distributed in the Gulf of Mannar, Palk Bay and Gulf of Kutch along the mainland coast and in Andaman and Nicobar and Lakshadweep Islands (Murty *et al*, 1989; Vijayanand & Varghese, 1990). One estimate is that there are about 400 species belonging to 175 genera coming under 50 families occurring in the Indian seas. The marine ornamentals occurring in these areas are clowns, damsels, wrasses, lions, surgeons, butterfly's, cardinals, bats and angels.

As far as the distribution of ornamentals are concerned, in Lakshadweep islands over 600 species are reported (Jones & Kumaran, 1980). Survey and assessment of ornamental fish resources of Lakshadweep revealed that the maximum possible yield of 165 species of ornamentals belonging to 20 families per year is 76, 46,000 (Murty, 2000).

In the Gulf of Mannar and Palk Bay, with extensive coral growth, about 100 species of ornamentals belonging to 30 families are known. (Murty, 1969). Butterfly fishes, wrasses, damselfishes, rabbit fishes, scorpion fish and puffer fish are among the dominant ones. (Mahadevan & Nair, 1965; 1968; Nair & Mahadevan, 1965; 1967).

Andaman and Nicobar Islands offer a variety of habitats which provide potential areas for exploitation of a rich array of ornamentals. About 150 species of ornamentals are known to be available in these islands (Sen, 1973; Dorairaj, 1994). However the ornamental fish potential of many of the islands of Andaman and Nicobar (572 islands) has not yet been explored. Except some studies done randomly in Lakshadweep, Andaman and Nicobar islands and Gulf of Mannar areas, proper studies have not been made to clearly understand the standing stock of marine ornamentals. Wild collection of ornamentals as well as invertebrates is going on without any control in the Gulf of Mannar area. Fishes and invertebrates are flown from here to Sri Lanka and Maldives.

India can be considered as a sleeping Giant in marine ornamental fish trade with a vast and untapped resource. If properly managed, involving the local fishermen groups and in a holistic manner it can earn a sizeable foreign exchange even to a range of US \$ 30 to 50 million. The Marine Park in the Gulf of Mannar and the Wandoor National park in Andamans are the sanctuaries available now. Wild collection of ornamental fishes alone may certainly lead to ecological destruction and disturbances in the delicate biodiversity of the coral ecosystem wherein these fishes live. Hatchery production is the only viable method in promoting trade of ornamentals apart from a planned harvest of ornamentals from wild in a holistic manner. During the last few years ICAR Institutes as well as Marine science departments of Universities have intensified research activities in the captive propagation of important marine ornamental species. The Central Marine Fisheries Research Institute conducted pioneering work in such activities. Hatchery breeding protocols have been established for many species, namely, *Amphiprion sebae* - , *A. percula* - Orange clown, *A. ocellaris* - False clown,

*Premnas biaculeatus* - Maroon clown, *Pomacentrus caeruleus* - Blue damsel, *P. pavo* - Peacock damsel, *Neopomacentrus nemurus* - Yellowtail damsel, *N. filamentosus* - Filamentous tail damsel, *Chrysiptera unimaculata* - One spot damsel, *Dascyllus trimaculatus* - Three spot damsel, *D. aruanus* - Humbug damsel, *Chromis viridis* - Blue green damsel, *Hippocampus kuda* - sea horse, more specifically on clowns and damsels in research centers of CMFRI such as Vizhinjam, Cochin, Mandapam, Karwar and Calicut.

In spite of many issues and problems facing the marine ornamental trade in our country, we can make a good entry by concentrating on mass scale hatchery production of many species belonging to *Amphiprion*, *Pomacentrus*, *Neopomacentrus*, *Chromis*, *Dascyllus* etc. However the situation prevalent in India commands very serious perusal and attention of policy makers, governments, non governmental organizations, researchers , fishermen groups and traders.. A realistic picture of the above issues is discussed by Modayil (2003).

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