

**Proceedings of
NATIONAL WORKSHOP ON
ORNAMENTAL FISH CULTURE DEVELOPMENT IN INDIA**

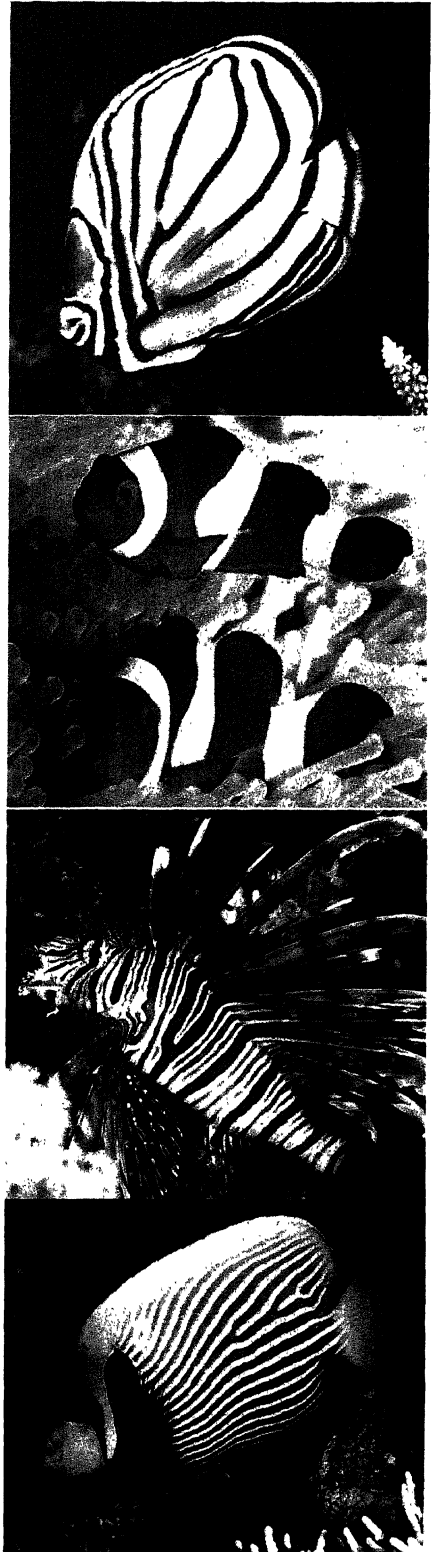
**22-23 February 2007
Chennai**



Published by

The Fisheries Technocrats Forum,
Chennai - 600 006

December 2008



SESSION - I

ORNAMENTAL FISH RESOURCES AND UTILISATION

POTENTIAL, PROBLEMS AND PROSPECTS OF ORNAMENTAL FISHERIES IN INDIA

A.G. Ponniah, T. Ravisankar and M. Kailasam

Central Institute of Brackishwater Aquaculture

75. Santhome High Road, R.A. Puram, Chennai-600 028

Abstract

The practice of keeping fish aquaria at homes, offices or hospitals has increased the demand for the supply of ornamental fishes of either freshwater or marine all over the world. Marine and fresh water aquaria are used as a tourist attraction in many cities. The major ornamental fish producing countries are mostly from Asia and Europe. The Eurasian region accounts for 71 % of global ornamental fish production and exports. The rest of ornamental fisheries are from Americas, Oceania and Africa. In Asian region, Singapore (34 %), Malaysia (15%), Indonesia (11%) and Japan (10 %) are the major suppliers in the ornamental fish trade. India figures out in the other minor supplier list with two per cent of global ornamental fish trade. In India, about more than 288 exotic species of ornamental fish have been recorded and 250 indigenous fresh water fish species and 150 marine water species have been identified as potential and suitable for tropical climate of India. This paper summarizes the current status of exploitation of wild stock, production through aquaculture and the biological and ecological potentials for ornamental fisheries in India.

Key words: Ornamental fish production from world and India; potential species, technology for production and future strategies.

Introduction

Fish keeping is an age old hobby. Chinese are the pioneers in ornamental fish keeping. Five hundred years ago, Chinese used a variety of containers for fish keeping such as dishes, bowls and small tanks that permitted viewing from the top for fish keeping. *Vivaria* made of indoor tanks and pools were used by Romans to advertise fresh food fishes in restaurants that were kept alive for use or for sale. Later on, *vivaria* were modified in to aquaria. First public aquarium was opened in Regent's Park, London on May 21, 1853 with the inspiration of Philip Henry Gosse, inventor of institutional aquarium. The other cities that quickly followed by London were Paris (1859), New York and Boston (1859), Hamburg (1864), Berlin (1869), and Brighton (1872), Washington (1873), San Francisco (1894) and Chennai (1909).

Nowadays traders keep fish for luck, *vasthu* or *feng-sui*; children and adolescents keep fish for fun and aged keep fish as pets and companion animals. Some psychiatrists advise their patients to keep fish to control psycho-somatic disorders like depression and high blood pressure. Now the aquaria has entered in houses, schools, tourist places, laboratories, offices, markets, colonies for amusement, education and also serve as an advertisement for fresh food fishes and aquatic animals/plants. Marine and fresh water aquaria are used as a tourist attraction in many cities. Export market and domestic demand for ornamental fish is fast growing. India has enormous potential in ornamental fisheries in terms of species and ecosystem diversities. But still ornamental fisheries in India are the neglected sector and remained untapped due to various reasons. This paper summarizes the current status, the biological and ecological potentials for ornamental fisheries in India, issues on production and marketing and future strategies for further development.

Global scenario of ornamental fish culture and trade

According to FAO statistics and Global Marine Aquarium Database, global ornamental fish trade constitutes less than 0.5 per cent of the total fish traded. While the ornamental fishery provides multiple linkages such as demand for accessories, feeds and creation of jobs in interrelated trading sectors. Ornamental fish culture also ensures socially equitable distribution of benefits along the value chain as this activity is time bound, labour intensive and livelihood options of vulnerable sections of the society like house-wives and unemployed youth (Ghosh *et al.*, 2003). An FAO committee constituted in 2002, noted that small-scale aquaculture for ornamental fish could be beneficial in terms of reduced pressures for over-harvesting of wild ornamental species and contribution to sustainable livelihoods. An analysis of FAO 2006 data revealed the following major points about global ornamental trade (Rana, 2007).

- ♦ Developing countries from tropical and sub tropical regions are the major sources of live aquatic ornamental products. Singapore, Czech Republic, Japan and Malaysia are key producers and United States of America (USA), European Union (EU), Japan, France are major consumers. Singapore imports and re-exports acting as a market 'hub' in Asia.

- ♦ Marine fishes are wild caught and fresh water fishes are cultured using technologies that are being applied to food fish.
- ♦ Singapore and Sri Lanka are well-known and established suppliers in global ornamental fish trade.
- ♦ Ornamental fish production is notably increasing from Czech Republic, Malaysia, Thailand, and India in recent times.
- ♦ USA is the major producer, importer, and exporter and Czech Republic is major producer and exporter in the EU.
- ♦ USA and China allow Genetically Modified Organisms (GMO), in ornamental fishes while EU and Singapore shun GMOs.

The major ornamental fish producing countries are mostly from Asia and Europe. The Eurasian region accounts for 71 % of global ornamental fish production and exports. The rest of ornamental fisheries are from Americas, Oceania and Africa. In Asian region, Singapore (34 %), Malaysia (15%), Indonesia (11%) and Japan (10 %) are the major suppliers in the ornamental fish trade. India figures out in the other minor supplier list with two per cent of global ornamental fish trade. The data presented in Figure.2 obviously reveal India's slow-moving development in the ornamental fish trade while comparing with much smaller counties like Singapore and Sri Lanka, which are much ahead of India. Major consumers and importers (which include demand for re-exporting) are USA (24%), UK (10 %), Germany (10%), Japan (9%), France (8%), and Singapore (5%).

Potentials of ornamental fish culture in India

Ornamental fish culture is an excellent business opportunity in India since there is strong demand from domestic and export markets. Ornamental fisheries in India have a good potential due to enormous geographical spread, extensive species diversity, and intensive research and development efforts that are already put in by the associated institutions.

Geographical spread

Indian ornamental fish trade is mostly with fresh water fishes (90%) of which 98 percent are cultured and two per cent are captured from wild. The rest 10 per cent of total ornamental fish trade are with marine fishes of which 98 per cent are captured and two per cent from cultured. With tropical climate, Western Ghats and North Eastern Ghats are 'hot spots' or important areas identified for ornamental fish breeding and culture (Mercy *et al.*, 2003). Chennai, Kolkata, Mumbai, and Kochi are established business sites of ornamental fish trade. Of late, Goa is also emerging as an important centre in this business. Most ornamental fish trade from these centres are of mixed type of freshwater and marine fishes. Major portion of ornamental fish export is done from Kolkata (90%), followed by Mumbai (8%) and Chennai (2%). In Kolkata, ornamental fish farms are located in North and South 24 Parganas, Nadia, Hooghly and Howrah districts and about 2000 people are involved in this trade. However, mostly freshwater ornamental fish species are cultured here. In Tamil Nadu, Kolathur village near Chennai is famous for ornamental fish production as cottage industry. There are about 600 families involved in this activity and they earn about Rs. 5,000/month per household. In Kerala, Marine Products Export Development Authority (MPEDA) and Kerala State Cooperative Federation for Fisheries Development (Matsyafed) have provided financial assistance to more than 500 farmers belonging to 11 Districts for ornamental fish culture. A proposal to set up two techno parks of ornamental fisheries one each in Ernakulam and Kollam districts is also in pipeline. The Fish Farmers Development Agency (FFDA) and Krishi Vigyan Kendra of Central Marine Fisheries Research Institute also provide training to the farmers in ornamental fish culture in Kerala. The Department of Fisheries, Tamil Nadu Government has proposed to establish an ornamental fish farm at an initial cost of Rs. 3 crores, near Perungalathur, a suburb of Chennai city. An ornamental freshwater fish farm by a Women Self Help group belonging to tribal families of Irula community is functioning well in the same locality.

Species diversity

In India, about more than 288 exotic species of ornamental fish have been recorded and more than 200 species of these are freshwater fishes are bred in different parts of India and still other species are imported as fry (Mahapatra *et al.*, 1999). A total of 400 species (250 indigenous fresh water fish and 150 marine fish) have been identified as potential and suitable for tropical climate of India (Rana, 2007; Sane, 2007).

Research and Development in Ornamental fish production

Research and Development (R&D) Centres in India like Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar, Central Marine Fisheries Research Institute (CMFRI), Kochi, College of Fisheries (CoF), Panangad, Kerala Agriculture University, College of Fisheries, Agartala and Centre for Advanced Studies in Marine Biology, Annamalai University, Parangipettai (CAS-MB) have standardized technologies for breeding and culture of many of the ornamental fish. The following section gives a partial list of species for which the R&D centres mentioned above made some technological advancement:

Freshwater ornamental fishes

A preliminary survey carried out in a National Agricultural Technology Project (NATP) project entitled "Germplasm inventory, evaluation, and gene banking of freshwater fishes" found more than 155 freshwater fishes that have potential as ornamentals. The institutions and species of their interest are the following:

CIFA, Bhubaneswar

Live bearers: Guppy (*Poecilia reticulata*), Molly (*Poecilia latipinna*), Swordtail (*Xiphophorus helleri* and *Platy* (*Xiphophorus maculatus*).

Egg layers: Cyprinidae (Carps, barbs, rasboras, danios, tetras, catfishes) – Goldfish (*Carassius auratus*), Koi carp (*Cyprinus carpio* var *koi*), Zebra Danio (*Brachydanio rerio*), Black widow tetra (*Gymnocorymbus ternetzi*), Neon tetra (*Paracheiridon innesi*), Serpae tetra (*Hyphessobrycon eques*), Cichlids– Angel fish (*Pterophyllum scalare*), Red line torpedo fish (*Puntius denisoni*), Loaches (*Botia* sp.) and Snakehead (*Channa orientalis*).

College of Fisheries, Panangad, KAU, Kerala –R&D on freshwater ornamental fish (funded by ICAR under the NATP)

Black spot barb (*Puntius filamentosus*), Melon barb (*Puntius fasciatus*, *Puntius melanostigma* and *Puntius pookodensis*), Mullya garra (*Garra mullya*), Malabar Danio (*Danio malabaricus*), Malabar hatchet chala (*Chela fasciata*), Batik loach (*Nemacheilus triangularis*, *Nemacheilus semiarmatus*) and Malabar leaf-fish (*Pristolepis marginata*).

College of Fisheries Agartala, North East- R&D for freshwater ornamentals (funded by ICAR under the NATP)

Spotted spiny eel (*Macrognathus aculeatus*), Golden snakehead (*Channa stewartii*), Giant Danio (*Danio aequipinnatus*), Blackline rasboras (*Rasbora daniconius*), Giant Gourami (*Colisa fasciata*), Dwarf Gourami (*Colisa lalia*), Day's Mystus (*Mystus bleekeri*) and Ticto barb (*Puntius ticto ticto*)

Marine ornamental fishes

Potential marine ornamental fish species resources found in India are: Clown fish, Damsel fish, Moorish idol, Lion fish, Parrot fishes, Box fishes or trunk fishes. Marine angels, Butterfly fish, Cleaner wrasse, Cardinal fishes, Surgeon fishes, Hawk fishes, Bat fishes, Puffer fishes and Seahorses. CMFRI, Kochi and CAS-MB, Parangipettai have made some progress with following species.

CMFRI - marine ornamental fishes and invertebrates:

Clown fishes (*Amphiprion chrysogaster*, *A. sebae*), Sea horse (*Hippocampus kuda*), Star fish (*Peataceraster regulus*), Damsel fishes (*Neopomacentrus filamentosus*, *N. nemurus*, *Pomacentrus caeruleus*), Cuttle fish (*Sepiella inermis*). Abalone (*Haliotis varia*), Sea cucumbers (*Holothuria scabra* and *H. atra*).

CAS-MB, Annamalai University, Parangipettai

Sabae clown fish (*Amphiprion sebae*), Orange clown fish (*A. percula*), Clown anemone fish (*A. ocellaris*), Yellow tail clown fish (*A. carkii*), Spinecheek anemone fish (*Premnas biacueatus*), Coral demoiselle (*Neopomacentrus nemurus*), Caerulean damsel (*Pomacentrus caeruleus*), White tail dascyllus (*Dascyllus aruanus*) and Three spot dascyllus (*D. trimaculatus*).

Prospectus of ornamental fish culture in India

Ornamental fish culture is a seasonal enterprise as the breeding and consequent seed production during certain period are taking place. For better utilisation of ornamental culture facility, it is obligatory to combine breeding operations with major species suitable for each season. An innovative entrepreneur can earn much higher profits by implementing such imaginative ideas. However, a typical computation of financial analysis of a model ornamental fish-breeding centre will be as the following.

Financial viability

A small ornamental fish-breeding unit with hatchery tank area of 100 sq.m and hatchery total area of 330 sq.m has reported to incur a fixed cost of Rs.6,45,000/- and Rs. 35,500/- as revolving variable costs per year (NABARD, 2007). The breakup of expenditure shows a high percentage is spent on civil works (77%) and equipment (18%) in fixed costs. In variable costs labour (33%), feed (32%) and brooders (16%) are the important components. The Net

Present Worth of discounted benefits stream is Rs.9, 21.168 and the Net Present Worth of discounted costs stream is Rs. 6, 76,731 for a project cycle of six years. This leaves a Net Present Worth of Rs.2, 44, 436 to the entrepreneur. The Benefit Cost Ratio is 1.36:1 and Internal Rate of Return (IRR) works out to 35 per cent. These indicators compare well with any of the rural enterprise like agriculture and livestock rearing which hover around 20- 30 per cent IRR.

Problems of ornamental fish culture in India

The most important issues that affect the development of ornamental fish culture in India are issues related to biological characteristics of candidate species, domestic development, and export markets and they are discussed below.

Issues related to biological characteristics:

The major issues related to biological characteristics are introduction of alien species and pathogens and damages caused by destructive fishing.

a) Introduction of alien species: Ornamental fish culture could become one of the main pathways of inadvertent introduction of alien species. Awareness and perception of public regarding this is limited and scientific studies on this aspect are incomplete. If quarantine protocols are not strictly enforced and adhered to, the unintentional introduction of alien pathogens is quite possible.

b) Destructive fishing: Sometimes ornamental fish captured with sodium cyanide that has rapid narcotic effect die after five months due to liver damage caused by cyanide. In wild collection, 50 per cent die immediately after collection and 10 per cent die during transport and 5 per cent die in holding facilities (Wood, 1985). There may be also chance damages to non-target organisms.

Suggestions on issues related to biological characteristics

Awareness and science based management of alien species: All the stakeholders of ornamental fish culture and trade should be aware of importance of this issue. Care must be taken in all the points of supply chain ensuring the protocols with regard to introduction of alien species are properly followed and unintentional introductions do not happen.

Effective conservation and management of ornamental fishes: The work of listing species and geographic locations of ornamental fish species and determine maximum levels of exploitation for each species must be completed at the earliest. A technical ban on indiscriminate exploitation of brooders and juveniles of ornamental fish species may be imposed. Sanctuaries for ornamental fish could be established as done in Peruvian Amazon. Ornamental fish capture, culture, and trade should be monitoring jointly by a team of forest rangers, State fishery staff, and customs officials. Public awareness should be created on sustainable and effective fish collection and post handling and certification and labeling of ornamental fish species.

Issues of domestic development

The four major issues that limit the domestic development of ornamental fish culture are 1) poor awareness on the importance of ornamental fish species as an livelihood option among the stakeholders, 2) knowledge skill gaps that currently exists among the stakeholders to undertake ornamental fish culture, 3) inadequacy of present level of technical and extension support especially on disease management and 4) imperfections in the domestic market channels of ornamental fish culture.

Suggestions on issues of domestic development

The suggestions to overcome the issues or bottlenecks in domestic development in ornamental fish culture listed above are given below:

- ♦ Central and State Governments should initiate new developmental schemes for ornamental fish culture.
- ♦ Establishment of zone wise model ornamental fish farms will help in popularising the ornamental fish culture.
- ♦ Involvement of rural women and self-help groups in ornamental fish farming should be encouraged.
- ♦ Setting up of more public aquaria in cities and towns will help in awareness building among public.
- ♦ Extension methods should be revamped to attract and motivate the fish farmers to take up ornamental fish culture.
- ♦ Promotion of ornamental fish culture could also be done through aqua-clinics.
- ♦ Government and leading NGOs should take a proactive role in perfecting the marketing channels for fair and equitable sharing of benefits generated by ornamental fish trade

Issues of export development

The important issues of export development are mostly due to lack of clarity on issues and policies and inadequate co-ordination among the departments.

Lack of clarity on the alien species: As discussed above, lack of clarity on the issue of the alien species do affect ornamental fish trade also.

Quarantine system: The protocols established on quarantine system should be strictly followed to avoid problems caused by unintentional introductions of alien species or pathogens.

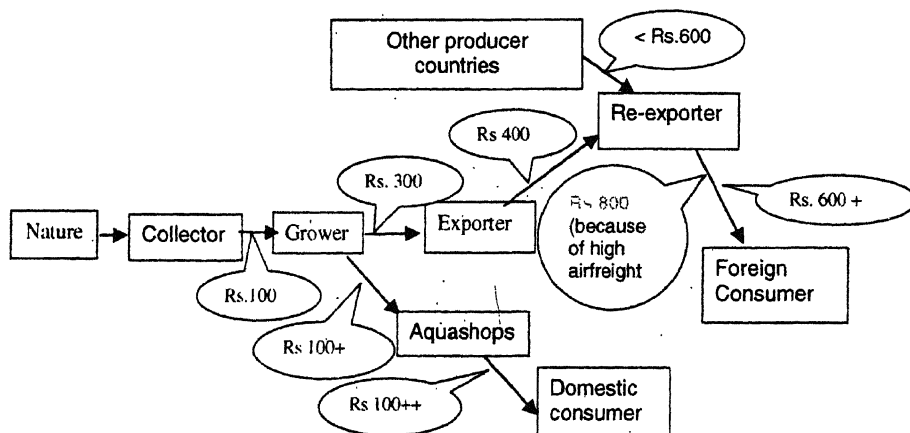
Policy support: Conducive policies are needed for initiating a large scale ornamental fish culture in India. The access to technology, credit, and marketing should be made as smooth as possible by adopting a right mix of policies.

Lack of inter departmental coordination among departments: Ornamental fish culture and trade involve many departments including Central/State Fisheries, Forest & Wild Life, Surface and Road Transport, Civil aviation, Customs and host of many other departments. Practically no coordination exists at present among these departments.

Technology up-scaling: Up-scaling from research to large-scale production is also a bottleneck in many of the cases. According to Sane (2007), a practitioner of ornamental fish trade in India revealed following technical points related to commercial up-scaling of ornamental fish culture:

- ♦ Ornamental fish markets need more variety than huge volumes of single species. Bulk production of single or few species leads to exporting to re-exporting countries at throwaway prices.
- ♦ Veterinary/health certificates should be issued per shipment basis, instead of present per species charge of about Rs.100 as at least 20 varieties are shipped per shipment.
- ♦ Present high rates of airfreight charges make export of ornamental fish from India uncompetitive (Rs.800 for direct export from India, while the same is made available by re-exporters at about Rs.600) as explained in value chain map in Fig. 1.

Fig. 1. Value chain map of endemic ornamental fish from India



Suggestions on issues of export development

R & D Centres should give importance for developing appropriate technology package with regard to propagation, breeding, and culture of indigenous ornamental fish species and the specific suggestions are:

- ♦ More R&D investments are needed to develop colourful strains of indigenous species through genetic selection.
- ♦ Overall policy support and inter-ministerial coordination is crucial for reduction in air freight.
- ♦ Consultations should be held with industry partners on alien species issue and a 'white' and 'black' list of alien species should be agreed up on.
- ♦ 'National Strategic Plan on Alien species' should be implemented in letter and spirit ensuring safe quarantine system.
- ♦ Public-private partnership is essential for up-scaling and should be encouraged in all forms.

- ♦ Well-organized ornamental fish value chain should be established with the objective of promoting equitable benefit sharing by all.

Conclusion

Today, culture of ornamental fish for aquarium is a rewarding industry and fish keeping indoors is a more popular hobby. With raising incomes of the public in general, fish keeping is no more a luxury. India is described as the 'sleeping giant' in ornamental fish culture. With right policy initiatives, the great potentials of India in terms of species diversity, geographical spread and R& D efforts already put in. Ornamental fish culture can tremendously contribute livelihood security of the rural poor and augment the national income in more socially equitable way.

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