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HARNESSING ORNAMENTAL FISHERIES RESOURCES FOR SUSTAINABLE GROWTH AND DEVELOPMENT: A TRADE PERSPECTIVE FROM KERALA, INDIA

Shyam S. Salim[1*], Sirajudheen, T.K[2]., Biju Kumar, A[2]., Pramod Kiran, R.B[2]. and Premdev, K.V[3].

[1]Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P.O., Kochi-682 018, Kerala.

[2] Department of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram- 695581. [3]The MPEDA, MPEDA House, Panampilly Avenue, PB No. 4272, Cochin-682 036

**Email: shyam.icar@gmail.com*

Abstract: Ornamental fish trade has gained paramount importance with more than 125 countries involved in the freshwater and marine fishes. The global trade is estimated to be around US $ 450 million registering a growth rate of ten percent since 2001. Asia caters up to 60 per cent of the global trade while India stands with a dismal 0.9 per cent with a portfolio of 30-35 fresh water species. The ornamental fish resources of Kerala has huge potential with untapped and unexploited resources. However the performance of the sector is not worthy and production is much below the demand. The SWOL analysis - Strengths, Weaknesses, Opportunities and Limitations analysis - is done to analyse the status of ornamental fish industry in Kerala. The results indicated that good export market, high demand, availability of under-utilized marine resources, potential for rural development, low cost effort, efficiency of ornamental fish marketers, institutional support for development and promotions were the major strengths. Dependence on wild caught species, inadequate data on resources, wastage of resources, unwillingness towards marine fishes, lack of trained/ skilled manpower and organized trade, lack of adept technologies, poor marketing facilities, backwardness in international market, weak market image and lack of fishing regulations were the major inherent weaknesses. The major opportunities were enhancement of species portfolio, increasing market value, less capital intensive, high popularity and demand, breeding and culture of indigenous fishes, faster market growth, entry to new market destinations, increased awareness of international buyers and support of government. Technological backwardness, technology transfer, insufficient awareness programmes, adverse government policies, competitions from neighboring countries, sustainability of resources and drastic drop in fish prices were the major limitations. The study suggests concerted efforts by the different stakeholders to enhance the production of the sector.

Keywords: SWOL Analysis, Indigenous fishes, Ornamental fish marketers, Organized trade, International trade, Market image, Species portfolio, Market growth, Technological backwardness

INTRODUCTION

Ornamental fish keeping is the second most popular hobby after photography and is an expanding multi-million dollar industry. The popularity of this hobby even in faraway places resulted in the marketing of ornamental fishes and currently this is among the leading industry in the aquaculture economy. The aquatic ornamental sector is undoubtedly the industry which transfers the largest numbers of animals globally. The establishment of scientific and technological advancements has led to an increased demand for freshwater as well as marine aquarium fishes in recent years and this has opened up new avenues for developing a lucrative and money-spinning trade for ornamental fishes.

The trade constitutes 80-90 per cent freshwater ornamental fishes and only the rest being supported by marine ornamental fishes (Dey,

2006; Kurup and Antony, 2010; Tissera, 2010). Dey (2010) reported that over 3.5 million hobbyists constitute this trade on a global basis. At present more than 125 countries are involved in the trade of freshwater and marine fishes (Dey, 2010; Kurup and Antony, 2010). In the last decade, the ornamental exports and imports grew from US$ 167.6 million and US$ 245.6 million, respectively in 1999 to US$ 343.9 million and US$ 349.4 million, respectively in 2008. The latest FAO statistics presented the world ornamental fish trade as US $ 731 million with an annual growth rate of about 10 per cent, of this US $ 392 million is from imports and US $ 339 million is through exports (FAO, 2007-2011). Asia stands up as the largest supplying region of this flourishing industry and catered up to 60 per cent of global demand, including both marine and freshwater fishes (Dey, 2006, 2010; Nair, 2006; Ahilan and Walkhom, 2007; Tissera, 2010; Kurup and Antony, 2010).

The export of ornamental fishes from India started on an experimental basis in 1969 with foreign exchange earnings to the tune of US $ 0.04 million (16.4 lakhs) and grew to US $ 0.99 million (443.84 lakh) in 2004-2005 (Sekharan, 2006) and to 555 lakh in 2006-2007 (Kurup and Antony, 2010). Dey (2010) also recorded a slow growing trend of fish exports of India from US$ 0.8 million in 2000 to US$ 1.7 million in 2008. India's share in global ornamental fish trade is negligible and the present export is dominated by wild caught species (Nair, 2006; Anikuttan, 2010; Ramachandran, 2010; Swain, 2010; Thomas, 2010). Among the 31 countries exporting ornamental fish in Asia, the share of India is only 0.9 per cent (Dey, 2010). India's overall domestic trade in ornamental fish is estimated to be nearly 15 crores (Kurup and Antony, 2010) and is growing at the rate of 20 per cent annually (Yadav *et al.*, 2007). Indian ornamental fish market is dominated by only 30-35 species of freshwater fishes and the country could not make any head way in export of marine ornamental fishes due to many reasons (Swain, 2010).

Even though Kerala is one of the leading fish producing states of India, the ornamental fish sector has not picked up yet. The market studies on the ornamental fishes are very important to evaluate the demand, supply, profitability and the species diversity in the trade (Nath *et al.,* 2010). Hence marketing research is needed for a sustainable trade of ornamental fishes in Kerala. Literature survey on the marketing of ornamental fishes of Kerala revealed that only very few works have attempted describing ornamental fish market in Kerala. The available ones mainly dealt with indigenous freshwater fishes (Harikumar, 2006; Sekharan, 2006; Kurup and Antony, 2010). Sekharan(2006) studied the prospects of marketing the indigenous ornamental fishes of Kerala and recorded a decline in export of ornamental fish from Kerala after a peak in 2000-2002 periods. Velayudhan (2005, 2006) studied the potential and strategies for the development of marine and freshwater aquarium sector in the state. The share of the state to the national ornamental fish export was estimated to be around 2.5 per cent (Harikumar, 2006). The aquarium fish export from the state is being treated under marine products. The contribution of aquarium fish to the total marine products and to the live products exports is given in Table. 1.

Table 1. Contribution of aquarium fish exports to the total marine products and to the live products exports of Kerala during 2010-11.

Particulars	Aquarium fish	Percentage to total marine products	Percentage to live products
Quantity in M T	70	0.009	1.346
Value in Rs. Crore	5.70	0.044	0.041
US Dollar Million	1.26	0.044	4.014

The study was undertaken with the following objectives:

- To analyze the strengths, weaknesses, opportunities and limitations of ornamental fish industry in Kerala.
- To analyze the consumer preferences of freshwater as well as marine ornamental fishes in Kerala
- To deduce the prospects for the development of ornamental fish industry in Kerala.

MATERIALS AND METHODS

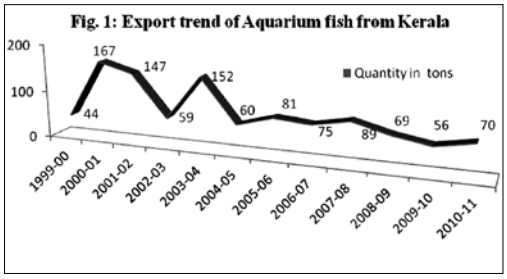
The study was conducted using both primary and secondary data. The primary data were collected using a pre structured survey schedule from 60 traders/suppliers and 90 consumers/ hobbyists from the three major cities of Kerala viz., Kozhikode, Ernakulum and Thiruvananthapuram. The primary data from the consumers /hobbyists included details on the awareness on the ornamental fishes, interest for aquarium upkeep, willingness to buy and pay. The details collected form traders included experience in trade, sources from of purchase and disposal. Secondary data collection was carried out from different sources such as Raja (2006), Sekharan (2006) as well as the data provided by MPEDA. These data were mainly used for analyzing the trade perspectives of freshwater ornamental fish in Kerala. The data were analyzed using SWOL analysis method. SWOL-Analysis is an informative tool for assessing the potential and status of any industry or any sector of production. It provides a complete picture of its Strengths (S), Weaknesses (W), Opportunities (O) and Limitations (L). However, the analysis of its strengths and weaknesses, which is essential, is possible only when the limitations are taken into consideration while also identifying the available opportunities. The analysis of the strengths, weaknesses, opportunities and limitations are very important to upgrade the sector and to flourish it, since it helps in problem identification, planning, decision making, appropriate technology implementation, precautionary measures for accelerating ornamental fish trade at sustainable level etc. The SWOL provides a basis for future action and decision making process.

RESULTS AND DISCUSSION

Strengths

Good export market

The export figure shows a growing trend for the aquarium fishes from Kerala (Fig. 1).



The export trend indicated that the exports from Kerala showed an impressive growth, which increased from 44 tonnes in 1999-2000 to 167 tonnes during 2001 but then stabilized around 70 tonnes during 2010-11

High demand for freshwater indigenous fishes

Many species found in the rivers and other fresh water habitats were highly preferred in the export market. The leading species include *P. denisonii, T. travancoricus, P. mahecola, C. dadyburjori, Mastacembalus armatus* and *P. fasciatus.* These fishes were consistently marketed from Kerala (Sekharan, 2006).

Marine ornamental fishes with great demand in export market

Most of the species collected for the trade are small, brightly coloured fish that survive well in captivity. Typically, there is a high volume of trade in relatively low-priced fish such as damsel fish, wrasse, butterfly fish, trigger fish and cardinal fishes. These groups of fishes

dominated the national (Kurup and Antony, 2010) and international (Wood, 2001; Wabnitz *et al.,* 2003; Gopakumar, 2004) markets, indicating the scope for domestic and export trade of ornamental fishes from Kerala. Velayudhan (2006) also reported that most of the ornamental fishes distributed in Kerala coast are of high export potential.

Availability of under-utilized marine resources

The coastal belt of the region is endowed with a variety of ornamental fish resources, which are still under utilized. Among these only about 35 species are coming in trade, of which many are utilized rarely for the purpose (Sirajudheen, 2012). Besides, there are many regions which are untapped and unexplored as a potential resource for ornamental fishes.

High valued and popular marine ornamental fishes

The coastal waters of Kerala are rich in expensive fishes such as angel fishes, lion fishes and moray eels (Biju Kumar *et al.,* 2010). The market value of many species of marine ornamental fishes has greatly increased when compared to the food fishes and freshwater ornamental fishes. For instance, the retail value for a kg of reef fish destined for the aquarium trade may be around 500 US$ to 1800 US$, while a fish used for human consumption is priced between 6 US$ 16.50 US$ per/kg. Most of the marine ornamental fishes, especially the damsel fish and clown fishes are very popular to the hobbyists in Kerala. The value of such fish as ornamentals is often in the order of magnitudes greater than their value as fish protein and thus offers great potential for valuable additional and sustainable economic benefits to local communities from the aquarium trade (Hodgson and Ochavillo, 2006).

Potential for rural development

The aquarium fisheries sector of Kerala has the potential to provide an alternative economic activity for rural people, fishermen and coastal populations (Wabnitz *et al.,* 2003).

Low cost effort

Fisheries practices in the fresh water bodies of the region are still in traditional way. However, the production per unit area in the region is still very high, which is one of the important strengths of this sector.

Efficiency of ornamental fish marketers

It was revealed from the suppliers or dealers in the region that most of them are aware of the hobbyist's requirements. Most of them possess high level of education and for a good majority of them fish keeping was a passion right from their childhood and they attached much importance to the conservation of the species.

Institutional support for development and promotions

The role of research institutes such as CMFRI and various universities of the state in resource analysis and breeding played a significant role in the promotion of indigenous ornamental fishes of Kerala. The schemes of state government, MATSYAFED, MPEDA and NABARD in conducting trade fairs on yearly basis, market development assistance, export developmental assistance and culture oriented subsidy also played a key role for the development of ornamental fisheries sector. The exhibitions taken up by the government of Kerala have increased the hobby which in turn has increased the demand for ornamental fishes.

Scheme for providing financial assistance for establishment of Ornamental Fish Breeding Units (OFBU)

MPEDA is encouraging mass production of good quality ornamental fish by assisting breeders for setting up modern breeding centers. Under this scheme, subsidy assistance up to maximum of 50

per cent of capital investment is given for setting up ornamental fish breeding units classified into 3 grades based on the investment and production capacity. Employment generation in rural and semi urban areas is a byproduct of this scheme. The details of maximum assistance under each category are given in Table. 2.

Table 2. Financial assistance schemes provided by MEDA

Grade (Orna. Fish Breeding Units)	Capital Investment (Rs.)	Maximum Subsidy assistance/Unit (Rs)
I	1,50,000	75,000
II	4,00,000	2,00,000
III	15,00,000	7,50,000

Weaknesses (W)

Dependence on wild caught species

The present trade of both freshwater and marine indigenous fishes depends on the wild population. There is no captive bred indigenous ornamental fish production on a commercial scale. Gopakumar (2004) reviewed the major issues associated with wild collection of ornamental fishes.

Inadequate data on resources

Since fewer studies have been focused to explore the resource abundance of both freshwater and marine ornamental fishes of Kerala, the data on resources were insufficient (Sekharan, 2006). Absence of a benchmark data on the availability and abundance of resources is a major weakness of the sector.

Wastage of resources

A wide variety of ornamental fishes including the high valued lion fishes, butterfly fishes, snappers and damsel fishes were discarded in the fishing harbours of Kerala due to the lack of infrastructure for keeping them alive onboard and lack of awareness among the fishermen about their potential coupled with absence of a marketing system (Suresh Kumar *et al.,* 2004). The marine coastal environment is not currently utilized for the production of ornamental species (Tlusty, 2002).

Unwillingness towards marine fishes

Risk taking was one important reason for the backwardness in marine ornamental fish export from Kerala. Many marketers considered it to be an unprofitable proposition to market marine fishes exclusively and hence preferred supplying marine fishes in combination with other fishes. The survey conducted among traders revealed that most of the marketers (72 per cent) dealt with freshwater fishes and a less percentage (28 per cent) dealt with marine fishes. Out of 300 consumers surveyed, only 8 were keeping marine aquaria whereas 274 dealt with freshwater aquaria. It was also revealed that about 20 per cent were not familiar with marine fish as they had never kept a marine aquarium. The technical requirements and high price of marine fishes are the major constraints in making of marine aquarium inaccessible to the common people (Xie *et al.,* 2010).

Lack of trained skilled manpower

The number of skilled divers specialized in ornamental fish collection as in the case of neighboring countries like Sri Lanka or Maldives were almost nil in Kerala (Sekharan, 2006). Though there are many skilled fish breeders in Kerala, their abilities were not used for the betterment of exports.

Lack of an organized trade

Marketers had diverse interests and lack of unity in their activities. Except for some scattered nonfunctional associations, no organized association of fish exporters were found in the state and the country. Associations can help in approaching the problems as one in regulating prices, monitoring activities within the industry

and protecting its members against bad importers who take our shipment and forget to pay them.

Lack of adept technologies

Lack of appropriate infrastructure, training and technology were the reasons for poor development of ornamental fish sector, mainly the marine sector of Kerala. It is revealed from the survey that 45 per cent of hobbyists were not keeping marine fish due to maintenance difficulties and unavailability or uncommon nature of marine fishes. In the international level, research on ornamental fish has reached in the development of transgenic fishes, compressed packing and feed technology, but in India the technology to transport the live ornamental fish in good health and high survival rates during catching, handling and transportation is still in its nascent stage. Rachman (2010) suggested that technologies developed in western countries are often not applicable in the tropical countries due to the lack of facilities and qualified human resources. Lack of awareness, appropriate infrastructure, training and technology were the reasons for poor development of ornamental fish sector in India (Ajith Kumar *et. al.,* 2007; Dey, 2010; Kurup and Antony, 2010; Thomas, 2010).

Poor marketing facilities and infrastructure

Non-availability of direct overseas flight to major market destinations from the airports of Kerala and lack of adequate live fish handling and transport facilities formed a serious obstacle to efficient distribution. The flight authorities were also hesitant to charge commodity rate due to the small quantity of ornamental fish consignments compared to the other export items which were exported in large quantities. Most inhibiting factor in ornamental fish export is the exorbitant freight rates to major importing destinations (Sekharan, 2006). Freight formed almost 20-50 per cent of the landed cost of fishes to the importer (depending on the size and the species of fishes) and such a situation existed because there were no specific commodity freight charges to most of the European and American destinations where the major buyers are located. Yet another drawback concerning infrastructure was that, majority of marketers in the state did not have sufficient facility as in the case of exporters of India for storing or acclimatizing the fishes before transportation. Poor handling and shipping techniques result in lack of quality product for export. These factors along with non-proximity of the collection sites to national links led to increased mortality rates.

Backwardness in international market

In the international market, India does not figure anywhere among the major ornamental fish exporting countries. India's share in the world trade is to the tune of 0.25 per cent. On comparing the position of Kerala in the Indian export trade, it was noted that Kerala occupied fourth position after the metropolitan cities like Calcutta, Bombay and Chennai with an export value far behind the metropolitan cities. Meanwhile, the potential of resources indicate that the state can achieve a prime position in India.

Weak market image

The study revealed that the Indian ornamental fish exports had a weak market image of broken contracts, lack of quality in product, deliveries of products not adhering to specification, short deliveries, unsatisfactory packaging, infrequency of delivery, unreliable and extended delivery times. Only a handful of exporters marketed quality products to keep up the image of the country. Industry inattention to a quality product creates a weak market image.

Lack of fishing regulations

Ornamental fishing regulations can be considered do not exist at all in the state. No quotas,

catch limits, closed seasons, banned areas have been assigned for both marine and freshwater ornamental fishes of the state. Since the present trade is localized in certain areas of freshwater and marine habitats of the state, there is an urgent need to formulate proper regulations.

Opportunities (O)

Enhancement of species portfolio

The present indigenous ornamental fish market dominated by 51 species of wild caught freshwater fish (Table, 4) and 35 species of wild caught marine fish (Table, 5). Many more species occurring in the region can be utilized for the purpose.

Increasing market value

The presently estimated values are higher than earlier estimates from different regions of India, indicating an increase in the values on temporal and regional basis. Seventy percent of Sri Lanka's total foreign exchange from aquarium fish is represented by marine fish as they fetch a higher value than freshwater species.

Less capital intensive

The small-scale nature of ornamental fish trade has a benefit in optimizing the use of land, labour, capital, and operational costs. Compared to freshwater aquarium trade, the investment as well as the profitability of marine aquarium trade is high. The profitability of both freshwater and marine aquarium fish trade in Kerala is very good and the results of revenue generated by this business indicate the sustainability and there is a good scope for a lucrative market of ornamental fishes. Relatively low investment and production costs and ability to compete with other natural products are the major advantages of aquarium trade. Ajith Kumar *et al.* (2010) estimated the economics for a backyard hatchery of marine ornamental fish and revealed that it is profitable to run it with a gross profit of at least 1,23,000/year from the 2nd year onwards. It was also revealed by Ignatius (2010) that by setting a small scale marine ornamental fish hatchery, one can earn a profit up to 20 lakhs per year with investment of only 6.5 lakhs and payback period of six months.

High popularity and demand

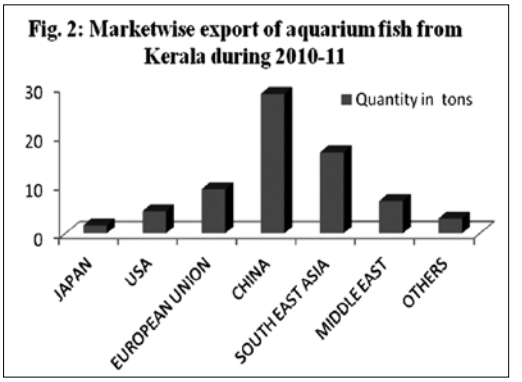
Respondents gave considerable importance to indigenous freshwater and marine ornamental fishes since the survey revealed that 80 percent of hobbyists are aware about indigenous ornamental fish. Even though more hobbyists keep freshwater aquaria, a good per cent (60 per cent) are interested in marine ornamental fishes and are willing to buy marine ornamental fishes. Price was found to be a relatively unimportant factor affecting purchasing behaviour of hobbyists in Kerala, because it was realized from the survey that 74 per cent of the interested hobbyists are willing to pay the actual market price. In America, aquarists spend an average of US$ 200 annually on livestock and supplies (McCollum, 2007). The same approach would be expected among hobbyists of Kerala, considering their interests and willingness they have expressed during the survey. The survey also revealed a growing interest among the young hobbyists (90 per cent) in aquarium keeping in providing a s better future. Alencastro *et al.* (2005) also found that most of the hobbyists in Florida are young, aged between 24 and 44.

Breeding and culture of indigenous fishes

By breeding the indigenous varieties the marketing or export can be boosted. Breeders can pay more attention to the culture of threatened and vulnerable varieties which have high demand in the markets.

Faster market growth

The indigenous ornamental fishes of Kerala especially *Puntius denisonii* has shown a quantum leap in market growth. Rather than concentrating



on one species, consumer demand and tastes have to be found to increase the market growth of other species. Most of the marine fishes distributed along Kerala coast were also of high demand in the international markets.

Entry to new market destinations

The major countries importing Indian indigenous ornamental fishes are Japan, U.S.A, U.K, Germany, and Netherlands. Since the flight facilities from Kerala are more in number to the Middle East countries, those countries have emerged to be prospective markets for the state and the country. Fig. 2 indicates the marketwise export of aquarium fishes from Kerala.

Increased awareness among International buyers

Of late an increased awareness was noted among the national and international buyers on environmental aspects and especially the consistent quality. Marketers who are able to supply quality fishes consistently will be able to obtain a position in the market. The value of such fish as ornamentals is often orders of magnitude greater than their value as fish protein and thus great potential for valuable additional and sustainable economic benefits to local communities involved in the aquarium trade.

Government support

Considering the potential for ornamental fish trade and export, many financial assistance schemes were formed by government of India as well as the state government. One of the best examples is through the Marine Products Export Development Authority of India (MPEDA) under the name "Rainbow Revolution" aimed to develop the ornamental fish production in order to cater the domestic and international demand. The Government of Kerala has also formed a company named Kerala Aqua Ventures International Limited (KAVIL) and developed a common platform for services to ornamental fish industry named Aqua Technology Park (ATP) in order to encourage the trade in the state. Velayudhan (2005) and Harikumar (2006) mentioned various schemes and developmental activities initiated and implemented by the department of fisheries under the Kerala government in order to popularize and boost the ornamental fish trade.

Limitations (L)

Technological backwardness

The lack of knowledge on appropriate husbandry practices was the major reason leading to large scale mortality. Dordi and Dasgupta (1983) reported that in 1980s, 25 per cent mortality was recorded in the fish consignments from India. Various management practices were adopted worldwide in order to reduce the post-harvest mortality of marine aquarium fishes that is typical to trade (Wood, 2001; Merkl *et al.,* 2003; Rubec and Cruz, 2005; Raja, 2006).

Technology transfer

The technological advancements in packaging and transportation systems led to reduction in stress and mortality up to some extent, but the traders' response in the present study indicates the lagging in the transfer of technology to the concerned might be the key reason for losses. Adaptive research is required to enable coastal communities with simple technologies

and training suitable for their background for propagating the culture and trade of freshwater as well as marine ornamental fishes. Community-based ornamental fish culture also contributes to the sustainable development of resources as well as the coastal communities through domestic and export markets.

Deficient awareness initiatives

Many ornamental fish awareness programs, workshops, exhibitions and trade fairs have been conducted in Kerala by organizations such as state fisheries department, MPEDA, etc. In order to popularize the marine sector, participation of marine aquarium traders and promoters in such events is essential. Educational campaigns sponsored by NGOs can have a positive effect on consumers in order to develop the marine ornamental fish trade sustainably. Gamain (2008) mentioned the role of public aquariums in popularizing the ornamental fishes among public.

Limitations of marine fish keeping

Difficulty in maintaining water quality, high cost of fishes and accessories, setting and feeding difficulties were the major limitations in the marine ornamental fish sector as required by 80 per cent of the hobbyists.

Adverse government policies

Legal implications deter marketers from judiciously exploiting the resources from the marine water bodies which is a lucrative collection site. Some of the respondents pointed out that live aquatic invertebrate, which were considered along with ornamental fishes till 1973 under the common term "tropical aquarium fish" were removed from trade after the formation of MPEDA, resulting in reduced marine ornamental fish trade as it became uneconomical to collect only marine fish without the invertebrates. In case of obtaining government support, lack of financial support and discouraging attitude of government along with prolonged official procedures were the major limitations faced by the traders. Pomeroy and Balboa (2004) reported the difficulties in running an ornamental breeding unit without subsidies and technical assistance in Philippines.

Competitions from neighboring countries

The export performances of our tiny neighbors, Sri Lanka and Maldives have improved tremendously due to the strong governments support to this sector and having superior access to channels of distribution.

Sustainability of resources

Though ornamental fish trade provides revenue for developing countries, the industry must be developed with a conservation ethic for it to be of lasting value. The possible limitations in supporting and maintaining the sector on a long term include over-exploitation of the natural populations of commercial species, destructive collection methods, high post-harvest mortalities, introduction of chemicals and introduction of non-native organisms. Generally a tendency noted was that the marketers of indigenous fishes depended much on the harvest of few of the demanded species rather than on wide varieties. Even though more than 100 varieties were noted in the ornamental fish trade and there existed a scope for more varieties to be introduced as ornamental fishes, there was an increased dependence on varieties such as Puntius denisonii and Tetraodon travancoricus.

Drastic drop in price

Indigenous fishes of Kerala fetch very low FOB price (Table 3) in the international market as marketers do not project a steady price for the fishes, either due to ignorance of the demand of the fishes in the market or due to the competition between the marketers.

Table 3. Major Indigenous fresh water ornamental fishes of Kerala

Sl. No.	Species	Trade name	Local name	FOB Price(US$)
1	*Amblypharyngodon mola*	Brass fish	Vayambu	0.40
2	*Aplocheilus lineatus*	Striped panchax	Poochutty	0.25
3	*Aplocheilus panchax*	Red panchax	Poochutty	0.04
4	*Aplocheilus blocki*	-	Manathukanni	0.14
5	*Anabas testudineus*	Climbing perch	Karippidi	0.20
6	*Barilius bakeri*	Blue spotedh illtrout	Pavukan	0.50
7	*Barilius barna*	Silver hill trout	-	0.10
8	*Barilius canarensis*	Jerdon'sbaril	Paral	3.50
9	*Chela dadyburjori*	Burjor's Brilliance	Chela	0.17
10	*Channa striatus*	Snake head	Varal	3.00
11	*Channa marulius*	Peacock snake head	Cherumeen	0.75
12	*Channa micropeltes*	Snake head	Bral	5.00
13	*Channa orientalis*	Snake head	-	0.60
14	*Channa gachua*	Brown Snake head	Vattan	4.00
15	*Chanda ranga*	High fin glass fish	Arinjil	0.08
16	*Danio malabaricus*	Malabar danio	Thuppalamkothi	0.25
17	*Esomus danricus*	Flying barb	Meshaparaval	0.05
18	*Etroplus maculatus*	Orangachromide	Pallathy	0.20
19	*Etroplus suratensis*	Pearl spot	Karimeen	0.35
20	*Eleotris fusca*	Bicolor goby	Mongal	0.15
21	*Garra gotyla gotyla*	-	-	0.30
22	*Gonoproktopterus curmuca*	Redtaile silver shark	Kooral	3.00
23	*Gonoproktopterus amphibius*	Scarlet banded barb	Urulankendei	1.60
24	*Gonproktopterus thomassi*	Nilgiri shark	Kooral	3.00
25	*Horabagrus brachysoma*	Yellow catfish	Manjakkoori	3.00
26	*Horabagrus nigricolaris*	White collared imperial	Manjaletta	2.50
27	*Lates calcarifer*	Giant sea perch	Kalanchi	1.50
28	*Lepiodcephalus thermalis*	Loach	-	0.04
29	*Mystus vittatus*	Striped loach	Chillankoori	0.20
30	*Macropodus cupanus*	SpfretailParadise fish	Karimkana	0.29
31	*Macrognathus aral*	Spiny eel	Aarakan	0.40
32	*Mastacembelus armatus*	Marble spiny eel	Aaral	0.12
33	*Notopterus notopterus*	Grey feather back	Black knife fish	0.40
34	*Nemacheilus striangularis*	Zodiac leach	Ko1ma; Koitha	0.80
35	*Nandus nandus*	Leaf fish	Muthukkila	0.30
36	*Ompok bimaculatus*	-	-	0.30

37	*Oryzias melastigma*	Blue eyes	Karimkana	0.04
38	*Pangasius pangasius*	-	-	0.70
39	*Puntius arulius*	Aruli barb	Vazhakkavarayan	2.25
40	*Puntius bimaculatus*	Two spot barb	Paral	0.30
41	*Puntius denisonii*	Red line torpedo fish	Chorakkaniyan	5.00
42	*Puntius fasciatus*	Melan barb	Vazhakkavarayan	0.16
43	*Puntius filamentosus*	Indian tiger barb	Poovalipparal	0.80
44	*Puntius mahecola*	Malini's barb	Valelchuttyparal	0.80
45	*Puntius sophore*	Soft fin swamp barb	Paral	0.20
46	*Puntius ticto*	Tic tac toe barb	Putterparal	0.12
47	*Puntius vittatus*	Silver barb	Attuvatta	0.12
48	*Rasbora daniconius*	Slender rasbora	Paral	0.09
49	*Tetraodon travancoricus*	Puffer	Attunda	0.10
50	*Wallago attu*	Killer catfish	Attuvala	1.20
51	*Xenetodon cancila*	Pipe fish	Kolaan	0.50

Table 4. Major Indigenous marine ornamental fishes of Kerala

Sl. No.	Species	Trade name	Local name	European Price (US$)
1	*Abudefduf saxatilis*	Sergeant major	Padatham	6.9
2	*Acanthurus nigrofuscus*	Brown surgeonfish	Pala	32.9
3	*Apogon* sp.	Cardinal fish	-	10
4	*Arothron* sp.	Puffer fish	Veerkkunnon	64.9
5	*Cantherhine spardalis*	Honeycomb file fish	Klathi	25
6	*Canthigaster bennetti*	Mooitoble	Klathi	16.99
7	*Cephalopholis sp.*	Coral-cod	Kalava	60
8	*Chaetodon auriga*	Threadfin butterflyfish	-	33.5
9	*Chaetodon collare*	Redtail butterfly fish	Pakkikadiyan	47.5
10	*Chaetodon vagabondus*	Vagabond butterflyfish	Manjakkallimeen	34
11	*Chelonodon patoca*	Milkspotted puffer	-	50
12	*Diodon hystrix*	Porcupine Fish	Pullipetha	39.99
13	*Epinephelus* sp.	Grouper	Kalava	35
14	*Gymnothoraxsp.*	Moray eels	Anjala	106
15	*Halichoeres* sp.	Wrasse	Vayittukadiyan	15
16	*Heniochus acuminatus*	Pennet coral fish	Purroamee	75
17	*Lutjanus sp.*	Snapper	Pahari, Kalava	30
18	*Myripristis murdjan*	Pinecone soldier fish	Perumkanni	17
19	*Narcine timlei*	Blackspottednumbfish	Therandi	100
20	*Odonus niger*	Trigger fish	Klathi	20.50

21	*Ostracion cubicus*	Yellow box fish	Thombu	21.9
22	*Platax orbicularis*	Orbicular batfish	Akoli	15
23	*Platax teira*	Long fin bat fish	Patha	24.5
24	*Plectorhinchus gibbosus*	Harry hotlips	-	24.5
25	*Plotosus lineatus*	Striped eel catfish	-	15
26	*Pomacanthus imperator*	Emperor angelfish	-	114.9
27	*Pomacanthus semicirculatus*	Blue angel fish	-	99.99
28	*Pomacentrus caeruleus*	Blue damsel	-	8.9
29	*Pterois sp.*	Lion fish	Chavarali	39
30	*Sargacentron rubrum*	Soldier fish	Annan meen	21.9
31	*Scarus ghobban*	Parrot fish	Chandi	35
32	*Siganus sp.*	Rabbit fish	-	30
33	*Thalassoma lunare*	Moon wrasse	Chulam	64.9
34	*Therapon sp.*	Croaker	Keeri	22
35	*Zanclus cornutus*	Moorish idol	Kodiyan	57.5

CONCLUSIONS

The South west region of India has a very vast potential in ornamental fisheries sector, which still remain unutilized and untapped. The ornamental fish resource of Kerala has huge potential with untapped and unexploited resources. However, the performance of the sector is not worthy and production is much below the demand. The Strength, Weakness, Opportunities and Limitation analysis on the status of ornamental fishery industry in Kerala concluded that the sector offers a huge scope considering the rich biodiversity and huge untapped potential possessed by the industry. It is important to evolve strategies in consultation with the farmers, professionals, researchers and policy makers to enhance the production and to upgrade the sector. The study also revealed that there exist a growing interest and demand for ornamental fishes among aquarium hobbyists of Kerala.

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