

# PROBLEMS AND PROSPECTS OF MARINE ORNAMENTAL FISH TRADE IN KERALA, INDIA

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## ABSTRACT

The scientific advancements in fish husbandry and aquarium technology coupled with its potential in earning foreign exchange have facilitated the growth of marine aquarium fishery sector across the globe. Nearly 2 million people worldwide are engaged in marine aquarium keeping, either for recreation or as a means of livelihood. However, with rich ornamental fish reserves especially in the south-east and south-west coastal areas, India's share is insignificant to the global export in ornamental fishery sector. In Kerala, there are very few studies reported on the marine ornamental fish trade and hence this study throws light on the status of ornamental fishery trade in Kerala, including availability of resources, demand for this sector, problems and constraints in keeping marine aquarium and suggestions for improving this sector. The present study was conducted in three districts of Kerala viz. Kozhikode, Ernakulam and Thiruvananthapuram and two different sets of interview schedules were employed to draw information on the status of ornamental fishing industry in Kerala and were administered among 60 traders and 90 hobbyists. Results show that the scope and demand for marine aquarium trade in Kerala is very high. Furthermore, the study portrays the demand for sustainable approach in promoting marine ornamental fishery sector in order to provide livelihood options to the fisher folk and to earn foreign exchange for the State.

**Keywords:** Ornamental fish, aquarium fish trade, Kerala

## I. INTRODUCTION

Globally, ornamental fish culture is getting great impetus due to its tremendous economic opportunities and prospects, and is holding second position among the popular hobbies next to photography. Innovations in fish husbandry and aquarium equipment technology have further facilitated the pace of its expansion (Sureshkumar et al., 2004; McCollum, 2007). Since this sector has greater potential in earning foreign exchange and employment generation, it is valued as a

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momentous sector across the globe. Of the total ornamental fishes used in aquarium keeping, 10 to 15 percent constitute marines species and rest from fresh and brackish water (Tissera, 2010). The rising popularity of marine aquarium heaps on the demand of marine ornamental fishes in the global market and thus triggered the international trade of marine ornamental fishes. It is estimated that 1.5 to 2 million people are engaged in marine aquarium keeping (Gopakumar, 2010a) either for recreation or as a means of livelihood. Annually, 20 to 24 million people are involved in the international trade with an estimate of 1,471 marine fish species worldwide (Wabnitz et al., 2003).

Since 1985, the global export of ornamental fish has shown steady rise with a major contribution from developing countries. 56 to 60 per cent of the global demand of both marine and freshwater ornamental fishes is met by Asian countries with highest share from Singapore, followed by Indonesia, and Thailand, accounted for largest supplying region in the world (Nair, 2006; Ahilan and Walkhom, 2007; Ajith Kumar et al., 2007; Dey, 2010; Kurup and Antony, 2010; Tissera, 2010). According to Bruckner (2005), more than 45 countries supply marine fishes to the global market and the total value of marine ornamental fish trade was USD 200-300 million per year (Gopakumar, 2010a)

India is endowed with rich ornamental fish reserves especially in the south-east and south-west coastal areas, which make this country one among the top ranking counties in terms of ornamental fish reserves. Though India has two biodiversity hotspots and rich source of ornamental fish resources distributed over its vast EEZ and its long coastline covering maritime States, it lies far behind in ornamental fish trade with an export worth USD 1.17 million during 2009-2010 (MPEDA, 2010). However, with India's rich piscine diversity of worth USD 30 Million per year (Ahilan and Walkhom, 2007), India is contributing insignificant share (0.3 percent) to global export in ornamental fishery sector and is mostly (90 percent) made with wild caught species (Nair, 2006; Thomas, 2010; Silas et al., 2011).

Notwithstanding the credit of the leading marine fish producing State of India, marine ornamental fish trade is still in premature stage in Kerala. Major milestone in this sector was made by Department of Aquatic Biology and Fisheries of the erstwhile Travancore University by setting up of a marine aquarium at Shankumugham in Thiruvananthapuram in 1938 (Velayudhan, 2006). Since then two more marine aquaria were set up by the Central Marine Fisheries Research Institute (CMFRI) at Vizhinjam and Kozhikode in 1998 and 2001, respectively. Even though considerable research has been done on the marine fish industry of Kerala, only very few works have attempted describing ornamental fish market in Kerala (Shyam et al., 2012). Moreover, the available literature on ornamental fish trade of Kerala (Harikumar, 2006; Sekharan, 2006) gives information only about freshwater ornamental fishing sector. Detailed market studies on the marine ornamental fishes are vital in assessing the demand, supply, profitability and the species diversity in the trade (Nath et al., 2010). Shyam et al. (2013, 2014) reported

that people having diversified income sources were the ones with better livelihood security and thus it becomes important to explore alternative and non-traditional sources of fisheries to assure alternative avocations to the poor. At this point, ornamental fish keeping has a great prospect to develop either as part time or full time business and thus could improve the livelihood security of the fisher folk. Besides, there is a huge possibility to open or augment any business like marine ornamental fish keeping by ensuring the availability and affordability of high value ornamental fishes along with awareness generation campaigns (Shyam, 2013). There lies a tremendous scope for this study to analyze the present status and prospects of marine ornamental fish trade in Kerala.

### **Objectives of the Study**

The general objective of this paper was to analyze the dynamics of marine ornamental fish trade in Kerala. However, the specific objectives were:

To study the supply structure of marine ornamental fishes in Kerala,

To analyze the consumer preference and willingness to pay of marine ornamental fishes in Kerala, and

To highlight the prospects for development of marine ornamental fish industry in Kerala.

## **II. METHODOLOGY**

The study was based on the data collected from the traders and consumers of ornamental fish in Kerala. Primary data was collected from the selected respondents using pretested questionnaire. Multistage sampling was employed in this study to select the population and unit of the study. The study was designed to collect information from traders and consumers of ornamental fishes of the three districts of Kerala viz. Kozhikode, Ernakulum and Thiruvananthapuram; which were selected based on their proximity to sea, pace of development, cultural background, population and proportion of wealthy population. Two different sets of interview schedules were employed to draw information on the status of ornamental fishing industry in Kerala. The first interview schedule was used to get information from 60 traders about the nature of and role in aquarium trade, willingness to engage in marine ornamental fish trade, species used in the trade, problems and suggestions for developing marine ornamental fish trade. The latter interview schedule was applied among 90 hobbyists/consumers to get data regarding their nature, choice of aquarium kept, interests towards marine aquarium fishes, willingness to pay for marine aquarium fish and constraints in maintaining marine aquarium fish.

### **Tools of analyses**

Average and percentage analysis were used to look at different variables

pertaining to the respondents of the survey. Garette Ranking Technique (Garrette and Woodworth, 1969) was employed to rank the problems in marine ornamental fish trade as expressed by respondent traders. The order of value given by the traders was transmitted into scores. For converting the scores assigned by the trader towards the particular problem, per cent position was worked out using the formula:

$$\text{Per cent Position} = \frac{100 (R_{ij} - 0.05)}{N_j}$$

Where,

$R_{ij}$  = rank given for the  $i$ th problem by the  $j$ th trader

$N_j$  = number of attributes

### III. RESULTS AND DISCUSSION

#### a) The nature of the trade

As marine ornamental fish trade of Kerala is in its infant stage, all the ornamental fish traders are following an amateur style of business and consider this as a supplementary income source. Besides, marine ornamental species is not much popular among ornamental fish traders of Kerala, the number of traders handling marine species was comparatively low with 28 percent (Table 1). Their distribution was found to be increasing while moving towards the southern districts - Ernakulum and Trivandrum, where the total number of ornamental fish traders was high with 21 and 24 traders, respectively. This is quite similar to the global scenario, where 85 to 90 percent of the total ornamental fish traded belong to freshwater (Tissera, 2010).

Type	Trivandrum	Ernakulum	Kozhikode	Total
Freshwater	17 (71)	15 (71)	11 (73)	43 (72)
Marine	7 (29)	6 (29)	4 (27)	17 (28)
Total	24 (100)	21 (100)	15 (100)	60 (100)

Figures in parentheses indicates per cent to total

#### b) Nature of hobbyists

The popularity of aquarium keeping is burgeoning worldwide, more and more youngsters are fascinated to follow this hobby. This situation is similar in Kerala where majority (66 percent) of the aquarium fish hobbyists belong to the age group below 35, of which 22 percent of the total fish traders represent youngsters below the age of 26 (Figure 1). The study revealed that marine aquarium keeping is not

common in Calicut in comparison with other southern districts (Figure 2). The highest number of hobbyists handling marine species was in Ernakulam District which accounts to 15 percent. Thus, the results furnish potential for developing marine aquarium industry in Kerala.

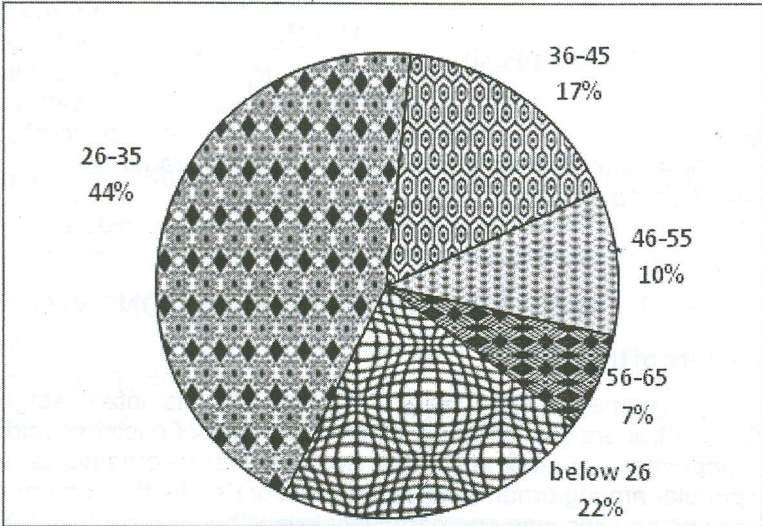


Figure 1. Age profile of hobbyists

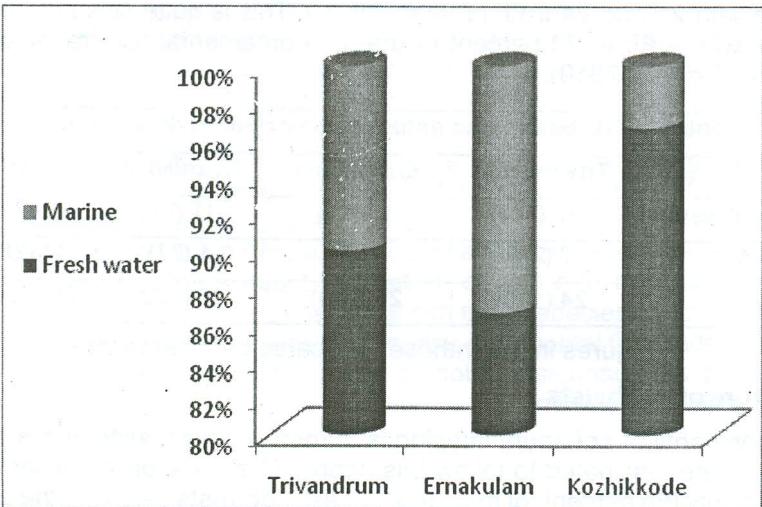


Figure 2. Type of aquarium hobbyists

### c) Marine Species diversity

Most of the species used for the trade are small, brightly coloured fish that survive well in captivity. Most popular fish species handled by ornamental fish traders were damsel fish, wrasse, butterfly fish, trigger fish, cardinal fishes and groupers etc. (Table 2). Generally, in Kerala high volume trade is happening in relatively low price fish species. Moreover, these factions of fishes are the popular species not only at national level but at global level too (Kurup and Antony, 2010; Wood, 2001; Wabnitz et al., 2003; Bruckner, 2005; Madhu et al., 2010), pointing towards the scope of domestic and export trade potential of marine ornamental fishes in Kerala. In addition, Velayudhan (2006) also highlighted export potential of Kerala, owing to the availability of various ornamental fishes along Kerala coast. Besides, Raja (2006) specified that 18 families of fishes were used in the marine aquarium trade in Gulf of Mannar.

**Table 2. Species mix of marine ornamental trade in Kerala**

Sr. No.	Family	Common (Trade) name	Relative number of species in trade
1	Pomacentridae	Damsel fish/ Clown fish	10
2	Chaetodontidae	Butterfly fish	7
3	Labridae	Wrasse	4
4	Serranidae	Groupers	4
5	Acanthuridae	Surgeon fish	3
6	Balistidae	Trigger fish	3
7	Apogonidae	Cardinal Fishes	3
8	Scorpaenidae	Scorpion fish	2
9	Monacanthidae	File fish	2
10	Pomacanthidae	Angel fish	2

Angel fishes, lion fishes and moray eels were the most expensive fishes found in this study, while damsel fishes and cardinal fishes were the comparatively cheaper ones as they swim in shoals and thus available in abundance. Uniqueness, size and abundance of the species are some of the key determinants in deciding the price. According to Wood (2001), the export value of small abundant species in international market, will be as low as USD 0.10, whereas interesting specimens that are readily available generally range from USD 1 to 5 and unique and exotic species (e.g. eels, clown fish, trigger fish, various butterfly fish, angel fish and groupers) vary between USD 10-30. This alone highlights the scope of developing marine ornamental fishery in concurrence with availability of fishery reserve in Kerala.

It is the fact that the market value of many marine ornamental fishes is very high as compared to that of fishes used for consumption. For instance, the retail value

for one kg of reef fish meant for aquarium trade may be worth 500 USD to 1800 USD, while same quantity of fish used for human consumption costs around 6 USD to 16.50 USD (Wabnitz et al., 2003), thus epitomising the fact. Furthermore, Nath et al. (2010) highlighted the worth of marine aquarium fishery by comparing the value of marine ornamental fish with edible fishes and freshwater ornamental fishes and estimated that equal quantity of marine ornamental fish is 100 times costlier than the edible fishes and 20 times than that of their freshwater counterparts. Besides marine ornamentals have a unit value and this makes them commercially more important than edible fish (Ajith Kumar et al., 2007). The above findings portray the scope of exploring and expanding ornamental fishery sector in Kerala to thrive domestic as well as international trade.

**d) Hobbyist's preferences towards marine aquarium fish**

Though, majority of the hobbyists keep freshwater aquariums, about 60 percent of the respondents articulated their interest in marine aquariums too (Table 3), and expressed their willingness to buy marine ornamental fishes. This depicts the demand for the same in the domestic market. Unavailability of marine fish species in the market, coupled with high demand in the market, would attract more entrepreneurs in this sector.

**Table 3. Hobbyists' interest in marine aquarium**

Interested or not	Trivandrum	Ernakulum	Kozhikode	Total
Yes	22 (73)	21 (70)	11 (37)	54 (60)
No	8 (27)	9 (30)	19 (63)	36 (40)
Total	30 (100)	30 (100)	30 (100)	90 (100)

Figures in parentheses indicates per cent to total

Price was found to be unimportant factor affecting purchasing behaviour of hobbyists in Kerala, as they are willing to pay maximum for their chosen fishes (Figure 3). Most preferred fishes of the respondents were damsel fishes, clown fishes, butterfly fishes, wrasses, trigger fishes, puffer fishes, eels and angel fishes (Table 4) due to its peculiarities like better survival rate, low cost and easy maintenance. Globally, damsel fishes make up almost half of the trade like angel fishes, surgeon fishes, wrasses, gobies and butterfly fishes accounting for approximately another 25-30 percent (Bruckner, 2005; Raja, 2006). With the demand and high consumer preference of marine ornamental fishes coupled with innovations in fish husbandry and aquarium technology, marine aquarium sector would have a great future in Kerala.

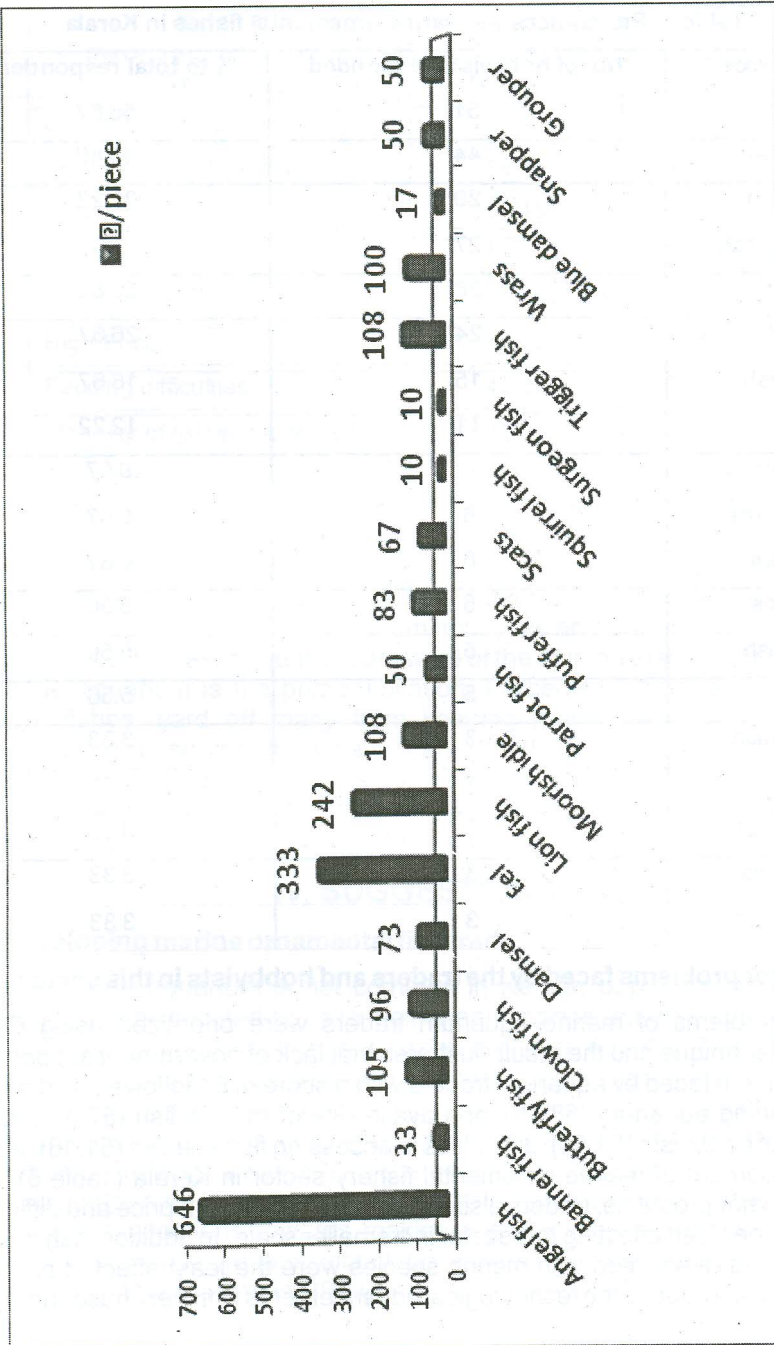


Figure 3. Hobbyist's preference and willingness to pay for marine fish



**Table 4. Preferences for marine ornamental fishes in Kerala**

Species	No. of hobbyists responded	% to total respondents
Damsel	51	56.67
Clown fish	44	48.89
Angel fish	29	32.22
Butterfly fish	27	30
Eels	26	28.89
Lion fish	24	26.67
Puffer fish	15	16.67
Wrasse	11	12.22
Blue damsel	6	6.67
Moorish idle	6	6.67
Snappers	6	6.67
Groupers	5	5.56
Parrot fish	5	5.56
Scats	5	5.56
Banner fish	3	3.33
Box fish	3	3.33
Sea horse	3	3.33
Squirrel fish	3	3.33
Trigger fish	3	3.33

**e) Major problems faced by the traders and hobbyists in this sector**

The problems of marine aquarium traders were prioritized using Garette Ranking Technique and the result illustrates that lack of government support is the major problem faced by aquarium traders with a score of 64 followed by difficulties in maintaining aquarium (58.45), non-availability of marine fish (57.45), varying interests of hobbyists (54.54), difficulties in accessing fish species (51.18), etc limit the development of marine ornamental fishery sector in Kerala (Table 5). Apart from the major problems, traders also face problems like high price and difficulty in getting proper feed affecting this sector in a smaller scale. In addition, fish mortality and diseases associated with marine species were the least affected problems, and it is possibly due to the technological advancements in fishery husbandry.

**Table 5. Analysis of problems faced by marine aquarium traders – Garette Ranking Technique**

Problems	Garette Score	Rank
Lack of Govt. Support	64	I
Aquarium maintenance	58.45	II
Availability	57.45	III
Hobbyis'ts interests	54.54	IV
Access to collection	51.18	V
High Price	47.72	VI
Feeding difficulties	43.27	VI
Mortality of fish in aquarium	42.09	VIII
Diseases of fish in aquarium	31.27	IX

Despite plenty of resources and high demand for marine fishes, marine aquarium sector of Kerala is facing several constraints. Figure 4 represents the constraints faced by the marine aquarium hobbyists and traders in Kerala. Nearly three quarters of the respondent traders were of the opinion that the unpopularity of the marine aquarium is the prime limitation. Perceived difficulties in rearing of aquarium fishes ward off many from keeping marine aquarium. The same problems were observed by Velayudhan (2006) and Sekharan (2006) too. Moreover, some of the respondents opined that exclusion of invertebrates from 'tropical aquarium fish' category after 1973 made reduction in ornamental fish trade as it is not economical to collect marine fishes alone without invertebrates.

#### IV. SUGGESTIONS

##### a) Developing marine ornamental fish trade

Since marine aquarium is not common in Kerala, popularization of marine aquarium has to be initiated so as to mainstream marine aquarium trade in Kerala as according to 82 percent of the respondents (Figure 5). 64 to 70 percent of the traders suggested that developing new and cost effective technologies to develop this sector is the need of the hour and hence government has to initiate programs and schemes to support and develop marine ornamental fish trade in Kerala. Furthermore, creating awareness, designing and disseminating appropriate technology, imparting training, and provision for infrastructure development are some of the suggestions towards making this business more popular. In this regard, role of public aquaria would be effective in popularizing the marine ornamental fish trade (Gamain, 2008).

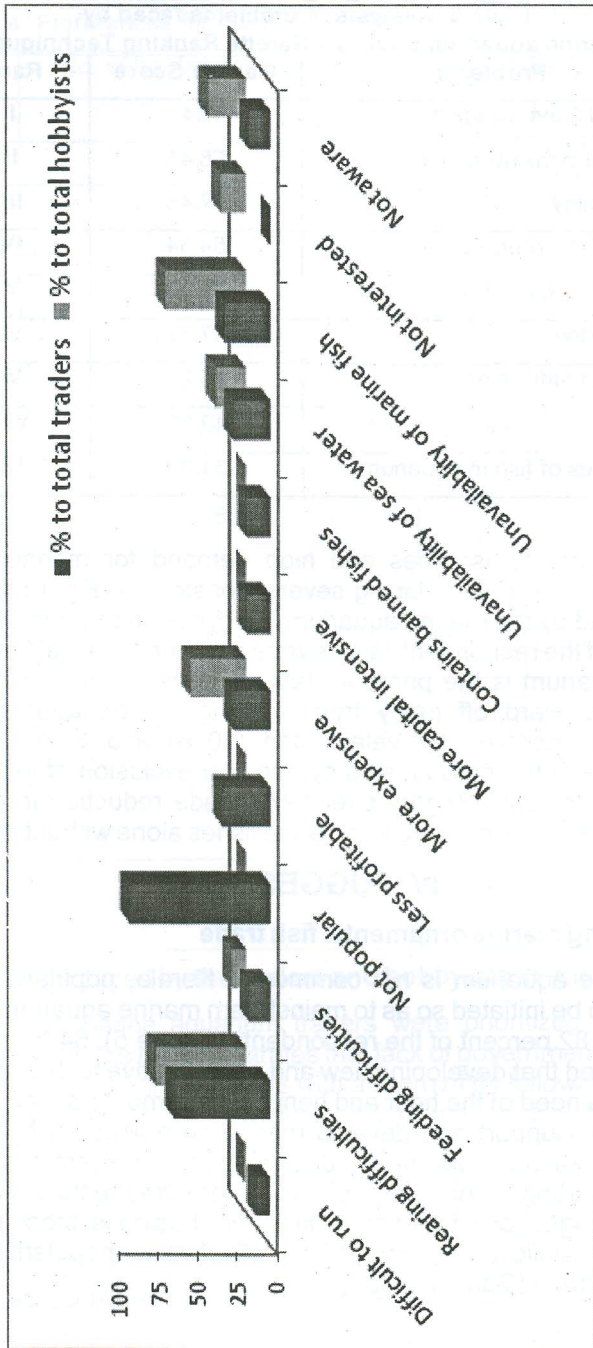


Figure 4. Constraints faced by the marine aquarium hobbyists and traders in Kerala

It is reported that the marine aquarium set up at Vizhinjam played an important role in popularizing marine ornamental fishes in Kerala (Anil et al., 2010a). Therefore, such platforms have to be established all over Kerala, especially in cities to inform people about marine ornamental fishes and the scope of marine aquarium keeping. Previously, several schemes and programs were implemented to popularize and boost the ornamental fish trade in Kerala, which was highly successful in developing freshwater ornamental fish trade in Kerala (Harikumar, 2006). At this point, there is vital need to implement such programs for developing marine ornamental fish sector too.

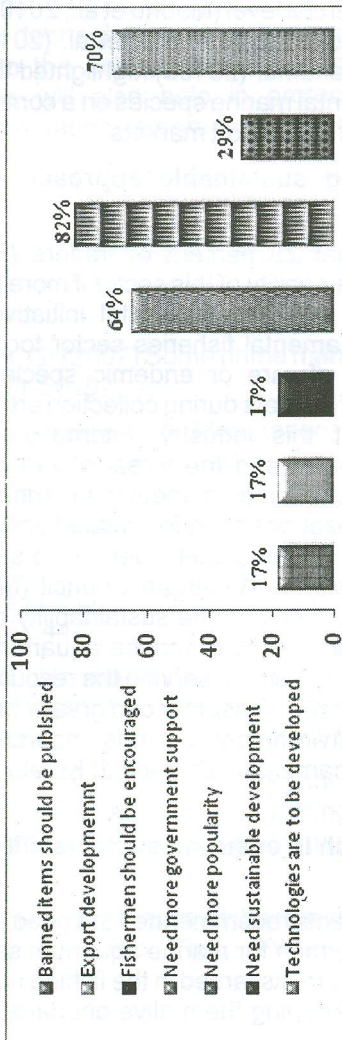


Figure 5. Suggestions for developing marine ornamental fish trade

### **b) Artificial breeding and rearing of marine ornamental fishes**

The dependence on wild-caught fishes might be the key reason for stagnation of the trade in the country (Kurup and Antony, 2010). Unlike freshwater ornamental fishes, the majority of the marine ornamental fishes in trade are wild-caught and they suggested that tank-bred and reared ornamental fishes are the final solution for the sustainable development of the trade and the way to conservation (Wabnitz et al., 2003; Harikumar, 2006; Raja, 2006; Ajith Kumar et al., 2007; 2010; Gopakumar, 2010a; Madhu et al., 2010; Thomas, 2010). The reports suggested that out of the 1800 species included in the trade, only 21 species were bred under captivity at commercial level (Madhu et al., 2010; Setu et al., 2010). The breeding initiatives carried out by Ajith Kumar et al. (2010), Anil et al. (2010b), Madhu et al. (2010) and Gopakumar (2010b) highlighted the need for developing breeding operation of ornamental marine species on a commercial scale in order to cater to the needs of domestic and export markets.

### **c) Need for developing sustainable approach in managing marine ornamental fisheries**

It is quite remarkable that 29 percent of traders (Figure 5) shared their apprehension about the sustainability of this sector if more people will be involved. Sustainability is the key to any developmental initiative and it needs to be addressed in the marine ornamental fisheries sector too. Destructive methods, over exploitation, collection of rare or endemic species, selective nature of collection and damage to reef habitats during collection are the major threats to the sustainable development of this industry. Internationally, lack of scientific information on collected species and the threat of extinction of target species (Wabnitz et al., 2003) has raised concern about the marine aquarium trade. Many international non-profit organizations have formulated and initiated strategies and standards in connection with all the stakeholders for a sustainable future of the industry. For instance, the Marine Aquarium Council (MAC) has developed a certification scheme in order to ensure the sustainability of marine organisms in trade, which outline the requirements of marine aquarium industry from reef to retail supply chain. Hobbyists' role in conserving the resources is also remarkable. A conscientious and well-informed consumer can greatly help protect wild species and safeguard the natural environment. So, it is imperative to plan sustainable management approach in ornamental fish trade in Kerala before scaling up of all the activities.

### **d) Participatory approach in ensuring sustainability in managing marine ornamental fisheries**

17 percent of the respondents recommended the need for encouraging coastal communities, especially fishermen for marine aquarium sector (Figure 5). A wide variety of ornamental 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 marketing system (Sureshkumar et al., 2004). Aquarium fisheries have the potential to provide an alternative economic activity for coastal populations (Wabnitz et al., 2003). The value of such fish as ornamentals is often appreciated greater than their value as fish protein and thus have great potential for valuable and sustainable economic benefits to local communities from the aquarium trade (Hodgson and Ochavillo, 2006). By appropriate technology development for utilizing these resources and awareness creation among fisher folk regarding the potential of wealth they are discarding, it is possible to grade up the sector of marine ornamental trade in the State, thereby providing sustainable income for the fisher folk as well as to the Nation. Hence, a comprehensive research is a prerequisite to come up with simple technologies and training and thus enable coastal communities to take up the new possibilities and challenges in this industry (Rachman, 2010). This will also help in protecting the resources through community-based conservation programme by the participation of coastal communities.

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