Chapter 1

Introduction
1.1 General Introduction

The keeping of ornamental fish in aquaria is an age old hobby, popular even today irrespective of age, class, creed or geographical variations in the residing area of hobbyists. In the contemporary times of space restrictions and craze for beautifying interiors, the aquariums have become an integral element of homes, offices, hospitals, hotels, business establishments, airports and other institutions. As popularity gained momentum, the need to transfer ornamental fishes from the resource abundant places to resource deficient places resulted in the marketing of ornamental fishes. The significance of ornamental fish trade was brought to light by International Trade Centre/ United Nations Conference on Trade and Development report (ITC, UNCTAD) on International trade in Tropical aquarium fish (Anon,1979) which portrayed the trade statistics as US $ 600 million at wholesale level or US $ 200 million in terms of imports (Cost & Freight). The report further added that, the domestic breeding costs in the principal markets rose sharply since 1973-74 and many developing countries got the opportunity to increase their export sales of exotic species. Hence it began to be less profitable to breed tropical fishes than to import stock and breeders or wholesalers found it necessary to supplement their product lines by imports to meet the rapid rise in demand in terms of quantity and species. From then, the hobby of keeping flashing colourful fish in aquaria which started as a plain pastime, transformed into a million dollar business in the world export market. According to Chapman (2000), the popularity and high value of ornamental fish have placed ornamental fish production among the leading cash crops in the
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aquaculture economy. Now it is for the developing countries to realise the potential of aquarium fisheries as an alternative economic activity and also form an important source of foreign exchange.

The era of globalisation which gained momentum in the nineties dismantled the tariff barriers to facilitate world trade and opened up new opportunities for both developed and developing countries, but it also posed serious risk to countries which were unable to reform their own markets to meet the requirements of the increasing non-trade barriers and become internationally competitive. From pepper and spices, to coffee and tea and then to shrimps and seer fish, Kerala's rich and varied export fare has been susceptible to the ebbs and tides of the national and international market for centuries and now it is the turn of the indigenous ornamental fishes of Kerala to be similarly affected.

1.1.1 History of ornamental fish keeping and marketing

The Britannica Encyclopedia (Anon, 2003a) noted the earliest known aquarists as the Sumerians, who kept fishes in artificial ponds at least 4500 years ago. The Encyclopedia added that the earliest records of fish keeping were reported from ancient Egypt and Assyria. The Chinese who raised carp for food as early as 1000 BC were probably the first to breed fish with any degree of success. The selective breeding of ornamental fish was later introduced to Japan, where the breeding of ornamental carp was perfected. The ancient Romans, who kept fish for food and entertainment, were the first known marine aquarists and it was in the works of Philip Gosse, a British naturalist that the term aquarium first appeared.
According to Fossa (2004a and b) reliable ancient sources indicated that the very first fish keepers who kept fish in ponds, lived in the Middle Eastern cultures of Assyria, Sumeria and Mesopotamia already more than 4000 years ago, but their interest in the fishes beyond their practical use for human consumption was not clear. Egyptians and Romans showed obvious interest in the decorative value of the fishes they kept. The honour for having created the first truly domesticated fish was attributed to the Chinese. Fossa (2004a and b) further added that the earliest Chinese literature that mentions gold fish dates from the first half of the first millennium and notes the reports of specimens of wild fishes with red scales in the Tsin dynasty or Gin dynasty period of AD 265 to AD 420. Religious aspects might have played a key role in elevating these red scaled fish from a merely interesting natural phenomenon, up to a first case of domestication of fish. Buddhism came to China from India in the first century of the first millennium, and one of its more important tenets was to respect all forms of life. With their conspicuous colour, the early gold fishes were very likely candidates for keeping in fish ponds within Buddhist temple and monasteries.

Anon (2002b) mentioned that the first long distance transportation of fishes took place in the 6th century AD in Europe and it was Cassiodorus who in 490-585 AD wrote how live carps were sent from Danube to Ravenna in Italy. According to Fossa (2004a) Chinese source from the 16th century tell of single coloured goldfish, as well as multicoloured variegated fishes. As early as the 16th century, goldfish was well
established in Japan, and about a hundred years later, the first imports to Europe took place. By 1910, large number of foreign fishes primarily from the South America and Asia had been imported into Europe and via Germany, many of them rapidly entered the United States of America, among them were Siamese fighting fish and the guppy. While goldfish or carp are often associated with Japan, they were actually first bred for their beauty and colour in China more than 1,000 years ago. Goldfish were first exported to Japan around 1500s, becoming an instant sensation. By the late 1600s, goldfish were brought to England, and over the next century they became very popular in ornamental lakes and ponds throughout the country. But Goldfish became commonplace in America only by the mid 1800s.

The principal factor in the growth of international trade in aquarium fish has been the development of international civil aviation since the second world war or perhaps by late 1960s (Anon,1979). World trade in tropical aquarium fish had assumed new dimensions leading to the changes in supply and distribution patterns in importing countries. Very recent innovations have been the advent of plastics and other modern materials. These resulted in cheaper and more plentiful equipment thus bringing the hobby within reach of even more people. When domestic electricity became available at the turn of the century, other species which required heating and other special conditions began to be kept and by about 1930 it became possible to keep saltwater fish in captivity, although high costs and supply distances restricted their acquisition. Because of
high mortality and expenses, marine aquariums were not found commonly in private homes before the middle of 1960s. Kvalvaagnæs (1982) wrote that, since 1970s technological advances from transportation improvements to artificial sea water, high powered filtration pumps and protein skimmers made it possible to distribute saltwater fishes from remote, formerly inaccessible regions to demand centres and for amateurs to successfully keep them in aquaria. According to Wabnitz et al., (2003) it is generally acknowledged that the collection and export of tropical marine fish for aquarium trade started in Sri Lanka in 1930, on a small scale. During the last quarter century and particularly during the last ten years, technology has developed to enable the keeping of tropical fishes with relative ease. This has fuelled a renaissance in fish keeping in general, as these beautiful tropical fishes have made their way into the living rooms around the world.

1.1.2 World status of ornamental fish marketing

Olivier (2001a) mentioned that the total wholesale trade in ornamental fish is estimated at about US $ 900 million and the retail trade of US $ 3000 million (Live animals for aquarium only). Singh and Dey (2003) noted that the estimated annual wholesale value of world trade in ornamental fish is estimated to be more than US $ 1 billion and in the retail level about US $ 1.5 billion are traded annually worth US $ 6 billion. The entire industry including accessories is estimated to be worth about US $ 14 billion.

Lim (2005) pointed out that, based on extrapolation from partial estimates of the United Nations Environment Programme in 2001, the
value of the marine ornamental fish trade was US $ 200-300 million per year and accounted for about 10% of the total international ornamental fish trade and indicated that the total ornamental fish trade could be as high as US $ 2-3 billion a year. Latest FAO statistics presented the world ornamental fish trade as US $ 448.77 million. Of this US $ 227.96 million is from imports and US $ 220.81 million is through exports (FAO, 2003). Rana (2004) argued that the differences between imports and exports may be mainly attributed to the undervaluing of exports for customs and tax reasons and inclusion of freight and import tariff. FAO (2003) statistics shows that, with an import of US $ 64.22 million, USA stands on top of the charts and Singapore tops the exporters list, with an export of US $ 41.43 million.

1.1.3 Ornamental fish trade in India

Hindu mythology glorified the Matsyavatara, the divine creations of nature which depicted the reincarnation of Lord Maha Vishnu and hence the Indians respected fishes, from time immemorial. Kulkarni (1982a) stated that Nawabs of Aoudh of Pre British days were said to have been interested in fish but whether they kept aquarium fish is not yet known. According to Sane (1982a), it was in Bombay in the first or second decade of the present century that aquarium keeping commenced as a hobby on a small scale which led to the formation of societies in Madras and Bombay and especially the Taraporewala aquarium in 1951. He further added that the aquarist society of India had held shows in Bombay while some were held in Madras a little later and as the hobby increased on one side, the
number of public aquaria grew throughout India and in the past two decades, it has been growing by leaps and bounds. By 1965 ornamental fish exporters could get enrolled with Marine Products Export Promotion Council and the registration of Marine Products Export Development Authority (MPEDA) came into force in 1973 (Sane, 1982a). MPEDA obtained inspiration from the ITC, UNCTAD/GATT report on ornamental fish trade (Anon, 1979) and organised a seminar in Bombay in 1982, thus beginning its activities for promoting ornamental fish trade. A compilation of the on the ornamental fish exports from MPEDA Statistics Review during the period 1969 to 2005, revealed that Indian ornamental fishes have been exported for the past 36 years. The export 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 (443.84 lakhs) in 2004-2005. On comparing the latest export statistics in the world trade i.e. 220.08 million US $ (FAO, 2003) with the export statistics from India in the corresponding year i.e. Rs. 254.95 lakhs (MPEDA Statistics Review, 2003), it was noted that the share of India formed just 0.25% of the world exports.

1.2 Background of the study

The fisheries sector plays a pivotal role in the national economy of India, in view of its contribution to the food basket. According to Yadava (2005), this sector contributed Rs. 1,37,180 million to the Gross Domestic Product (GDP) during 2003-2004 (at constant prices), which amounted to 4.42 percentage share in agriculture GDP and 0.96 percentage in the total
GDP. Viewing the categorisation of ornamental fishes in India's export basket it can be seen that they come under marine products export, which in turn is included in the agriculture and allied products export. According to Venkateshan (2006), export of marine products amounted to Rs.6646.69 Crores in 2004-2005 and ornamental fish export during that year (443.84 Lakhs) formed 6.68% of the marine product exports. The ornamental fish export from Kerala in that year (4.6 Lakhs) as per MPEDA Statistics, formed just 1.03% of the Indian ornamental fish exports in 2004-2005.

Figure 1.1 Ornamental fish export from Kerala

Figure 1.1 depicts the ornamental fish export from Kerala during 1995-96 to 2004-2005. The figure reflects a decline in exports from Kerala after a peak in 2000-2002 periods which formed a major impetus for the study.

1.3 Relevance of the study

The fisheries sector of Kerala is well developed but compared to the food fish sector the ornamental fish sector has not picked up. Several studies on the indigenous ornamental fish resources of Kerala are presented in
the literature review section of the study which pointed out that there was a potential for marketing those fishes and described no further. Hence marketing research has to prepare the firms in Kerala to a new world prospect of the trade to sustainably market the indigenous ornamental fishes of Kerala. The economic benefits of aquarium fish trade and especially indigenous ornamental fish trade have accrued only to a few, but it can create a lot of job opportunities at all levels that include primary, secondary and tertiary as well as ancillary industries connected with aquarium business and also bring in foreign exchange earnings. Given the necessary encouragement and required assistance by all concerned, there is a very good scope for the ornamental fish Industry to grow up in a fast pace. Fall in prices of the cash crops such as rubber, coconut and arecanut persuaded farmers to opt for alternative avocations such as ornamental fish breeding or marketing. Seasonal character of the fishing industry and the post tsunami scarcity for fishes resulted in the limited employment for fishermen and they too looked forward to alternative sources of income. Hence the farmers and fishermen who have access to downstream of water bodies and tribal people or fishermen who have access to upstream water bodies can be subjected to trainings in collection, breeding and marketing of indigenous fishes. The results of the study is expected to provide information on the sustainable marketing of the indigenous ornamental fish of Kerala and yield information needed by collectors, wholesalers, retailers and resource managers and new entrants, regarding the state of industry and provide suggestions for successful future management and policy making campaign.
1.4 Objectives of the study

The objectives of the research which sought insights into the possibilities for marketing the indigenous ornamental fishes of Kerala were as follows,

1. To identify the marketers of India, catering the indigenous ornamental fishes of Kerala to the domestic and export markets, in order to compare the marketing mix strategies pursued by the different categories of marketers.

2. To find the most prospective export markets for the indigenous ornamental fishes of Kerala.

3. To study the consumer preferences in the domestic ornamental fish market of Kerala that will enable innovative ventures into this potential market to enhance the industry in a great way.

4. To conduct a SWOT analysis of ornamental fish industry in Kerala to analyse the strengths, weaknesses, opportunities and threats.

1.5 Limitations of the study

- Fishermen were not included as respondent marketers as they were not full time marketers engaging in indigenous ornamental fish marketing, by utilising the four marketing mix tools namely product, place, price and promotion.

- SWOT analysis was based on the results obtained from the previous chapters and were sorted under four heads namely strength, weakness, opportunity and threats.
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1.6 Plan of the study

The thesis is organised into four sections. The first section is an introduction to the study and comprises Chapter one and Chapter two.

- Chapter one provides an overview of the study and describes the background of the study, history and status of ornamental fish keeping and marketing in the world, history and status of ornamental fish keeping in India, need for the study, the objectives probed, scope and limitations of the study, plan of the study and the literature survey.

- Chapter two discusses the research design and methodology.

The second section is on the marketing mix pursued in indigenous ornamental fish marketing and the section is spread into four chapters i.e. Chapter three, Chapter four, Chapter five and Chapter six.

- Chapter three portrays the indigenous ornamental fishes of Kerala in the marketing scenario.

- Chapter four outlines the channels of distribution in marketing indigenous ornamental fishes.

- Chapter five presents a study on the price of indigenous ornamental fishes.

- Chapter six examines the promotional strategies adopted to boost the ornamental fish sector in Kerala.

The third section is on the traditional markets and the future prospective markets for indigenous ornamental fishes of Kerala. The 7th and 8th chapters are included in this section.
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- Chapter seven deals with prospects in export market for indigenous ornamental fishes of Kerala.
- The eighth chapter is devoted to the prospects in domestic market for indigenous fishes as ornamental fishes.

The fourth section is the concluding section which includes the ninth and tenth chapters.

- Chapter nine presents a SWOT analysis of the indigenous ornamental fish marketing industry in Kerala.
- Chapter ten gives conclusions and recommendations of the study.

1.7 Review of Literature

1.7.1 Marketing

As a prologue to the study on the prospects of marketing the indigenous ornamental fishes of Kerala, a scanning of literature on ornamental fish marketing was carried out to show the relevance and significance of the research objectives of the present study. The literature review also seeks to show that other researches have not yet adequately explored the objectives of the present study.

Generally people tend to equate marketing with selling. Levitt (1960) drew a perspective contrast between the selling and marketing concepts. Selling focuses on the needs of the seller; marketing on the needs of the buyer. Marketing management functions in the marketing literature is termed as marketing mix and the four factor classification of market mix was popularised by Mc Carthy (1981). Chaston (1984) states that in the fishing industry, the widely accepted image of marketing is that
it is simply responsible for promoting the product in order to increase sales. He also stressed the need to identify the product needs of the customers who make up the market sector in which the company operates, to ensure that the company's products offer the attributes most capable of satisfying the need. Only at this point in marketing process can the company begin to use the variables of price, promotion and distribution to generate the required level of sales. Chaston (1984) further added that, in the fishing industry there have been numerous examples of companies who failed to appreciate the full scope of marketing management functions and invested in increased capacity without assessing the real nature of the market need. American Marketing association defines marketing as the process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and services to create exchanges that satisfy individual and organisational objectives (Bennet, 1988). The marketing concept holds that the key to achieving organisational goals consists in determining the needs and wants of target markets and delivering the desired satisfaction more effectively and efficiently than competitors. According to Shoot and Butte (1992), the concept of marketing mix refers to the set of controlled demand impinging instruments that can be combined into a marketing programme used by a firm (or any other organisation) to achieve a certain level and response from target market. Talukdar and Bhowmick (1993) points out that the perishable items having shorter life need special attention for orderly marketing to make them available at proper place, time and form desired by the consumers in well presented manner at proper place. Hence timely harvesting and
procurement, quick transportation, modern storage and processing, advance packaging and maintenance of a cool chain in their marketing process are some of the factors for immediate attention and a weak marketing process not only affects the social status of the producers and consumers but it also affects country's economy at large. Larkin et al., (2001d) noted that the market data on ornamental fishes generally do not identify the attributes of the product fully and project price and quantity as if the products are homogenous and experimental market approach assumes that the product, ornamental fish is heterogeneous i.e. differentiated with respect to attributes such as species, country of origin, method of capture, culture, size, colour, price and condition. He carried out a study based on conjoint analysis which is an accepted methodology to elicit consumer preferences for product with different attributes of varying levels.

The booming ornamental fish trade has given rise to an extensive literature on various aspects relating to ornamental fish trade. The literature on ornamental fish trade in the study is described under the heads global ornamental fish trade, ornamental fish trade in different countries, the ornamental fish trade in India and Kerala with special reference to the indigenous ornamental fishes of Kerala.

1.7.2 Global ornamental fish trade

Conroy (1975) highlighted the international trade in ornamental species. Anon (1979) presents a study on international trade in tropical aquarium fish and carried out a market study in USA, Germany, UK, the
Netherlands, Belgium, Sweden, France and Switzerland and summarised the major findings as main characteristics of international trade in tropical aquarium fish by country. The report portrayed the data on demand, supply, import duties and taxes, distribution network, prices and trade practices. Bassleer (1994) stated that worldwide sales of ornamental fish are estimated at US $ 900 million wholesale and US $ 3 billion retail. Some 99% of the market comprises home hobbyists with the remaining 1% consisting of public aquaria and research institutes. Ramachandran, (1999) presented an introduction to the international trade in ornamental fish. Olivier (2001b) described the dynamic distribution network in marketing. The study involved fishermen or collectors, the breeders, the wholesaler, the exporter, the importer, the transhipper, the retailer and other important players and also presented an overview of the supply and demand situation in ornamental fish trade. She also listed the problems in ornamental fish trade as supply problems, destructive fishing methods, mortality rates and the concept of sustainable development applied to fish keeping. Lim (2005) analysed the FAO trade statistics from 1976 to 2002 and noted that there were several trends emerging in the global ornamental fish trade. The international trade situation was further updated by Singh and Dey (2006).

1.7.3 Ornamental fish trade in different countries

Eichler (1981) discussed the possibilities and problems related to the exporting of ornamental fish from Mozambique. He stressed the need to investigate the market situation in Europe, America, Japan and South
Africa, the channels for export and maintained that to make recommendations for an export venture, it was necessary to look at what species are available for export, the possibility of catching and acclimatising them and the interest of dealers in buying them, conditions closely connected to their competitiveness with those being exported from other countries.

Albaladejo and Corpuz (1981) examined the status and trade mechanics of the Teh Aquarium Fish Industry of Philippines aiming at the establishing of guidelines for resource management schemes that would ensure the protection and continuous growth of the industry. Interviews were held with collectors, middlemen, and exporters concerning the history and present status of the industry. Inherent problems of the industry are reviewed and recommendations and suggestions as to what resource management policies can be promulgated to ensure the growth of the industry are presented in this paper.

Kvalvaagnaes (1982) described some of the problems to be overcome for Indonesia to successfully develop further its ornamental fish trade and also mentioned the sources of fishes, species, species of interest, prices, supply methods, marine invertebrates, and freshwater plants. Sadovy (1992) carried out a preliminary assessment of the marine aquarium export trade in Puerto Rico through a series of informal interviews and inspected the export shipment species lists of six major export business and noted that 106 species of fish and invertebrates were exported from the country which added to 160,000 and 200,000 organisms.
in 1991. Seventy percent of this volume was composed of six species. He further added that the unregulated industry in the country needs urgent monitoring and regulating.

Jonklaas (1982) carried out pioneer works on ornamental fish trade from Srilanka and described the aquarium fish potential in some developing countries with special reference to Srilanka and India. According him the aquarium fishery in Sri Lanka began as long ago as the 1930s, but it was not until the 1950s that it was firmly established and began to expand. It is a high value industry, with viability dependent on a healthy resource base. Jonklaas (1985) wrote on the population fluctuations in some ornamental fishes and invertebrates off Sri Lanka. Roy (1995) wrote on better management of the ornamental fish sector in Srilanka and noted that captive breeding and export of ornamental fish was an important industry in Srilanka which provided jobs, incomes and foreign exchange but also raised environmental concerns and he added that Bay of Bengal Project (BOBP) brought all of ornamental fish industry’s players together to discuss management. Madhu (1996a) in an article entitled business runs on trust presents the profile of the leading exporter from Srilanka who also put forward his views of trade and its management. The exporter opined that, rather than an absolute ban which would also ban the species in abundance, the fly by night operators are to be discouraged for management regulations. He also mentioned the transformation of the industry from a wild caught fish dependant one to tank raised fish dependant one. The industry which has no insurance runs
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on trust as it is fraught with risks of delayed payment, mortality and natural disasters and profit margin has to cover all these. Madhu (1996b) writes on the ornamental fish divers of Srilanka who were instrumental in elevating the position of India in the world trade. Rana (1998) highlighted the factors that attributed to the incredible development of Srilankan ornamental fish sector of transforming itself from traditional marine ornamental fish exporting country to a source of high quality cultivated fishes thus increasing the exports from around US $ 0.5 to US $ 5 million between 1994 and 1996 exports. The factors noted were the shift from small backyard facilities where ornamental fishes were reared on a part-time ad hoc basis to purposely built facilities managed on a full-time professional basis, parallel development of components such as economic viability of production, nature of producer, organisation, local institutional and human capacity, relevant infrastructure and a sound appreciation of the intricacies of international markets, government incentives such as exemption of import duties on equipment and feed and local tax along with provision of land and infrastructure in some cases the entrepreneurship of the private sector. Werakoon (1998) gave a brief account of the development of the ornamental fish industry in Sri Lanka, considering future trends and requirements for advancements and covered areas such as adequate stocks of freshwater aquarium fish; harmony among breeders and exporters; research and development; government guidance and support; and adequate air freight facilities and export services. He concluded that research and development is a key activity to support the industry and there is a need to produce new varieties, prevent and treat
diseases, improve fish nutrition and feeding, and pass on technology and management practices to the small producer. Ekaratne (2000) briefly reviewed the status and trends in the export trade of ornamental fish species, the impact of the export effort on resources, and the status of information relevant for resource and habitat management. The study enlisted the marine and freshwater species, including endangered species, and explained of the population, biology, ecology and distribution of those fishes. Wijesekara and Yakupitiyage (2001) assessed the present status and future trends in the ornamental fish industry in Sri Lanka to probe the fish production system which caters the international market; and identified the constraints within the industry. They added that the aquarium fish industry in Sri Lanka has become a valuable foreign exchange earner during the past few years, by exporting wild caught marine, brackish-water and freshwater species as well as captive bred freshwater fish earning Rs.530 million in 1998.

Edward (1988) prepared a preliminary report on the aquarium fish trade of the Republic of Maldives. Edwards and Shepherd (1992) pointed out that the export of aquarium fish from the Maldives began in 1980 and in 1989 almost 54,000 marine fishes, worth approximately US $ 130,000, were exported. The collection of aquarium species is confined to a relatively small area around the capital island, Male. Estimates of annual exports of 95 species were obtained by examining packing lists held by Maldivian Customs. In parallel, the population densities of about 70 aquarium-fish species were estimated by visual assessment. Using a
number of assumptions, potential yields for 65 of these species, those for which export data were available, were estimated for the area (530 Km$^2$) within a 13 Km radius of Male. Monitoring and regulation of the aquarium fish trade is discussed, together with the need for collection of catch statistics by those involved in the trade. The importance of regulation of collection techniques, of standards of facilities, and of satisfactory packaging of fish for export, is stressed. If more accurate estimates of sustainable yields are to be obtained, there needs to be monitoring of populations of key aquarium fish species in designated collecting areas where exploitation levels are known. Until such estimates become available, the cautious approach adopted in the Maldives to estimate yields and set species-based quotas will, it is hoped, prevent local overexploitation. Adam (1995) reviewed the aquarium fish trade in Maldives. According to Adam (1997), the aquarium export fishery from Maldives started in 1979 exporting mainly to Sri Lanka. The fishery centered around the International airport where the fish are air freighted to Sri Lanka, Europe, USA and the Far East. About 100 species of fish are exported, with 20 species comprising over 75% of the trade. Some of the species exported are very rare in the Maldives and are very vulnerable to overexploitation. The fishery is reviewed and management issues and options for monitoring and regulations are also discussed.

that, in spite of being a city state with very little land for agriculture, the
country has more than 64 fish farms in 2001, and is the largest producer of
farm bred fishes. For Singapore to remain competitive in the world market
both farmers and the exporters of the country strive continuously for higher
productivity and better fish quality. Agro Veterinary Authority (AVA) also
works closely with the industry and the research institutes aiming at the
improvement of production technology and fish quality for export. Lee
(2005) attributes the success of ornamental fish industry in Singapore to
its excellent operational environment and unique strength of local players.
He also gave a brief account of the recent trends and issues confronted by
the ornamental fish industry of the country. Ling and Lim (2006) presented
a clear picture of status of the trade and farming in Singapore. The farms
have added upto 70 with 156 hectre farm area which produced 132.9
million pieces of ornamental fish worth US $ 23.7 million, which accounted
for 46% of the fish exported from the country.

Betram (1996) wrote on the aquarium fishery in Cook Islands and
stressed the need for management and added that the recently developed
fishery for aquarium fish has been a success in terms of creating
employment, fisheries development and self imposed management.
Graham (1996) described about the managing of Managing Palau's
aquarium fishery and Graham (2001) wrote about the Live Reef Fisheries
of Palau, its history and prospects for management.

Chapman et al., (1997) stated that ornamental fish production is
among the leading cash crops of the United States of America aquaculture
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economy, and retail value of the fish trade is worth approximately US $ 1,000 million. Using import and export documents trends in total values for the U.S. trade in ornamental fish was reported and the number and value of the most commonly imported ornamental fish was found out. Adams et al., (1999) projected the volume and value of marine ornamentals collected in Florida. Adams et al., (2001) provides a brief description of the industry in Florida during the 1990s, focusing on the existing set of harvest regulations, trends in volume and value of landings by major species groups, and harvest by region, so that the resource managers can develop more effective regulatory measures that provide for the sustainability of the resource, thereby ensuring that Florida retains its share of this growing market. The marine life fishing industry in Florida is defined by the state as the non-lethal harvest of marine plants, finfish, and invertebrates that are sold live for commercial purposes (primarily into the saltwater aquarium industry). Adams et al., (2001) while writing on International trade in live, ornamental 'fish' in the U.S. and Florida, described the U.S. trade in live, ornamental 'fish' during the 1994-98 periods. Imports and exports are discussed by country of origin and destination. In addition, trends in international trade in live ornamentals through Florida ports of entry are described. Where ever possible, these trends are described by product form. The discussion highlights the relative importance of the international market for this increasingly important market to purveyors of live marine ornamentals in Florida. Larkin et al., (2001b) highlighted the economic profile of the Florida's marine life industry by summarising the industry data on total landings, revenues and trends over time. Regional analysis
showed the primary collecting areas located in Florida. Seasonal analysis shows when the majority of landings occur within the year. Statistics on the number of participants by type provide insight into the size of the industry. Trends are evaluated in terms of changes across the nine year period from 1990 to 1998. Larkin et al., (2001c) carried out US tropical wholesalers survey to understand the demand for Florida products both domestically and internationally and the need for changes in the way industry is regulated and to provide insight concerning the following issues such as recent market trends and channels, importance of imports, differences in marketing imported versus domestic products, marketing advantages and disadvantages of species collected in Florida, identification of major foreign competitors, factors influencing sales of live animals and expectations on the future of the industry. The study stated that Florida firms deal primarily in marine species and collect much of their own product whereas wholesalers outside Florida handle more freshwater species and purchase most of their inventory, the majority from suppliers and the study suggested that the marketing strategies in Florida should point to the high quality of Florida species with emphasis on the growing popularity of the invertebrates.

Dufour (1997) concludes that harvest of ornamental marine fish is of economic interest for Pacific Island countries and if their transportation costs and salaries are controlled, the development of this activity could quickly yield for an annual harvest of 100,000 fish, a turnover of US $200,000 and 10 to 20 permanent jobs. He proposed that catches of
Chan and Sadovy (1998) carried out a market survey and review of government statistics to establish imports and exports of marine ornamental fishes into and out of Hong Kong, examined the local trade in terms of volume, value and species composition. The survey concluded that when compared with net imports, export and re-export volumes over the 15-year period were small, indicating that most imports entered the local market, or were exported, unrecorded. The market survey of marine aquarium shops in Hong Kong was carried out. From this survey, an annual estimate of 957,563 coral reef fish was calculated for the local trade, valued at HK $ 57,453,780, with a mean retail price of HK $ 60 per fish. These figures account for an estimated 2-3% of the global value and volume of marine aquarium fish trade, according to 1992 figures and, compared with government figures, indicate that official declarations of imports are under reported by at least 2-3 folds. A total of 342 marine aquarium fish species, from 49 families, were recorded with about 60% belonging to the families Labridae, Chaetodontidae, Pomacanthidae and Pomacentridae.

Fang (1998) presented a status report of the ornamental fish industry in Taiwan, which is recognised as an important exporter of ornamental fish. The steady supply of skilled manpower, long experience in ornamental fish cultivation, large domestic market and enterprising management are factors contributing to the success of the industry. Ten
major categories of exportable ornamental fishes from Taiwan are African Cichilids, blood Parrots, South American Cichilids, discus, killifish, koi and endemic freshwater varieties and marine varieties.

Daw et al., (2001) describes the findings of research conducted in Eritrea in 1997, when the capture, transport and export of aquarium fish were reviewed and potential impacts and the status of management were investigated through liaison with stakeholders and researchers. To earn revenue for Eritrea, a 20% export tax was imposed, although this was calculated from declarations by the operators. The emerging nature of the trade allowed detailed monitoring by the Ministry of Fisheries. However, management efforts were constrained by a lack of capacity for enforcement and baseline research. Several potential effects of the trade exist but other, land based impacts may be more pressing concerns for Eritrea's reefs. Research priorities for management are discussed as well as the implications of mariculture of Eritrean species by other nations.


Dey (2005) elaborated on the Malaysian ornamental fish industry
which is marching ahead to number one position in the world trade. He pointed at the official statistics published by the department of fisheries which noted that 408 million ornamental fish was produced in 2003 and exported US $ 18.09 million worth of fish in 2003 to over 55 countries, accounting for over 10% of the global exports, positioning it as the second largest exporting country. A unique feature of the country noted by him was that each of the state specialised in different varieties of fish. Intensified efforts have been made to propagate indigenous varieties and successful attempts in this direction have been achieved in the breeding and marketing of dragon fish, *Scleropages formosus*. Leong (2006) described the status of ornamental fish industry in Malaysia, which started off in the fifties and have made a quantum leap over years to garner a market share of 9 percent of the total world exports second only to Singapore. The country produces about 400 species and 600 varieties of aquarium fish produced from about 450 farms and a total area of farming not less than 1000 hectres.

1.7.4 Ornamental fish trade in India

Taking cue from ITC, UNCTAD/GATT report on international trade in ornamental fishes (Anon, 1979) the Marine Products Development Authority of India (MPEDA) took up a workshop which came up with several papers on ornamental fish trade in India. Bawne (1982) described the status of aquarium fish trade in Bombay. Chapgaar (1982) made a compilation of some of the popular Indian aquarium fishes of India with description of their external appearance and place of occurrence based on
the works of Day. He also mentioned the persons who were instrumental in the introduction of some Indian ornamental fishes into the trade. Mukherjee (1982) added a note on the prospect of aquarium fish for international trade. Sane (1982a) gave a detailed description of the status of the ornamental fish trade in India. From the time he began exports in 1962, to the present scenario and notes that the export of live tropical aquarium fish has been neglected due to the lack of awareness in the people and officials at different levels, regarding these small sized and unimportant fish which can earn a tremendous foreign exchange for the country. Shenoy (1982) mentioned the scope for development of export trade of tropical fishes from the Eastern region of India.

Dordi and Dasgupta (1983) opined that even though India has a vast coastline and plentiful marine resources, the country has not been successful in earning enough foreign exchange due to the disorganised trade. He adds that an essential part of the export of live aquarium fish is suitable distribution system with proper care towards packing and transportation and hence the article is devoted to the often neglected subject of packing.

MPEDA with the assistance from the Centre for the Promotion of Imports from the Developing Countries (CBI), the Netherlands and under the bilateral cooperative programme of Indo-Netherland took up projects in phased manner. Phase -1 of the project (Tomey, 1985) dealt with resource survey of marine ornamental fishes in Lakshadweep water, Phase -2 of the project (Tomey, 1986) was on a pilot study on the
transportation of fishes from Kawarathi to Amsterdam, Phase -3 (Anon, 1986) dealt with, training mission to Netherlands, workshop and sales mission to West Europe with the participation in the Interzoo fair- 88 and Phase - 4 was a workshop on ornamental fish export. The workshop had papers by Shenoy (1986), Nopany (1986) and Sane (1986). Nopany (1986) discusses the problem in ornamental fish export from India as breeding, freight charges, lack of incentives and requested the granting of a cash compensation of fifteen percentage to offset exporters high cost of collection and transportation, and also a subsidy to breeders to the extend of at least 25% in cost of land, sheds and other constructions for establishment of fish farms as infrastructure for storing aquarium fish. Shenoy and Dey (1986) prepared a feasibility report on the setting up of an ornamental fish exporting unit for enhancing the ornamental fish export from India.

Basavaraja et al., (1988) wrote on the live-bearing freshwater ornamental fish, all of which belong to the family Poeciliidae. The paper also details the methods involved in the breeding of these species of fish, describing their gestation, delivery and larval rearing. Bhaskar et al., (1989) wrote on the exotic freshwater aquarium fishes and their role in the aquarium fish trade in India. The paper listed 261 species of egg laying and 27 species of live bearing fishes which has been introduced into India. Kumar (1995) wrote in detail on the culture of ornamental fishes and their export potential. Nayar (1996) briefly described that ornamental fish trade is a booming trade in various countries and especially in India and put
forward the reasons in the way of expansion of the industry. Murty (1996) wrote on the distribution of ornamental fishes in Lakshadweep Islands, Andaman group of islands and several islands in Gulf of Mannar and Palk Bay. Dominant species of ornamental fishes in the Lakshadweep, common ornamental fishes from Wandoor Marine National Park, Andamans, important ornamental fishes known from Gulf of Mannar and Palk Bay have been listed. Brief notes on natural history of major ornamental fish groups have been summarised. The author concludes by providing suggestions to formulate a strategy for exploitation and export of ornamental fish, to control over exploitation. Hand book on aqua farming compiled by Dey (1996) describes the domestic ornamental fish market of India which has two hundred full time and one thousand five hundred part time ornamental fish breeders. He further described the Indian ornamental ichthyofauna which includes freshwater, brackish water and marine fishes, the mass production of both marine and freshwater fishes, diseases and the setting up of an export oriented ornamental fish unit. Jayashankar (1998) noted that ornamental fish trade has emerged as a resource with considerable economic potential and pointed out that apart from improving foreign exchange reserves this trade can generate more job opportunities and self employment. The paper lists commercially important marine, ornamental fishes of India; discusses captive propagation and culture, research and development efforts needed and use of DNA finger printing for identification, efficient monitoring and genetic improvement of stocks; and stresses the importance of aquarium fish culture in earning foreign exchange and generating rural employment opportunities. Kumar (1999)
presented a rough statistical data which shows the present status of aquarium industry in India and added that in India most of the aquarists are inaccessible to modern technical developments in ornamental fish farming. He listed the common Indian varieties of aquarium fishes and also discussed the measures to be taken for the development of the ornamental fish production and boosting of exports. Mohanta and Subramanian (1999) described diseases in an ornamental culture system such as microbial diseases, fungal diseases and protozoan diseases. Various management techniques of prevention and treatment of these diseases have also been discussed. Mukherjee et al., (1999) notes that West Bengal's devil catfish (*Chaca chaca*), a native fish which had been considered unimportant and 'trash fish', now rules the foreign market of aquarium fish. But the indiscriminate use of pesticides and other environmental factors are threatening their existence. A list of some of the exportable ornamental fish treated as trash fish in West Bengal is presented and an examination is made of various problems which face the ornamental fish industry. Gopalakrishnan and Ponniah (1999) wrote about the introduction of red Piranhas for aquarium purposes in India and the stressed the need to exercise caution while introducing piranha and all other exotic fishes including aquarium fishes. According to Dayal and Kapoor (2001) the domestic market of India is quite promising for tropical ornamental fish with the demand exceeding the supply. They referred the Western Ghats of India as a goldmine of fish biodiversity and presented a comprehensive list of 106 ornamental fish endemic to Peninsular India, with special reference to the Western Ghats and also detailed the
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conservation status of some 48 potential freshwater ornamental fish out of the 106 ornamental fish reported from Peninsular India.

Sane (2000) briefly examined the potential for export of some ornamental fish species from the Western Ghats region of India and suggested that attempts should be made to develop infrastructure for the ornamental fish trade and understand the breeding behaviour and requirements of endemic ornamental species to lead to a mass-scale breeding and an assured supply of fish, giving a boost to the export figures of these species. Ramachandran (2002a and b) listed the exotic fishes popular in the aquarium market of Kerala along with their prices.

Das and Sinha (2003) described the four categories under which the Indian ornamental fish trade can be categorised namely, culture, breeding, export and marketing of accessories and adds that farmers and exporters have to be brought together for the purpose of integrating the production and export activities in a manner that would be mutually beneficial and such a relationship will push up the level of exports from the country. Ghosh et al., (2003) wrote on ornamental fish farming which has become a small scale aqua business in India. Swain et al., (2003) while writing on the prospects of export oriented freshwater ornamental fish culture in India notes that emphasis must be laid on systematic cataloguing of commercially important aquarium fishes bringing in new species for diversification, detailed studies in breeding, biology, behaviour aspects, nutritions feed formulations disease diagnosis and comprehensive health management. Sane (2005) stressed that lack of
facilities to import brood stock of beautiful exotic fishes is a factor affecting ornamental fish exports from India.

1.7.5 Ornamental fish trade in Kerala

There is a paucity of information on the ornamental fish trade in Kerala apart from the works of Ramachandran (2002a and b), Shyma (2002) and Saju (2003). Literature survey on the marketing of indigenous ornamental fishes of Kerala revealed that very few works attempted describing aspects relating to the marketing of indigenous ornamental fishes.

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Review of literature on indigenous fishes of Kerala revealed that, substantial works have been conducted on the distribution of tropical fresh water fishes in Kerala. The monumental ichthyofaunal study of Day (1865 and 1878) was followed by works in the southern region by Pillai (1929) who reported the presence of 369 species from the Travancore region and his list contained freshwater (72 species), brackish water and marine forms. John (1936a and b) documented 73 species from Travancore region. Hora and Law (1941) and Hora and Nair (1941) reported the presence of 76 species of freshwater fishes from Travancore. After that most of the studies were conducted in the South Western gap during the forties and fifties and include Raj (1941a and b), Chacko (1948), Menon (1950), Silas (1950), Menon (1951a and b) and Silas (1952). Silas (1953) described the new fishes from Western Ghats with notes on *Puntius*
Silas (1954) noted Garra hughi, a new Cyprinid fish from Western Ghats and Silas (1958) noted the Cyprinid fishes of the genus Chela.

The earlier specific study in the higher reaches of Chalakkudy river system in Anamalai and Nelliampathy hills was carried out by Silas (1951). Later Thobias (1973) carried out a detailed study on the fishes of Thrissur district which was followed by a study by Antony (1977) on Systematics, ecology, binomics and distribution of the hill stream fishes of Thrissur district. Inashu (1991) carried out the systematics and bionomics of Inland fishes of Thrissur district and listed 57 species of which 17 species were from the Chalakkudi River. Pethiyagoda and Kottelatt (1994) reported three new species from Chalakkudi River under the genera Travancoria, Osteochilichthys and Horabagrus. Biju et al., (1996) reported the occurrence of Tetraodon travancoricus in Chalakkudy and Keecheri rivers. Shaji et al., (1996) reported new species under the genus Garra. Ajith Kumar et al., (1999) described the fish fauna abundance and distribution in Chalakkudy river system.

Rajan (1955) added notes on a collection of fishes from the head waters of Bhavani River. Fish fauna distributed in Silent Valley region was studied by Indira and Rema Devi (1981), Remadevi and Indra (1981), Remadevi and Indra (1984), Remadevi and Menon (1992a) and Remadevi and Menon (1992b).

Remadevi and Indra (1986) reported Noemacheilus pambarensis from Idukki. Shaji and Easa (1992) worked on the extension of the range


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Several aspects of ornamental fishes have been taken up of late. Premkumar and Balasubramanian (1984) studied the breeding biology of the Scarlet banded barb, *Puntius amphibius* from Chackai canal. Inashu (1993) worked on the sexual dimorphism of fresh water puffer fish
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identified 40 species (belonging to 20 families) of the potential marine ornamental fishes in the trawl bycatches of the Ponnani fishing harbour, South West coast of India in order to assess the temporal and spatial availability of these fishes were discarded due to low consumer acceptance and small size. Literary works that explore new avenues for indigenous fishes as ornamental fishes need to come up for their effective utilisation in a sustainable way.