

# **A study of the constraints affecting ornamental fish production in Sri Lanka**

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## **Abstract**

Although Sri Lanka is endowed with favourable climatic conditions and resources for breeding and rearing ornamental fish for export, a considerable number of ornamental fish producers as well as exporters have given up the industry within a relatively short period of time. This study was conducted to understand the present status of the industry and to identify the problems that have caused these failures.

The study was conducted from March to December in the year 2007 and covered Colombo, Kaluthara, Polonnaruwa, Negombo, Wattala, Rathnapura, Avissawella, Kandy, Kegalle, Padukka, and Gampaha areas, where ornamental fish culture is known to be popular. The survey was carried out by interviewing ornamental fish farmers using a structured questionnaire survey that was designed to elicit the required information.

Most (75%) of those surveyed were identified as small scale farmers. A majority (56%) of them used only cement tanks for their culture activities. Only 47% of farmers had proper technical knowledge or training on fish culture while 42% directly supplied their fish products to the exporters.

The most important constraints identified by the study were as follows: (1) The sale price of fish not changing in keeping with the increase in the material costs of production - Feed, cement, sand, transport and labour - in recent years. (2) Difficulty to find export markets for newcomers to enter the export market. (3) Lack of quality brooders and information on the most suitable fish varieties for the different climatic and water conditions in different areas in the country (3) Feed availability and cost. (4) Lack of adequate knowledge and technical support with regard to disease control and water quality management. (5) Difficulty to survive in the off season. (6) Difficulty in obtaining credit for expansion and the lack of sufficient involvement of responsible authorities in overcoming all these identified constraints.

**Keywords:** ornamental fish, constraints, farmers, exporters

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## **Introduction**

Having a display of colourful and fancy fish, commonly known as ornamental or aquarium fish, both in the home and in the workplace, is one of the oldest and most popular hobbies in the world. The attractive colouration and quiet disposition of ornamental fish provide a source of joy and peace for people irrespective of their age group.

The global trade in ornamental fish is increasing rapidly at around 6% annually. With the increase in demand for ornamental fish, especially in the US, Europe and Japan, many countries in Asia have started capturing and culturing beautiful and coloured ornamental fish to supply this lucrative market. In the aquaculture sector, ornamental fish breeding, culture and trade provide excellent opportunities as a non-food fishery activity for employment and income generation. It is, moreover, environmental friendly, socially acceptable and is a low investment, small scale enterprise with usually high returns (Panigrahi *et al.*, 2009).

## ***Ornamental fish in the World***

The annual world trade in ornamental fish is estimated at US\$ 2.2 billion, 98 per cent of which are from tropical fish. According to FAO, since 1985, the value of international trade in exports of ornamentals has increased at an average growth rate of approximately 14 per cent per year. Developing countries account for about two-thirds of the total export earnings (Kumar, 2010).

The major ornamental fish producing countries are mostly in Asia and Europe and together account for more than 70% of global exports. The rest are from the Americas, Oceania and Africa. Developing countries from tropical and sub tropical regions are the major sources of live aquatic ornamental products and Singapore, Czech Republic, Japan and Malaysia are key the producers. Singapore imports and re-exports, thus acting as a market 'hub' in Asia (Panigrahi *et al.*, 2009). In the Asian region, Singapore (34 %), Malaysia (15%), Indonesia (11%) and Japan (10%) are the major suppliers to the ornamental fish trade. Major consumers and importers (which include demand for re-exporting) are USA (24%), UK (10%), Germany (10%), Japan (9%), France (8%), and Singapore (5%) (Ponniah *et al.*, 2007).

## ***Ornamental fish production in Sri Lanka***

### ***Potential for ornamental fish culture in Sri Lanka***

Ornamental fish culture provides an excellent business opportunity in Sri Lanka since there is a strong demand from both domestic and export markets. The aquarium fish industry in Sri Lanka has become a valuable foreign exchange earner during recent years, earning as much as Rs. 929,844,220 in 2006. Sri Lanka exports ornamental fish to

about 48 destinations in the world and among them UK, USA, Japan, France and Germany are the major buyers (Gunasekera, 2007). The prospects for developing this industry in Sri Lanka is good due to the wide geographical spread, extensive species diversity, and the ongoing research and development efforts by associated institutions in the country.

### ***Composition, culture and production systems of ornamental fish in Sri Lanka***

The ornamental fish production sector in Sri Lanka includes fresh water as well as marine and brackish water species. On average, freshwater fish contribute 90% of the value of the total output and marine fish contribute 10% (Weerakoon *et al.*, 2009). While the marine and brackish water aquarium fish are generally caught from the wild (Indian Ocean), the total output of fresh water ornamental fish consist of farmed product (90%) and wild collections (10%).

The ornamental fish production sector in Sri Lanka consists of fish breeders, fish farmers (small, medium and large scale), out growers, middlemen, collectors and exporters. The breeders produce and sell fish fry to farmers for rearing. Fish farmers raise the fish in their farms to marketable size and either export them directly or sell them to exporters, directly or through middlemen (Wijesekara *et al.*, 2001). Some farmers may also do their own breeding. The fish that are not up to export quality are sold in the local market.

The popular and successful method adopted by exporters to meet their demand is the use of out-growers. In this system, exporters breed the fish and supply those fish fry, feed, chemicals, basic technology and advice to the fish farmers who work as out growers to them.

When fish are grown to the exportable size and are ready for the market, the exporters will buy back the product and will deduct the cost for fry, feed, and chemicals when making payments. The fish collectors are involved in capturing fish from the wild and supplying directly to the exporters and the majority of them deal with marine species.

Two types of culture systems for ornamental fish can be seen, namely, large outdoor mud ponds or indoor/outdoor cement tanks. The method of culture is related to the variety of fish. Usually varieties such as Angelfish, Carp and Gold fish are raised in mud ponds and Guppies, Mollies, Swordtails and platys in cement tanks. High-density culture in cement tanks has become more popular since it optimizes the use of land, labour, capital and operational costs and minimizes any adverse impact on the environment. Fish raised in cement tanks are also found to acclimatize more easily to aquariums in the importing countries. It should be noted, however, that each system has its own advantages as well as its drawbacks.



Despite the very favourable conditions prevalent in Sri Lanka for rearing ornamental fish, it has been observed that many persons engaged in this activity have given up the trade due to their inability to consistently maintain production of good quality and healthy fish for export. During the last decade, the ornamental fish trade in Sri Lanka has only been able to secure 3-5 % market share in global trade (Weerakoon *et al.*, 2009) and Sri Lankan production has not been able to meet volumes required by the export market (Yu, 2009).

A study was carried out, therefore, to assess the present situation in the sector and in particular to identify the likely reasons for the failures, as we believe that such an understanding is crucial for the sustainability and development of this valuable foreign exchange earning industry in Sri Lanka.

### **Materials and Methods**

The information relating to the present status of the industry was collected by literature surveys including statistical reports and publications of the Export Development Board (EDB), Sri Lanka Customs, National Aquaculture Development Authority (NAQDA) as well as through interviews with knowledgeable officials.

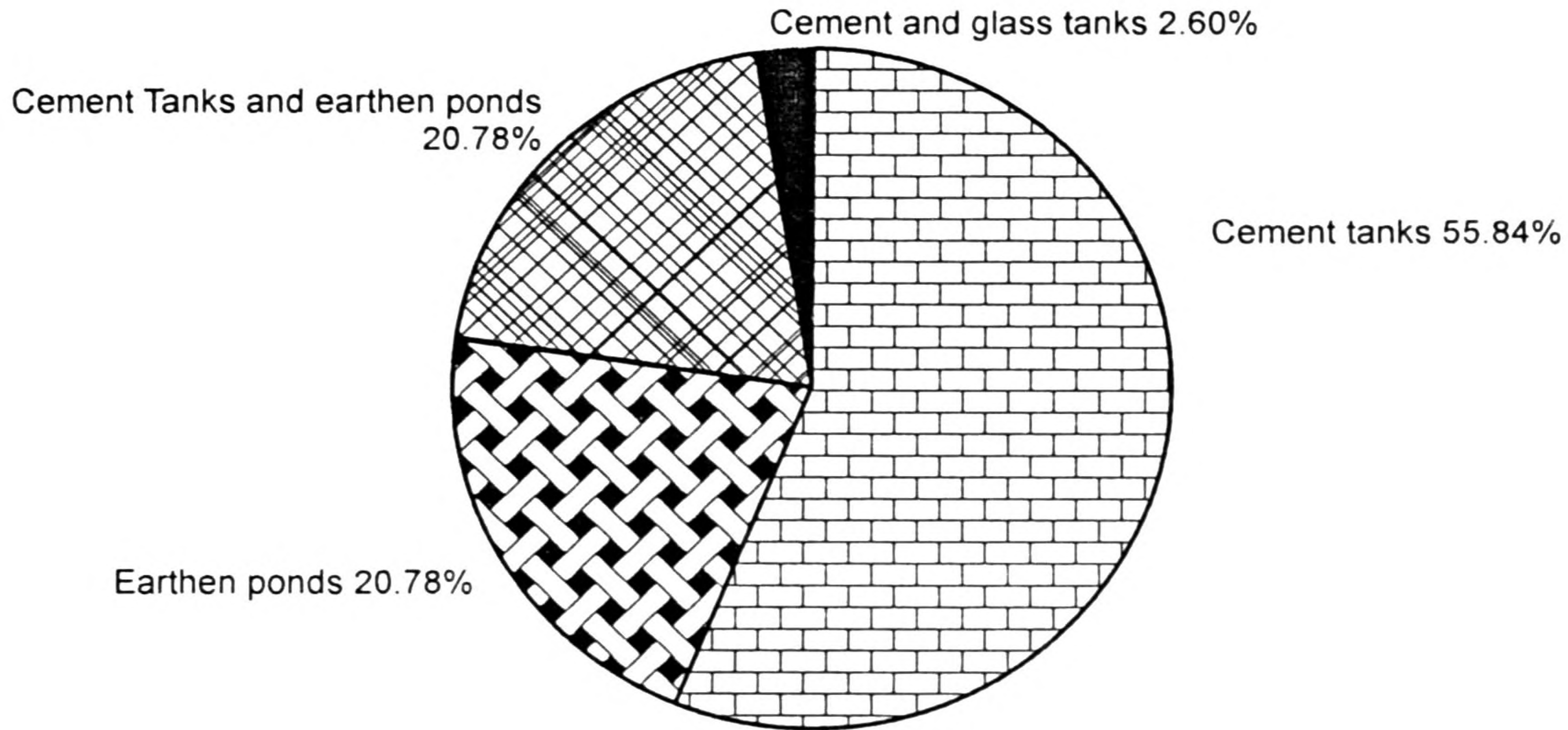
The survey was conducted in 2007 in Colombo, Kaluthara, Polonnaruwa, Anuradhapura, Rathnapura, Kandy, Kegalle and Gampaha Districts, where the majority of ornamental fish farms are located in Sri Lanka. During the study, data were collected from 77 ornamental fish farms from the 8 districts in the country where the ornamental fish culture is popular. Those were categorized as small scale farms (monthly production < 3000 fish), medium scale farms (monthly production 3000 - 10,000 fish) and large scale farms (monthly production >10,000 fish) according to their production capacity. Production capacity was estimated considering the number and sizes of the tanks and mud ponds available in the farm since most farmers did not disclose their monthly production.

Factors that affect the development of the industry such as culture facilities, educational levels of the farmers, exposure to training, experience, fish varieties and marketing constraints were identified using a pre-tested questionnaire administered to those engaged with the activities in ornamental fish industry. Other observations made during the visit were also taken into account. Collected data were tabulated and analyzed using SPSS 16.0 statistical package.

### **Results**

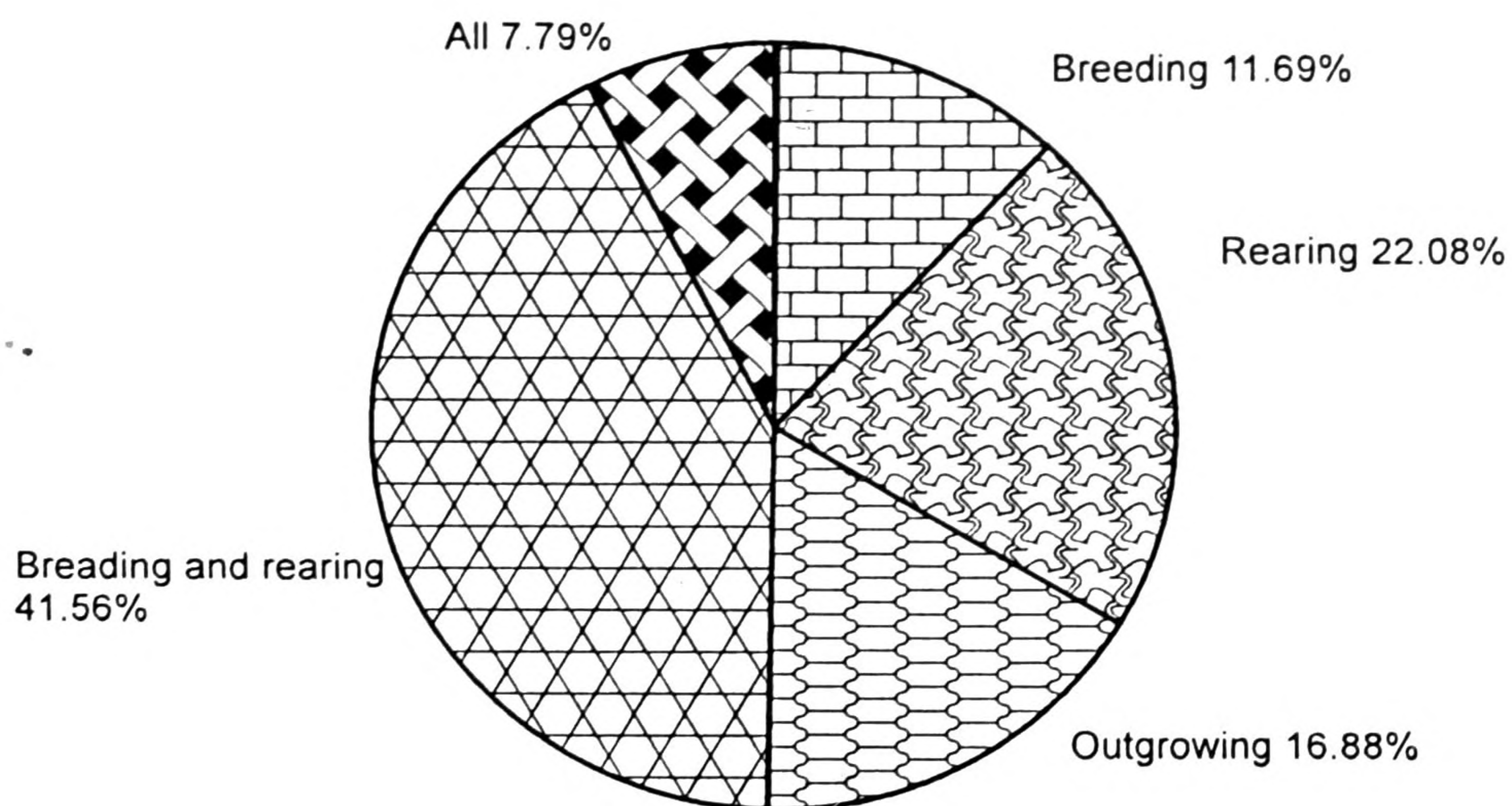
According to the criteria used nearly 75% farms were categorized as small-scale, 20% were medium scale and only 5% were categorized as large-scale farms. About 56% of fish farmers used cement tanks, 20.8% mud ponds, while the balance 21% used both cement tanks and mud ponds for their culture activities (Fig. 1).





**Fig. 1.** Type of facility used to culture the fish

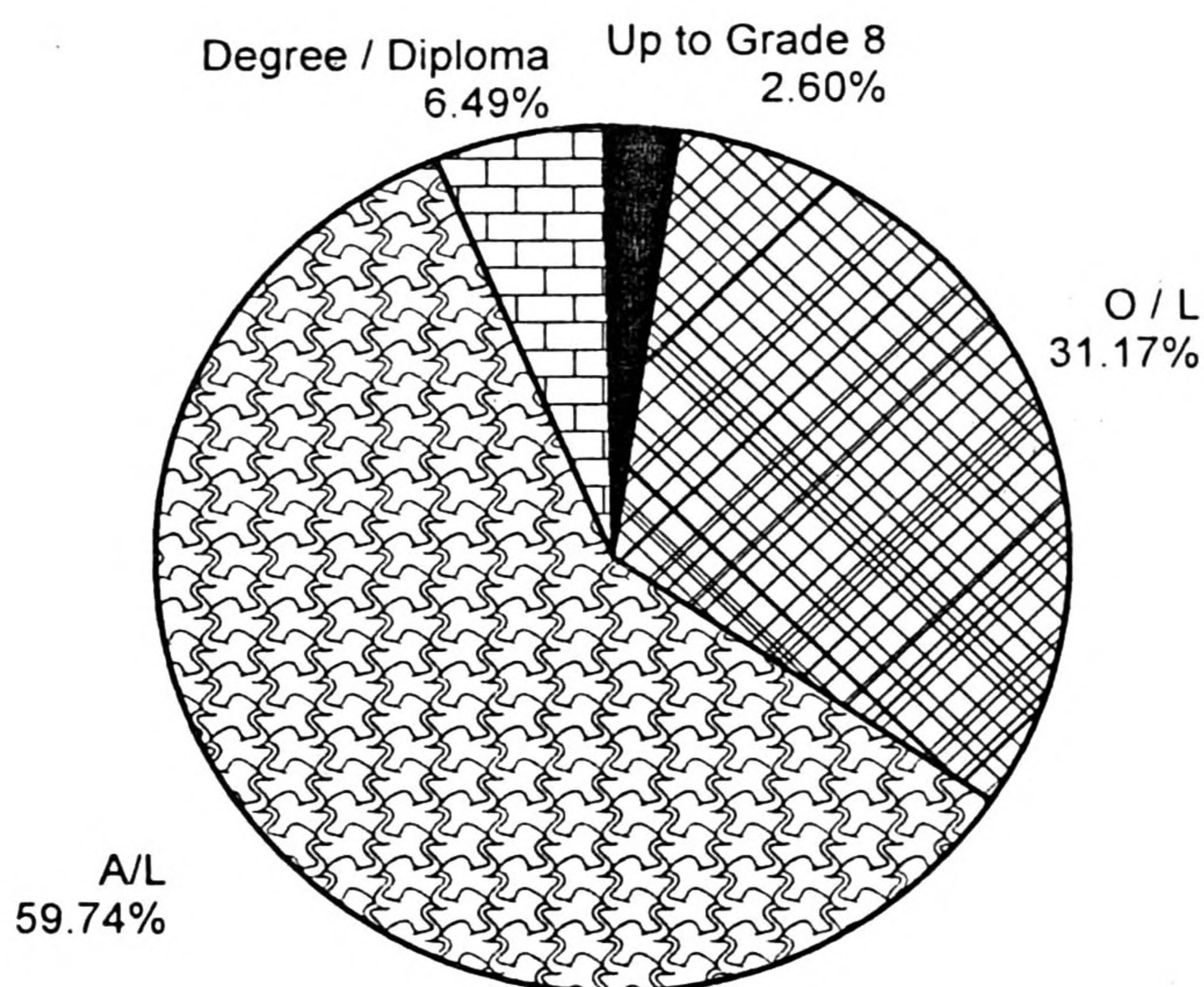
Majority of the farmers (41.6%) were involved in both breeding and rearing activities and 22% were involved in only rearing (out growers). A smaller proportion (11.7%) was involved only in breeding and most of them were exporters. They supply their fry to the out growers and buy the grown fish when they are ready for export (Fig. 2).



**Fig. 2.** Culture activities of the studied population

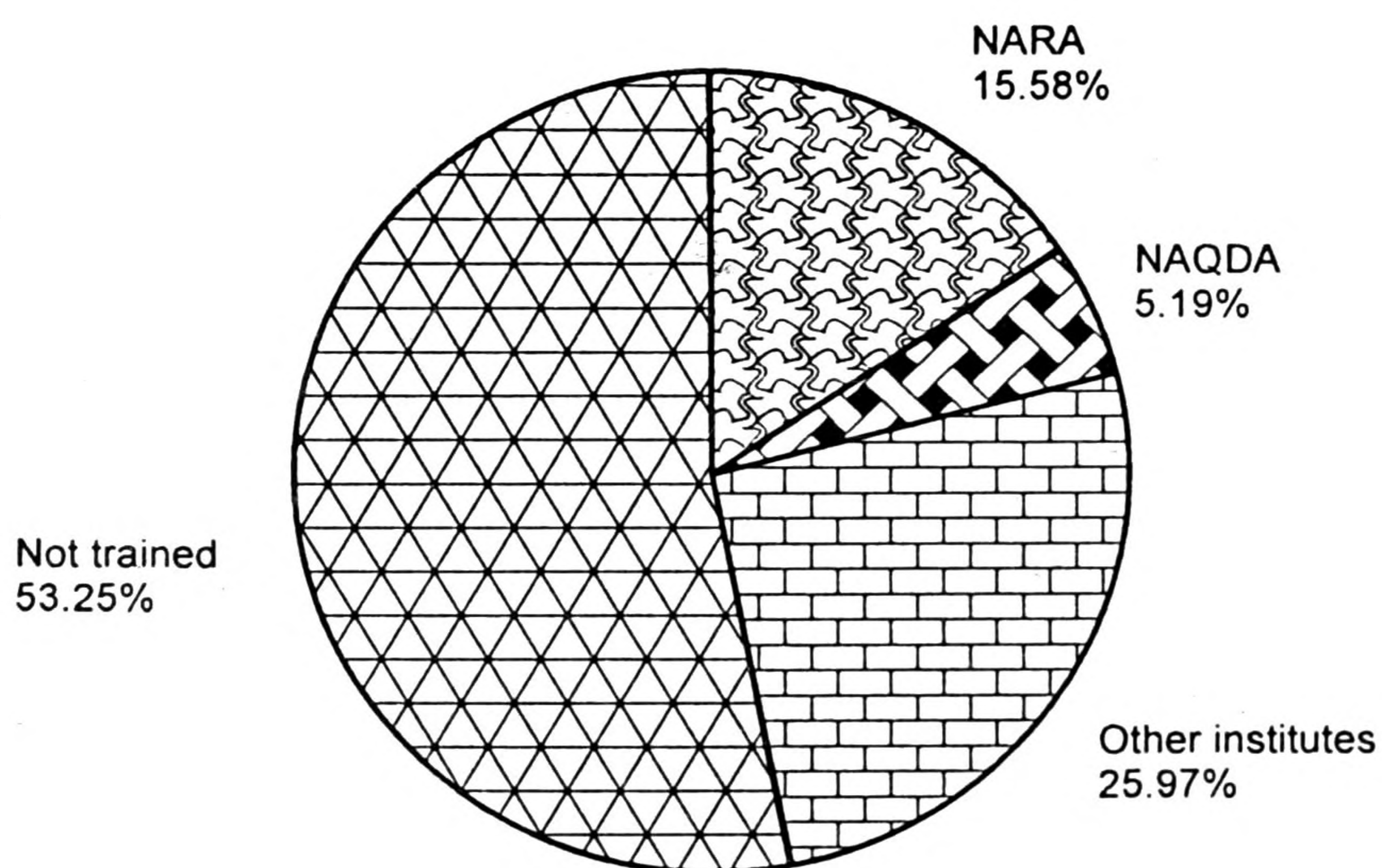


The educational background of the studied population is shown in Fig. 3. Around 31.2 % had studied up to the ordinary level (O/L) only and a majority (59.8%) up to the advanced level (A/L). Only 6.5% of the farmers were graduates.



**Fig. 3.** Educational level of studied population

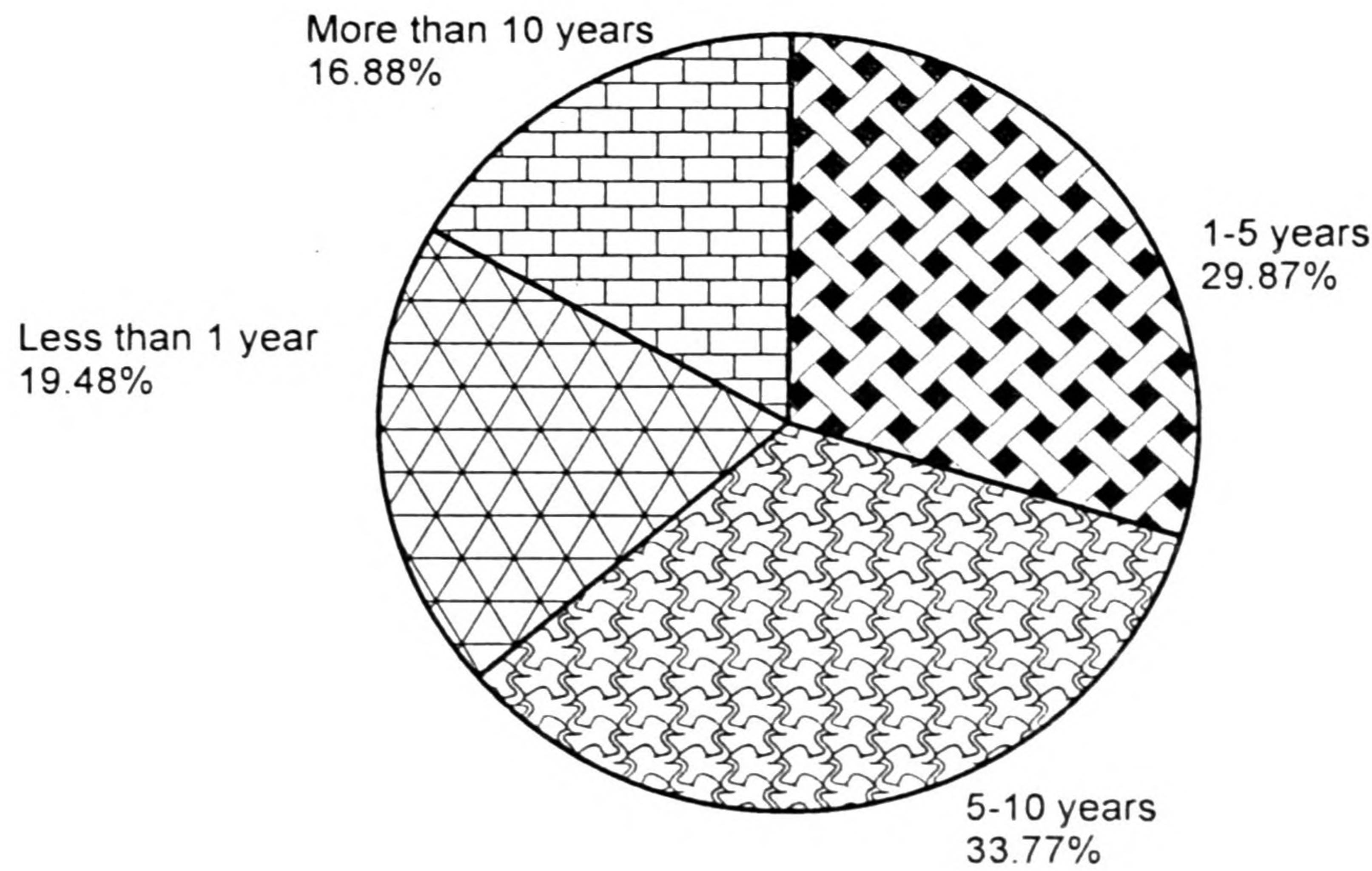
A majority (53.3 %) of the farmers had no formal training on ornamental fish culture while the balance 46.7% had undergone training at different institutes including NARA and NAQDA. Of these, only 15.6 % of the studied population had been trained at NARA through various programmes (Fig. 4).



**Fig. 4.** Training of farmers on ornamental fish culture

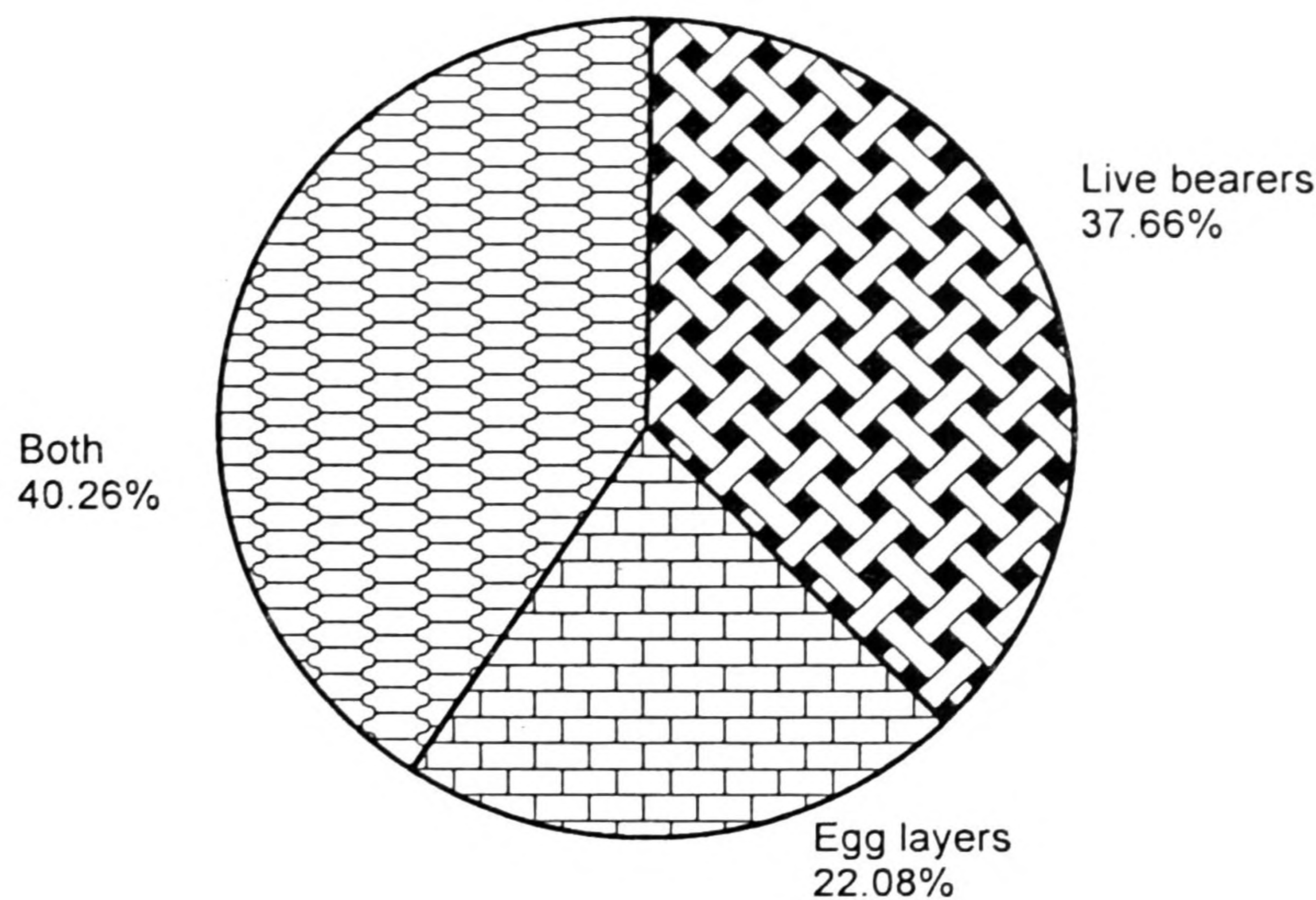
The majority of the studied population had gained knowledge through experience and the experience of the people involved in the industry is shown in Fig. 5.





**Fig. 5.** Experience on ornamental fish culture among the studied population

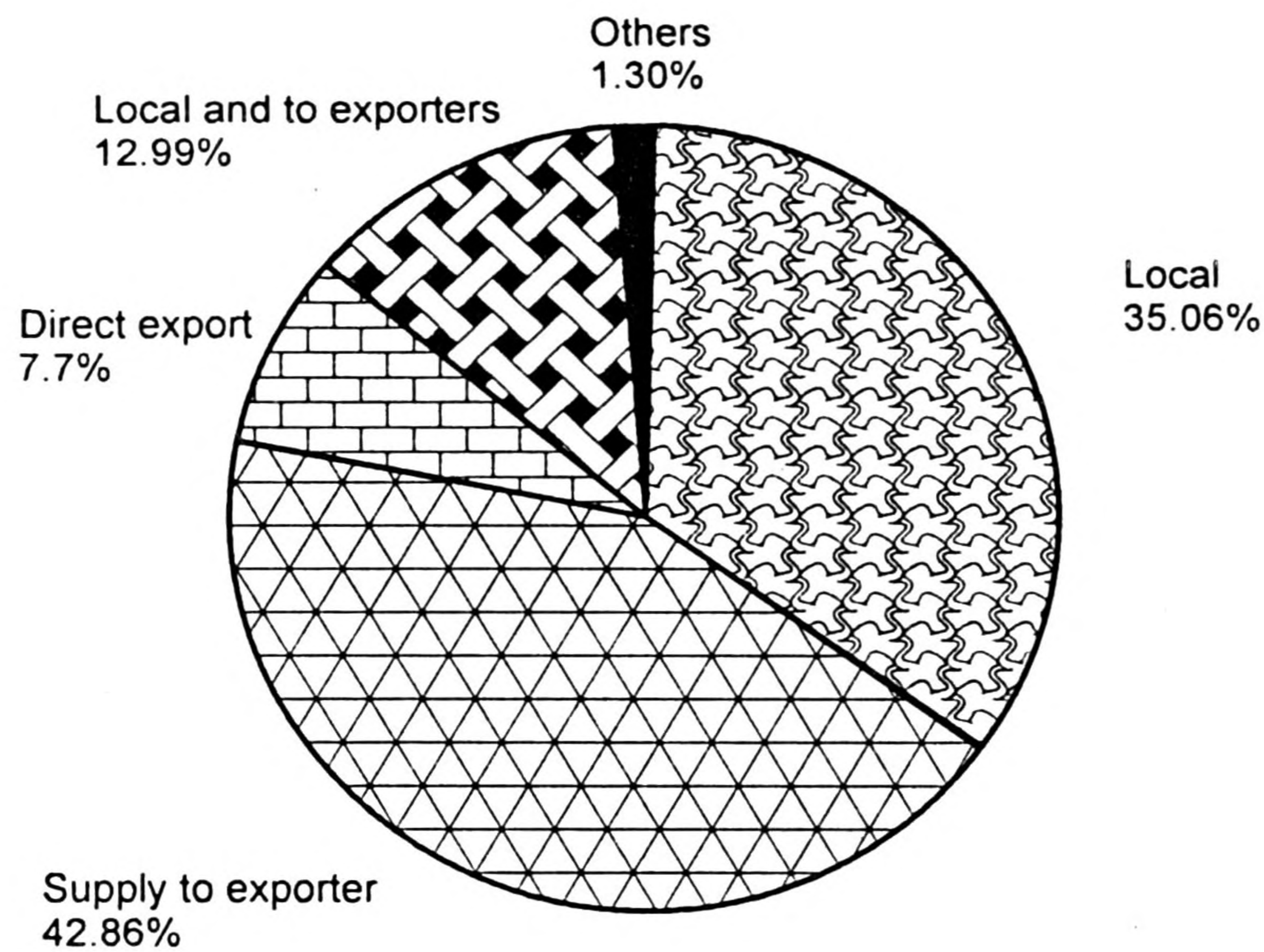
Fish varieties cultured in these farms targeted different markets. Most farmers cultured only live bearers (37.7%), mainly guppies, platys, sword tails and mollies; of them as much as 62% cultured only guppies. About 22% of farmers cultured egg layers including Carp, Goldfish, Angels, Gouramies, Barbs, Oscars, Zebras, Discus, Cichlids, Catfish, Fighters, tetras etc. A proportion of 40.3% cultured both egg layers and live bearers (Fig. 6).



**Fig. 6.** Fish varieties cultured by the studied population

Among the studied population, more than 50% had targeted the export market and sold their products to the exporters. A few of them (7.7%) directly exported their products (Fig. 7).





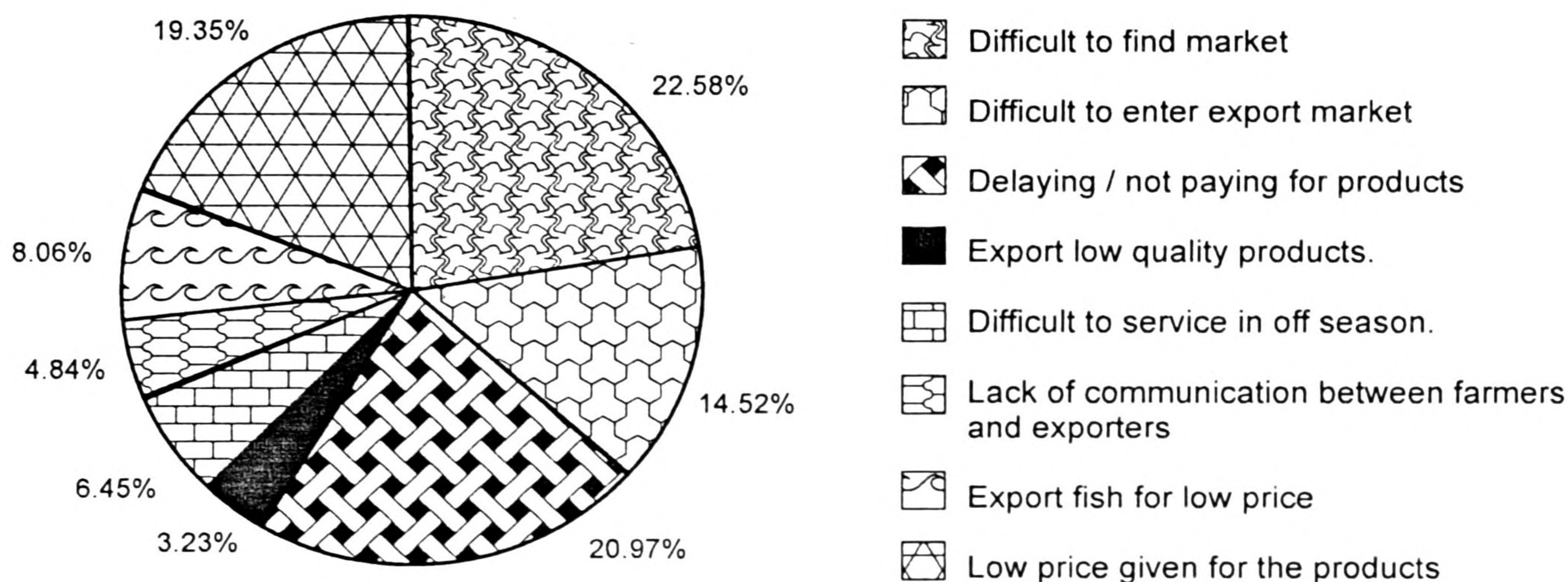
**Fig. 7.** Markets targeted by the studied population

The data presented above showed that the people involved in ornamental fish sector are not uniform but consist of a variety of different socio-economic levels, age groups, educational backgrounds and experience and need to cater to a variety of markets as well. As a result, they face different constraints and limitations during their operational activities. From the data collected the problems faced by the farmers could be mainly classified into three categories, namely, market issues, production issues and issues related to knowledge and information. The problems are listed according to priority below.

Issues related to marketing identified by the survey and arranged according to priorities are shown below; they are also shown in Fig. 8.

- Difficulties in finding markets for their product
- Difficulties in entering the export market
- Delays and/or non-payment for their products
- Difficulties in maintaining the enterprise in the off-season
- Export of fish in some cases for low prices
- Export of low quality products
- Lack of communication between small scale farmers and exporters

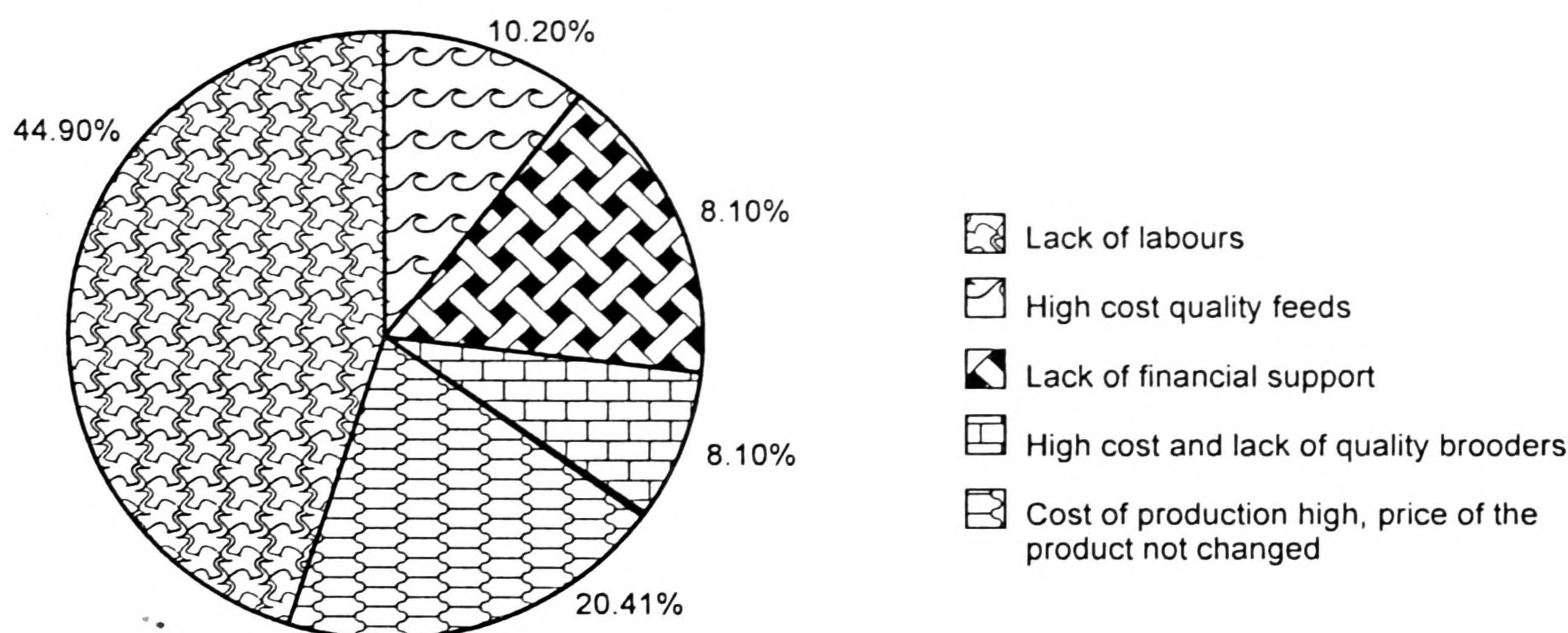




**Fig. 8.** Market issues faced by the studied population

The Production issues identified by the studied population, arranged according to priority are shown below and in Fig. 9.

- The prices paid for products has not kept pace with the increase in cost of production
- Difficulties in finding good quality brooders, the high cost of brood fish and the inability of small scale farmers to afford this high cost
- Lack of good quality feed for fish and the high prices of the feeds
- Difficulty to get financial support (credit) for farm expansion
- Difficulty in finding suitable labour



**Fig. 9.** Production issues faced by studied population

Issues related to knowledge and information identified by the studied population and arranged according to priorities are shown below and in Fig. 10.

- Poor knowledge regarding diseases, water quality management and low cost feed preparation
- Lack of literature about the most suitable fish varieties for the different geographical areas and different climatic conditions of the country
- Inadequate state support
- Lack of market information about the changes in the overseas demand
- High freight charges



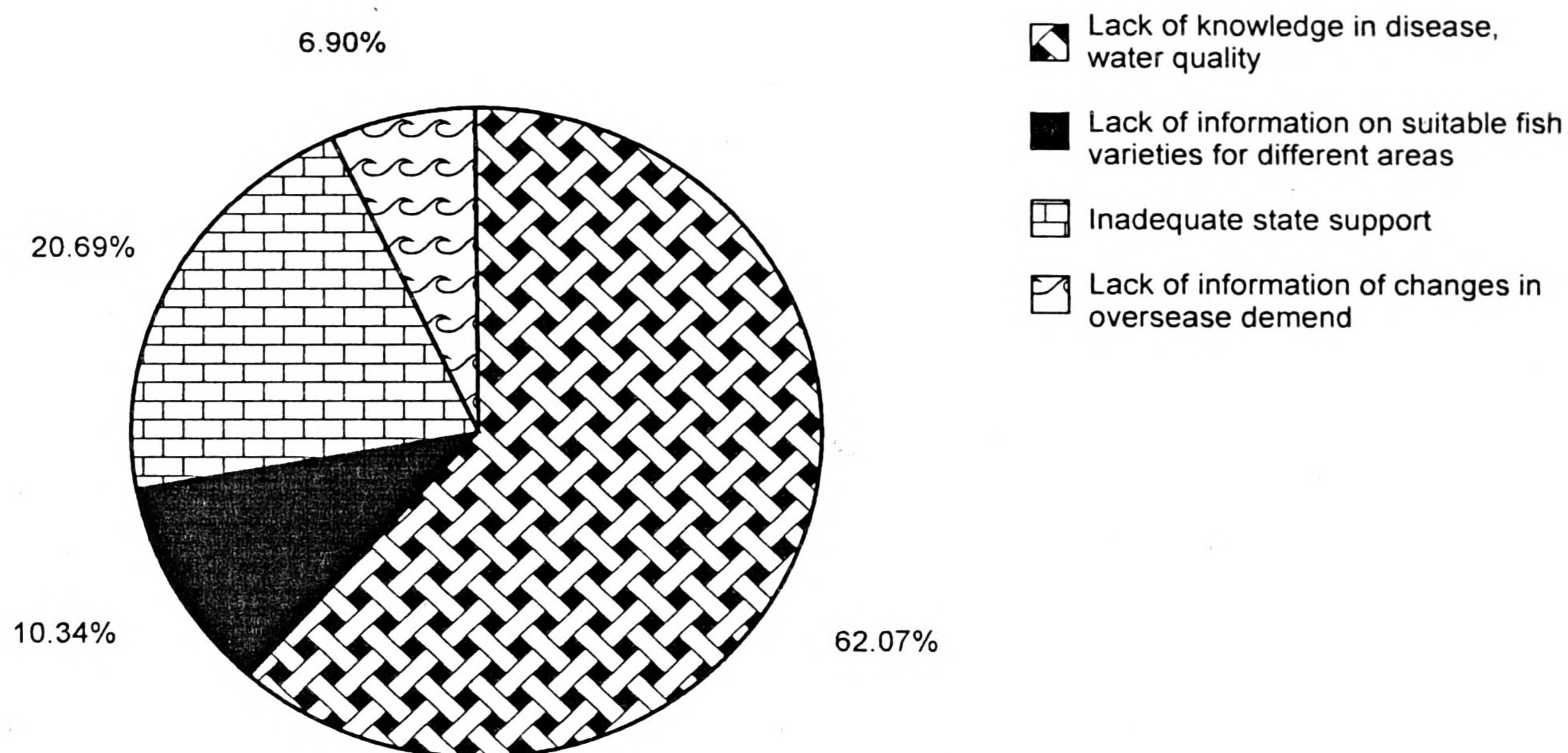


Fig. 10. Issues related to knowledge and information faced by studied population

Most of the surveyed population (29.9%) had both market and production problems whilst 26% had issues relating to marketing only and 22.1% only in production; only 15.5% of those surveyed had no constraints as shown in Fig. 11.

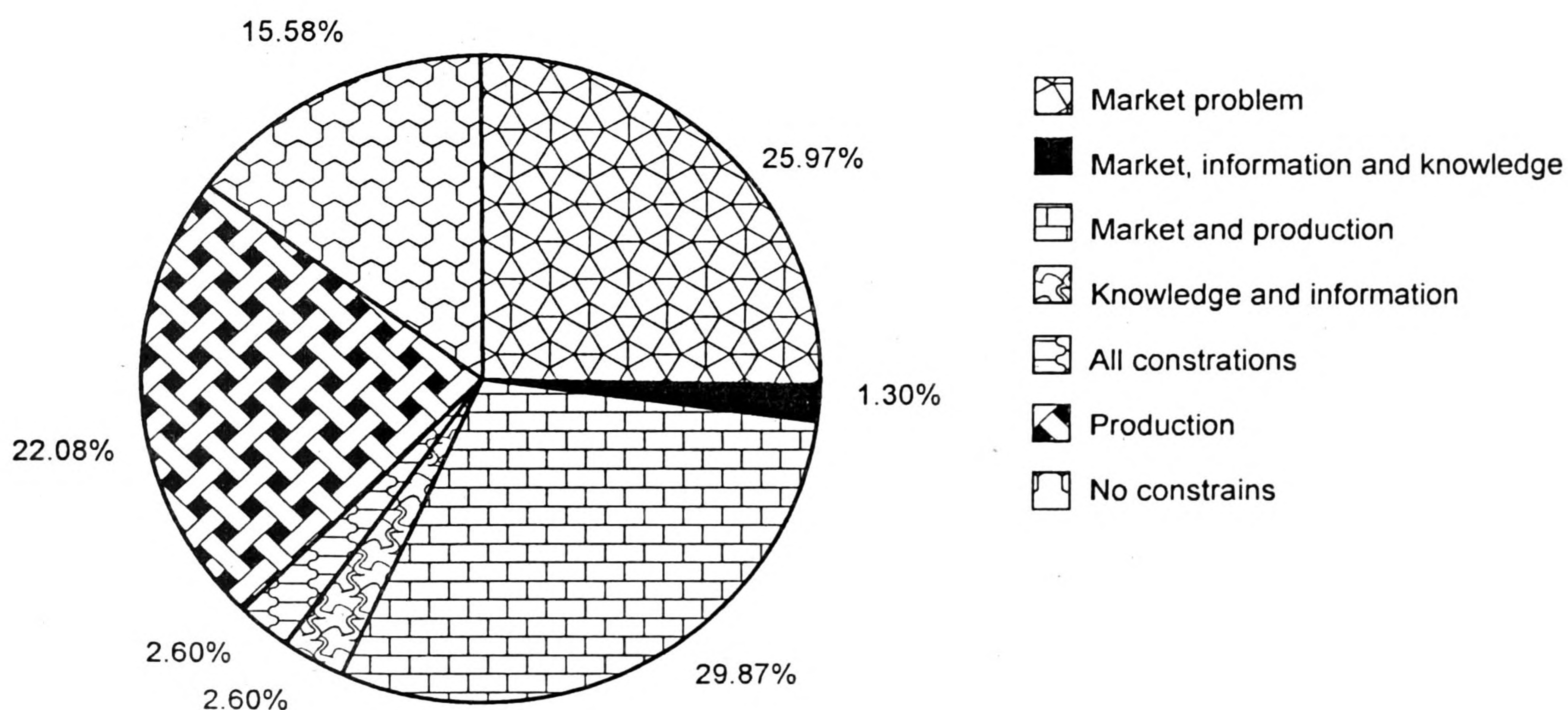


Fig. 11. Constraints faced by studied population



## **Discussion**

The survey reported in this paper was able to identify several key issues that currently limit the production, expansion and development of the ornamental fish industry in Sri Lanka. They can be categorized as shown below:

### ***High production cost***

According to farmers, the cost of production has increased drastically during recent years but the sale price given for the fish has not changed at the same rate. This has badly affected the sector and in particular, the small and medium scale farmers. According to them, the sale price of fish within the last 10 – 15 years has not increased or increased only by 1 – 2 Rupees. But the costs for transportation, raw materials for construction (cement, sand) as well as for feed, medicines, packaging materials and utilities such as electricity have shown a marked increase during the same period. This has resulted in drastic reductions in profit margins from the investments and led in many instances to closure.

The major factor for a successful ornamental fish trade is the ability to supply the world markets with a wide variety of fish of a consistently high quality. Since the ornamental fish exporters in Sri Lanka are not capable of producing large numbers of fish within their resources and facilities, however, they are highly dependant on the small and medium scale farmers for their requirements. These farmers need adequate protection to ensure the future of the ornamental fish industry of the country and the government's commitment to provide increased support to the small scale and medium scale farmers in the sector is a prerequisite for the sector's sustainable development. The commitment should take the form of a clear articulation of policies, plans and strategies and also the availability of adequate funding support.

### ***Inadequate knowledge and skills and support***

It is critical for farmers and exporters to be up-to-date in technology and management skills in order to stay competitive, productive and profitable. The survey showed, however, that most entrepreneurs and employees currently in the business lack these attributes. It also revealed that 53% of the population had not been properly exposed to the subject. Their knowledge is inadequate with regard to fish nutrition, prevention & management of disease as well as the management of water quality, all of which are critical areas which directly affect the quality and quantity of the final product. More efforts need to be made, therefore, to enhance skills and marketing aspects of the people involved by providing suitable training courses and by maintaining a comprehensive network of field extension agents around the country. Capacity building through training and deployment of those technical staff is thus a very important aspect.



Most of those involved in ornamental fish culture were not aware of the availability of Institutions from which they can get technical support when problems are encountered. The technical support needed includes advice and information on culture management as well as back-up services such as pond water quality analysis and disease diagnosis. Suitable documentation should be made available for this purpose.

### ***Problems of marketing***

In Sri Lanka, the exporting of ornamental fish has always remained the exclusive preserve of a few individuals and it is a very difficult task for any newcomers to become exporters. This has affected the further development of the industry. More assistance should be available to prospective exporters with regard to finding export markets and information about foreign buyers.

At the same time, due to the high competition between exporters, some export their products at low prices regardless of quality, while others export low quality fish at lower prices. Such practices in the sector have led to the buildup of a bad reputation for Sri Lankan products in the foreign market, resulting in turn, in unfavourable impacts on the development of the industry. Sri Lankan products often do not receive the correct price for their exports and the country loses foreign exchange due to this reason. A system to regulate quality and prices is needed to overcome this problem. Grading fish according to quality and an agreement between exporters on the price quoted for a particular grade of product will build a reputation for Sri Lankan products and lead to increases in the foreign exchange earned.

A lack of adequate communication channels between small-scale fish farmers and established exporters has led to the enriching of middlemen at the expense of the fish farmers. Prospects for the growth of the industry have been further hampered by the lack of information on current foreign market preferences. As a result, exporters have often been caught unawares of the changes in the demand for specific varieties, being informed by their buyers only when the demand had already been established. This inability to anticipate demand, results not only in missed opportunities but also losses in sales. A proper system that monitors changes in demand and promptly informs both farmers and exporters is needed to overcome these problems.

Ornamental fish farming has a seasonal market, due to the seasonal changes of the European countries who are the major buyers of the ornamental fish in the world. This results in an approximately seven months of peak and five months of lean export sales. According to the exporters, during the off-season in the EU countries the sales drop to 60% to 70% (Yu, 2009). This seasonal variation affects the small and medium scale farmers badly since the income is insufficient to cover their monthly expenses.



Access to export markets has also become complicated by the need to comply with regulations concerning product quality and safety requirements on the part of importing countries. It seems that, market access could be improved through the development of certification systems for quality of the product. Lack of compliance with these standards and regulations could have a serious impact on international trading of aquaculture products from developing countries.

Since aquarium fish are exported live, and as a large quantity cannot be packed in a limited space, the freight cost is high when compared to other exported items. Therefore, many of our competing countries have provided incentives to their exporters involved in this business. But in Sri Lanka this type of incentive scheme or concessionary air freight rates are not available and because of that the present high rates of air freight charges make export of ornamental fish from Sri Lanka uncompetitive in world markets. The authorities responsible should introduce suitable schemes to ensure that our exports remain competitive.

Expansion of the industry has been hampered by the problems discussed above and in addition, by the lack of good quality brood stock and feeds as well as the difficulties in obtaining credit. In view of these drawbacks, promoters of the industry cite the need for greater and stronger government support for the industry as well as better collaboration between the private sector and government. Responsible authorities should take a proactive role particularly by improving the market channels to ensure a fair and equitable sharing of benefits generated by the ornamental fish trade to all players.

### ***Identified needs for the further development of the sector***

Further development of the aquarium fish industry in Sri Lanka and access to the foreign market could be ensured by developing the following areas which are very important to compete and survive in foreign markets.

1. Ornamental fish markets demand variety rather than large volumes of a single species. The demand for ornamental fish of varied hue and variety is seen to be increasing rapidly across the world. Bulk production of single or only a few species leads to exporting to re-exporting countries at throw away prices. Therefore, breeding of new varieties of fish is crucial to the further expansion of the industry.
2. The optimal environment conditions for different fish varieties vary and it is essential to provide those conditions to the fish to obtain high growth and survival rates and healthy and quality fish suitable for the export market. In Sri Lanka, climatic conditions differ across the producing areas and most farmers are not aware about the varieties suitable for their locality. Cultivating varieties not suitable for their environmental conditions leads to problems such as poor



growth rates, low breeding rates and increased susceptibility to disease. Research should be carried out on these aspects and the results conveyed to the farmers.

3. The quality and cost of feed is a crucial component in the development of ornamental fish production in the country. Presently, as shown in Fig. 9, shortages of good quality feed supplies has been identified as a constraint. The development and availability of fish feed of adequate quality at a relatively low cost is an urgent need for the industry.
4. Development of improved handling and transportation techniques are necessary to reduce the operational costs in the industry, since aquarium fish are exported live and consignment sizes generally small. Exporters are often faced with great difficulties such as high air freight charges and delays at customs due to congestion leading to high mortality and losses.

### **Conclusions and Recommendations**

Despite being an industry with a great potential in Sri Lanka, the promise has not been achieved due to a number of constraints. The sustainability of the industry itself at present appears threatened by factors that have caused opportunities to be lost and hampered the growth of this promising industry.

To overcome these issues and remain competitive in the global market, it is necessary firstly to apply science and modern technology in the industry. Strong research and development activities covering breeding and development of new varieties, nutrition and feeds, control of diseases and improved management of farms are needed.

In order to develop and maintain the quality of the exported fish and to establish a reputation in international markets, a fish quality evaluation system for the exported product should be put in place.

There should be more involvement of the relevant authorities in finding markets and protecting the small-scale farmers since they are the most important contributors to the export trade. There should be opportunities also for newcomers to become exporters and through that establish a healthy competition that will ultimately be beneficial for the farmers. At the same time, expansion into new markets should be encouraged and responsible institutions should support such activities.

Finally, a system through which exporters can agree on prices - based on species and quality - should be developed for the benefit of the industry and to improve the foreign exchange earned through export of ornamental fish by the country.



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