Distribution, abundance and status of *Botia dario* in the ornamental fish market, Bangladesh

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Abstract

This research was carried out to determine the abundance, distribution, and marketing channels of *Botia dario* in several areas of Bangladesh through a questionnaire survey. Survey information was collected from the fishermen, aratdar, faria, retailer, consumer, wholesaler and aquarium fish keeper. The quantity of *B. dario* gathered overall from the four districts of Mymensingh, Kishoregonj, Sunamgonj, and Sylhet and calculated the abundance of this species. *B. dario* was discovered in considerably larger quantities at Dekhar Haor in south Sunamgonj and Bhramhaputra River in Mymensingh than other locations. This species started to appear in local markets in August, although it was more common from September to October and becomes scarce after November. In the marketing channel, fishermen directly sold *B. dario* to the consumer (22.6%), to the retailers (19%), to the aratdar (50%), and to the wholesaler of the ornamental fish market (5%) and a little portion (3.4%) was consumed by them. There were two species of *Botia* available in the ornamental central fish market of Katabon, Dhaka. Among the shopkeeper in this market, 2% were stocked *B. dario* and 16% stocked *B. lohachata*. In each month, average 30 pieces of live *B. dario* are sold by a shopkeeper in the ornamental fish market where an average price was 40 BDT per pair. Price ranges for dead *B. dario* in the food fish market vary greatly, from 450 to 700 BDT per kg. Lower price of live *B. dario* was observed in the sunamganj's fish market compared to the other fish market. In the ornamental fish market, 57% of shopkeeper reported that has medium demand and 43% has low demand. But in the edible fish market, 35% of respondents reported strong demand and has medium demand by the 65% responder. Due to its enormous potential in the fisheries sector and the demand it has in both markets, conservation and culture are essential to prevent the extinction of this species.

Keywords: Fish abundance, Marketing channel, *Botia dario*, Catch per unit, Live fish

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Introduction

Small indigenous species (SIS) of freshwater origin grow up to a length of about 25 cm or 9 inches in Bangladesh (Hossain and Afroze, 1991). Over 150 species have been classified as "Small Indigenous Species" among the 261 freshwater fish species in Bangladesh (Amin *et al*., 2009). These fish are regarded as a great source of vital proteins, macro and micro-nutrients, vitamins and minerals compared to other commonly available foods. Along with these nutritional values, some SIS fishes like as Pabda (*Ompok pabda*), Puti (*Puntius sophore*), Kholse (*Awaous guamensis*), Boumach (*Botia dario*), Meni (*Nandus nandus*), Bele (*Awaous guamensis*), Gutum (*Lepidocephalichthys guntea*) are bright and colorful which attracts the pleasure seeker people to keep them as pets in aquarium (Dey *et al*., 2015). *B. dario* is very colorful and attractive species and locally called as Rani or "Bou mach" in Bangladesh and consider as ornamental and edible fish (Rahman, 2005). It is one of the rare SIS that has both edible and attractive properties (Dey *et al*., 2015). It is mostly recognized as a food fish because of its outstanding flesh quality (Hussain *et al.*, 2007) and it has significant amount of fat and mineral content when compared to large freshwater fishes (Hossain *et al*., 1999). This species also has a moderate demand among aquarium fish lovers due to its spectacular color pattern (Gupta and Banerjee, 2012). Now-a-days *B. dario* has begun to be supplied to several countries (Ghosh *et al.*, 2003). This fish found in rivers, clean upland streams, and wetlands with a sandy floor (Froese and Pauly, 2014). In Bangladesh, it is found in streams and river of Mymensingh, Sylhet, Dinajpur, Rangpur, Chittagong hill tracts (Rahman, 2005).

A marketing channel is a series of interconnected networks that go from the production sector to the consumer sector. The ornamental fish marketing channel involves a comprehensive chain of entrepreneurs and businesses, including fish collectors from natural water bodies, local dealers, exporters, aquarium makers, fish breeders, ornamental fish farmers, vendors, and so on (Swain *et al.*, 2008). Ornamental fish trade is a multibillion-dollar industry involving over a hundred nations (Rodriguez, 2000). Owning ornamental fish as pets is one of the most popular hobbies nowadays (Kurup, 2003), and the growing demand for aquarium fishes has progressively opened the way for worldwide ornamental fish commerce (Jayasankar, 1998). Ornamental trading is currently developing in Bangladesh, despite its marginal position. Dhaka has the most aquarium fish stores (Mostafizur *et al.*, 2009). The ornamental fish trade has the potential to contribute significantly to the economies of Bangladesh both as a source of foreign cash and as a possible source of rural employment. On the availability and distribution of *B. dario* in Bangladesh, there have only been a few studies so far. So, this study was conducted in order to learn more about *B. dario*'s potential as an ornamental fish in Bangladesh as well as its availability,

marketing methods, and future prospects.

Methods and materials

Selection of the study area

There were 11 Upazilas under the 8 districts were chosen for species distribution and to identify the marketing channels from farmers to local fish and aquarium markets, which are shown in Table 1.

Table 1: Survey area in this experiment.

Division	District	Upazilla	Place
Dhaka	Dhaka	Sadar	Katabon aquarium fish market
	Kishoregonj	Bhoirab	Ratrikalin Matsha Arot
		Kuliarchar	Matsha Arot and Mach bazar
Chittagong	Feni	Sadar	Rakamari Hatchery
	Comilla	Sadar	Aquarium shop in New market
	Noakhali	Sadar	Aquarium shop in Maijdee
		Begumgonj	Aquarium shop in Chowmuhoni
Mymensingh	Mymensingh	Sadar	Notun bazar
Sylhet	Sylhet	Sadar	Kazir bazar
		Gulapgonj	Mach bazar
	Sunamgonj	Shantigonj	Pagla bazar

Data collection

This survey was carried out for 5 months period from August to December, 2017. Information were gathered from both primary and secondary sources. Primary data were collected through questionnaire interviews. The questionnaire was composed of both open and closed form of questions. To execute the proposed research work several target groups had been identified and selected for this interviews such as the fishermen, wholesaler, retailers, ornamental fish trader etc. Secondary information were gathered from research journals, reports and internet.

Sample size

There were 95 respondents selected randomly from 11 fish markets of Bangladesh. Among them 44 respondents were ornamental fish trader, 16 fishermen, 9 wholesaler and 26 retailers (Table 2).

Table 2: Sample sizes of this survey.

District	Place	No. of respondents	R	W	F	O
Dhaka	Katabon aquarium fish market, Sadar	30	-	-	-	30
Kishoregonj	RatrikalinMatshaArot, Bhoirab	10	2	4	4	-
	Matshaarot and Mach bazaar, Kuliarchar	8	4	2	2	-
Feni	Rakamari Hatchery, Sadar	1	-	-	-	1
Comilla	Aquarium shop in New market, Sadar	5	-	-	-	5
Noakhali	Aquarium shop in Maijdee, Sadar	3	-	-	-	3
	Aquarium shop in Chowmuhoni, Begumgonj	5	-	-	-	5
Mymensingh	Notun bazaar, Sadar	10	5	3	2	-
Sylhet	Kazir bazaar, Sadar	8	5	-	3	-
	Mach bazaar, Gulapgonj	7	5	-	2	-
Sunamgonj	Pagla bazaar, Shantigonj	8	5	-	3	-
		Total = 95				

[N.B: R= retailer, W= wholesaler, F= fishermen, O= ornamental fish trader]

Problems encountered during data collection

Some problems were confessed during interview such as: retailers were busy in trading and unwilling to talk, they thought the researchers to be the government official of tax or other department and feared to talk, language problems or use of their local terminologies, data in local units. The problems were overcome by the researcher through given extra attention and more discussion.

Data Analysis

After collecting requisite data, relevant tables were prepared. Then the data were processed and analyzed with a view to achieve the objectives of the study. Microsoft Excel (2007) program was used for data analysis and for chart, graph and diagram preparation.

Results

B. dario was mainly found with other fishes when the fishermen activated their fishing. Fishermen sold this fish to the nearer local market mixing with other small indigenous species.

Among the four selected districts, Mymensingh, Kishoregonj, Sunamgonj, and Sylhet, *B. dario* was mostly found in the Sunamgonj area based on the total amount of harvested fishes. It had been revealed by questionnaire survey that *B. dario* was mostly available between the month of late July to October on Dekhar Haor at Dakshin Sunamgonj and Dowarabazar upazila in Sunamgonj. In Sylhet, it was found in the Surma River and the adjacent rivers and canals from August to October. But the availability of *B. dario* in Sylhet sader, and Golapgonj was relatively lower than Sunamgonj. Targeted dead fish was sold with the mix of other species by the

fishermen in Notunbazar, Sylhet. Trading of live *B. dario* was observed in the area of Sunamgonj and Mymensingh district.

In Mymensingh, *B. dario* was available in the Bhramhaputra river and its adjacent canals between the month of August to October. At that time, this fish was abundantly found in Mymensingh Sadar, Muktagacha, and Trishal upazilas. It had been found that some fishermen of Sadar were able to supply live *B. dario.* In the upazilas of Bhoirab, Kuliarchar, Itna, Mithamoin, and Austogram in Kishorganj, *B. dario* was found to be rather scarce from November to August but available in the month of September and October.

Quantity of B. dario harvesting in different study areas

Highest average quantity (25.8 kg/fisherman) of *B. dario* was caught by a fisherman in Sunamgonj and followed by Mymensingh (18.6 kg/fisherman), Sylhet (12.3 kg/fisherman) and Kishoregonj (12.3 kg/fisherman) in a season (Table 3).

Table 3: Average quantity (kg) of catch per fishermen in different months.

District	August	September	October	November	December	Total avg. quantity (Kg) in each district
Sunamgonj	2.25	8.25	8.25	5.25	1.8	25.8
Sylhet	1.05	3.75	3.75	3.75	0	12.3
Mymensingh	1.05	5.25	5.25	5.25	1.8	18.6
Kishoregonj	0	3.75	3.75	3.75	1.05	12.3

Marketing channel of Botia dario

The marketing channel of *B. dario* in Bangladesh started from the wild catchers to consumers which passed through a number of intermediaries such as fishermen, middle man (foria), aratdars, wholesalers and retailers.

B. dario was harvested by almost all small fish catchers intentionally or unintentionally from the freshwater body. They harvested *B. dario* by operating *gher jal* from traditional fishing boat. The harvesting was done in between August and December. Generally *B. dario* catchers sold their catches in the nearest fish markets. Sometimes they sold in far distance markets to get much profit.

In this study, there were two types of the marketing channel identified, namely as:

1. Fisherman to food fish market
2. Fisherman to ornamental fish market

In the first marketing channel, fishermen directly sold about 22.6% to the consumer and 19% to the retailers. But 50% of *B. dario* to the aratdar with the presence of foria. Then the aratdars sold to the retailers by auctioning. Consumer bought these fishes from the retailers of the local fish markets. In the second marketing channel shows that fishermen sold about 5% of live *B. dario* to the the wholesaler of ornamental fish markets on order basis, 5% to the ornamental shopkeeper (retailer). In case of ornamental fish market, wholesaler sold 90% of the total fish to the customer

directly and the remaining 10% was sold to the retail shops (Fig. 1). About 3.4% was consumed by fishermen of the total catch.

Status of B. dario in ornamental fish market

For this study, some ornamental fish markets in Noakhali, Feni, Comilla and Dhaka were selected. Among these markets, *B. dario* was only available in the ornamental fish markets of Katabon, Dhaka. There were only 2% pet shops in Katabon kept this indigenous species. Only two species of *Botia* were available in these ornamental fish markets which were *B. dario* and *Botia lohachata*. About 2% shopkeeper stocked *B. dario* and 16% seller stocked the other one (Fig. 2). According to ornamental fish seller, *B. dario* and *B. lohachata* were not seen abundantly all the year round due to low availability of spawner in the natural waterbody.

Price variation in different food fish market

The price of the fish was dependent on the availability, size and the supply of the fish in the market.

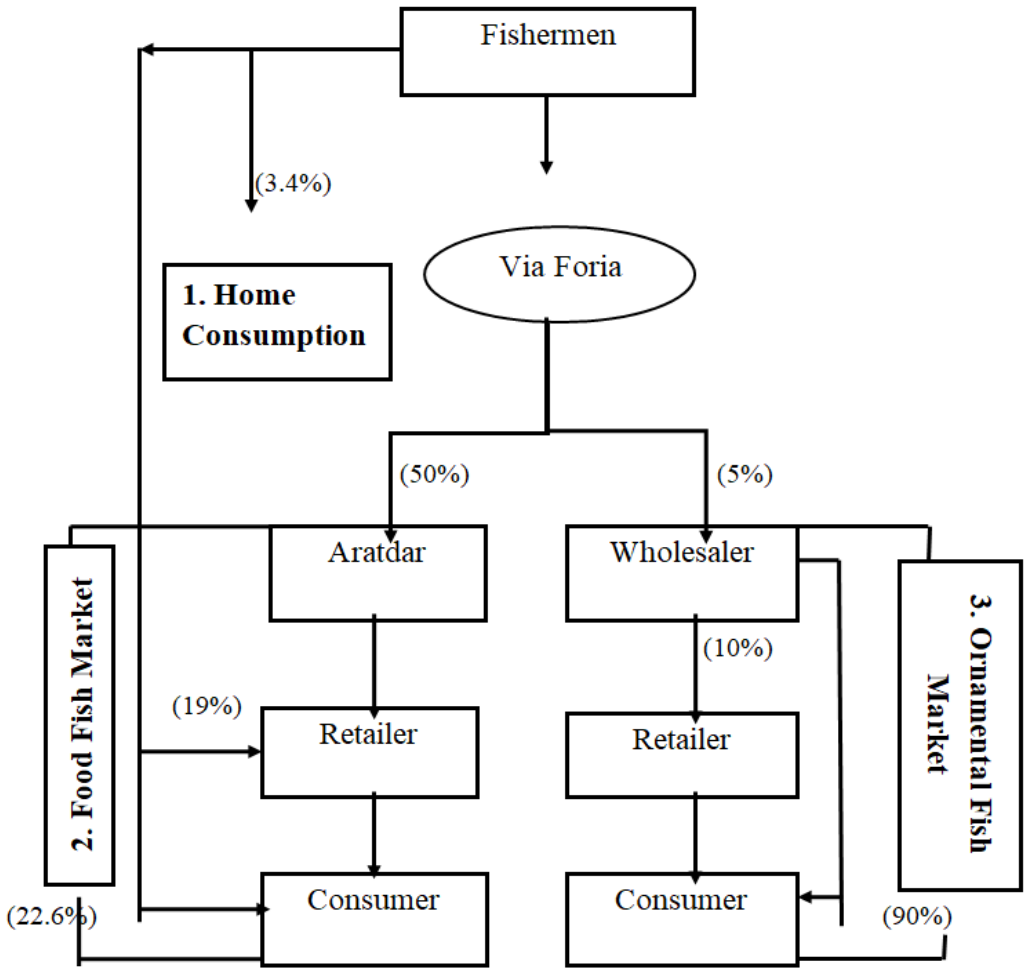

Figure 1: Marketing channel of *Botia dario* in Bangladesh.

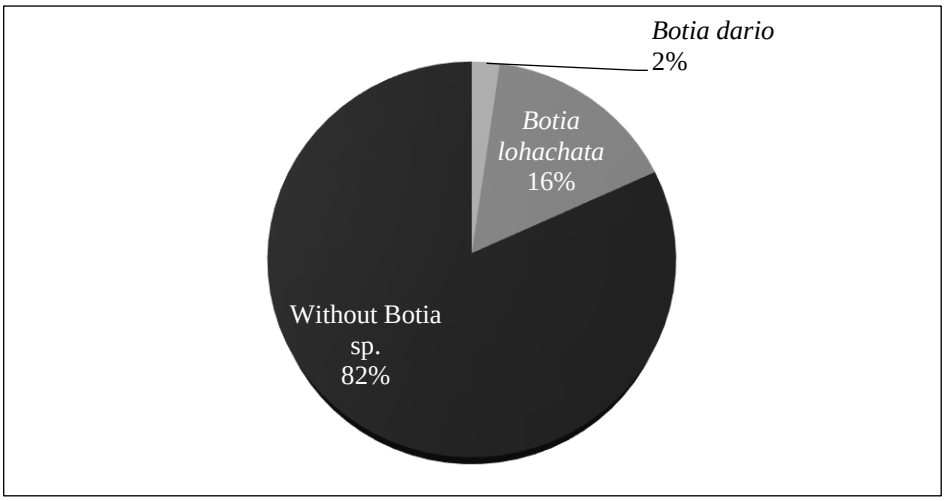

Figure 2: Status of *Botia dario* in ornamental fish shop.

This species was highly available in Sunamgonj and Mymensingh district, the price was relatively lower in these areas while the price of this fish was relatively higher in Sylhet and Kishoregonj. The price decreased when the supply increased in September and October and the price increased when supply decreased in early August and late October. During the study, it had been found that some fishermen sold live *B. dario* to the customer if have consumer demand. Fishermen sold live *B. dario* at 13 BDT per piece in Pagla bazaar, Sunamgonj in September and 16 BDT per piece in Mymensingh Sadar in October (Table 4).

Table 4: Price variation of *B. dario* in different fish market.

District	Market	Months	Price (BDT)	
			Dead/kg	Live/piece
Sunamgonj	Pagla bazaar, Dakshin Sunamgonj	September	450	13
Sylhet	Kazir bazaar, Sadar and Golapgonj Mach bazar	September	600	-
Mymensingh	Notun bazaar, Sadar	October	550	16
Kishoregonj	Bhoirab and Kuliarchar Matsha arat	October	700	-

1 USD= 105 BDT

Comparison of B.dario with the most demandable ornamental fishes

Ornamental fishes were sold according to their demand in the market. Rani fish had a large difference in selling quantity and price from the other demandable fishes. Among the demandable species Gold fish and Comet were sold in highest quantity in every shop. They were sold in about 500 pieces in each week with an average price of 80 BDT per pair. Silver Arona, Golden Arona, Koi Carp, etc. were the most expensive ornamental fishes found on the Katabon ornamental central fish market, Dhaka. Angel fish was sold at about 300 pieces/week and at 70 BDT per pair and Guppy fish was sold at about 400

pieces/week and at 50 BDT per pair in almost every shop. But Rani fish (*B. dario*) was sold at 40 BDT per pair in 2% shops only (Figs. 3 and 4). Average selling quantity of a shop was 30 pieces/week when available in market.

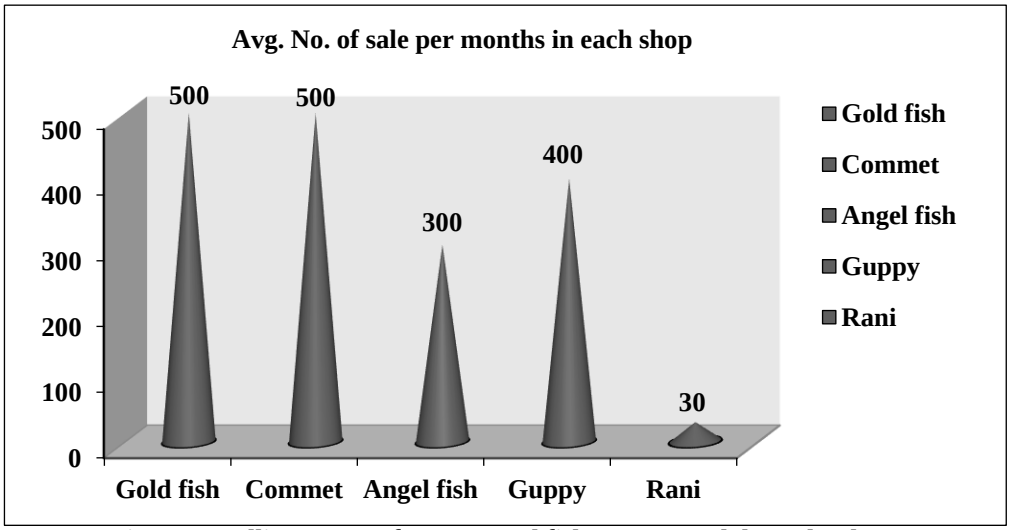

Figure 3: Selling status of ornamental fishes per month by a shopkeeper.

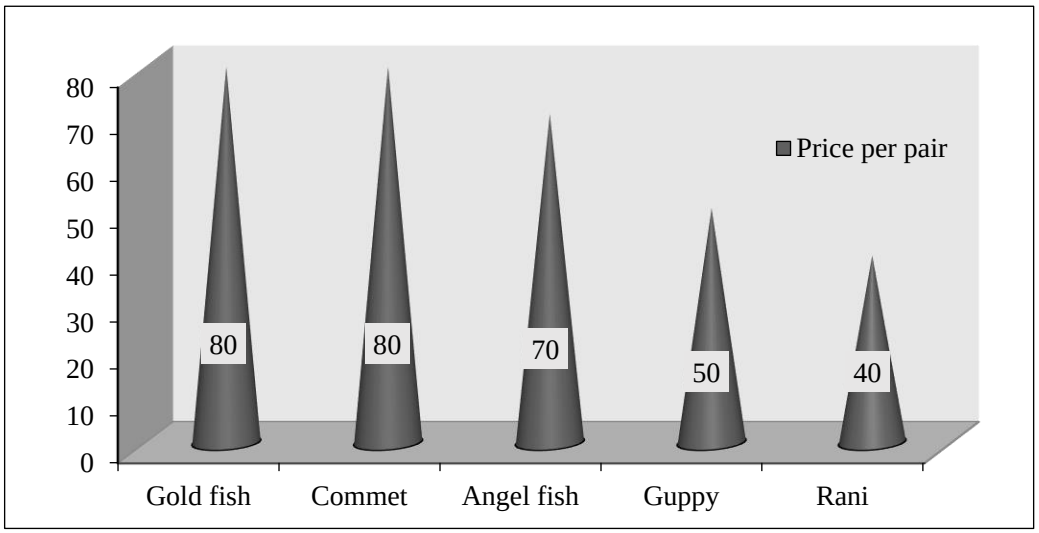

Figure 4: Difference in price per pair of ornamental fishes.

Breeding season of B. dario

The majority of fishermen (67%) in Sunamgonj and Sylhet claimed that the *B. dario* species reproduces between the months of May and June, whereas the 33% fishermen in these areas believed that the breeding season was between the months of June and July (Fig. 5).

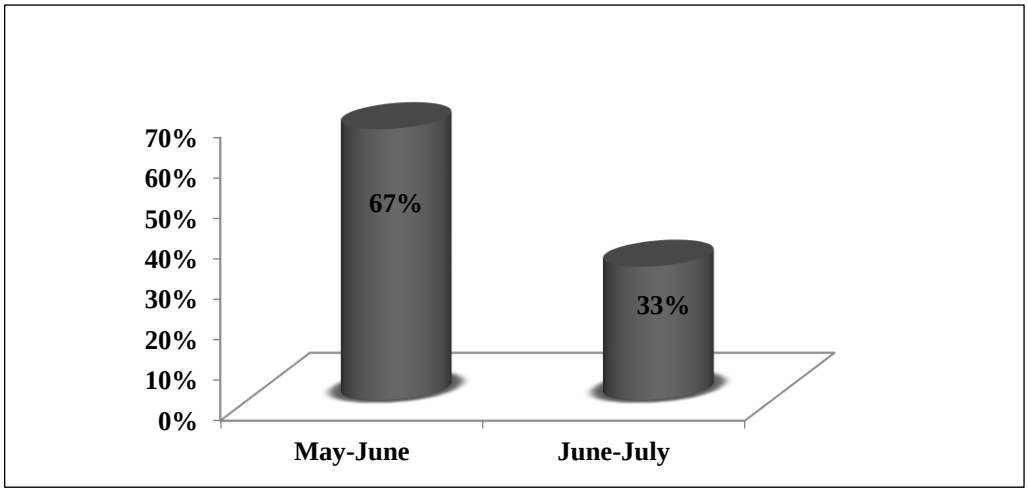

Figure 5: Breeding season of *Botia dario.*

Demand of B. dario in diverse fish market

There are low, medium and high different demand levels were used to understand the demand level for *B. dario* in the fish market. Due to their shyness and concealing tendencies, 57% of ornamental shopkeeper have reported that the demand was medium level in the ornamental market and 43% cited has low demand (Fig 6). But in food fish market, 35% of respondents indicated that *B. dario* was in great demand as a food fish because it was delicious to eat and had a lot of animal fat, the market for food fish was dominated by other species and the remaining 65% reported its medium demand in the fish market (Fig 6).

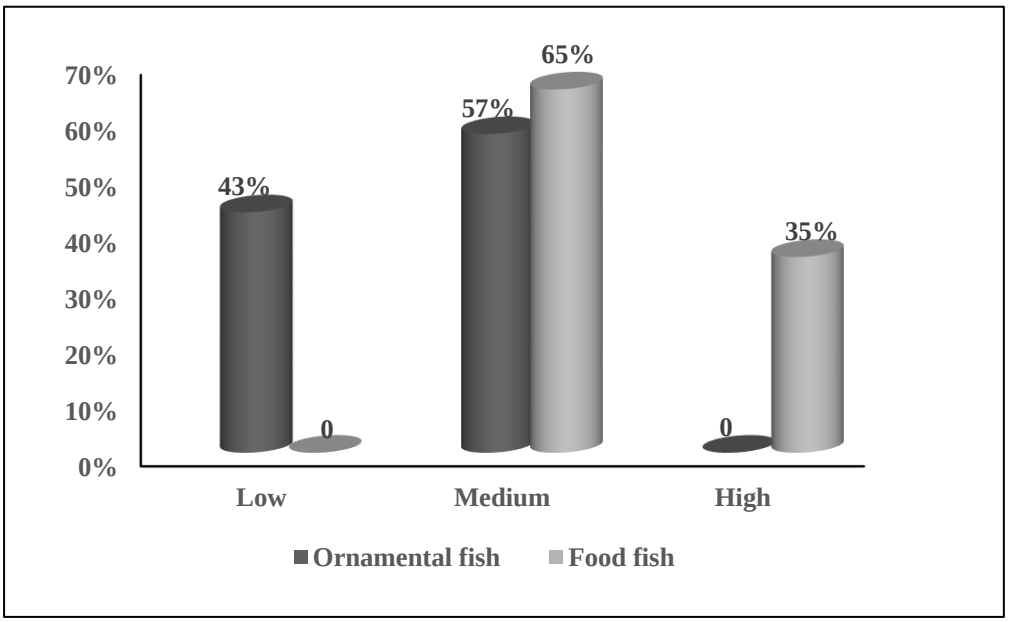

Figure 6: Demand of *Botia dario* in different fish market.

Discussion

The present study revealed that the *B. dario* species was mostly available in the haor areas of Sunamgonj district. This fish was also found in Bhramhaputra river basin in Mymensingh, Meghna river in Kishoregonj and Surma river in Sylhet district. Similar results was found by Rahman (2005) and this fish was common in streams and river of Mymensingh, Sylhet, Dinajpur, Rangpur and Chittagong hill tracts. *B dario* prefer to live in clean water in all types of freshwater water ponds (canal-bills, river-canal, haor-bore) and mainly found on the months of September to October and after that it became rare after from November (Palash, 2015). Throughout the rainy season, from late October to December, it was only present in modest quantities (Sarker *et al.*, 2022). When the water level in the beel declined during the dry season, more of them were caught in nets, revealing their commercial insignificance.

In the present study it had been observed that the presence of this fish in the study areas was comparatively lower than expectation. Hamilton (1822) also reported that loaches are scarce and are infrequently netted and traded in marketplaces with other kinds of fish, but in small quantities. In the study areas, fishermen stated that the elimination of perennial water sources, harmful fishing methods such as fishing with small mesh size nets, overfishing, and habitat damage, are rendering this fish endangered. According to the International Union for Conservation of Nature (IUCN, 2015), the natural population of *B. dario* had decreased by about 60% in the last 20 years due to a variety of factors including habitat loss from insecticide use in paddy fields, siltation of upland rivers, lifting of stones and sands from river beds and construction of flood control dams, ecological changes, overexploitation, destruction of breeding grounds, and lack of proper management. If the relevant authorities do not take decisive action in this problem, such fish will become endangered like other indegenious fish.

It was found that marketing channel of *B. dario* in Bangladesh started from the wild catchers to consumers or ornamental fish keeper which passed through a number of intermediaries such as fishermen, foria, aratdars, wholesalers and retailers. Hossain (2004) stated that SIS distribution chain started from farmers or catchers to consumer through middlemen or foria, wholesaler or aratdar and retailers. He described two market system, wholesale market and retail market, in his study. Ahmed *et al.* (2005) and Paul *et al*. (2016) also reported that the market chain from producers to consumer passed through a number of intermediaries: local traders, agents/suppliers, wholesalers and retailers.

During the study there were two indigenous ornamental fish species found, *B. lohachata* and *B. dario,* and they were only available in the ornamental fish market of Katabon, Dhaka. Alam *et al.* (2016) found *B. dario* and *B. lohachata* species in the

ornamental fish markets of Barisal division. Price variation of *B. dario* depends on the availability, size of fish, season demand of fish and location of sources. Different price ranges were found in this study. Hossain (2004) reported that the price range of SIS varied widely from 50 to 450 BDT per kg dead fish depending on species with various factors. In ornamental fish market, the average price of Rani fish (*B. dario)* was about 40 BDT per pair in the September to December when this fish available in the natural sources and aquarium fish market. On beside that, the price range was higher of this fish in off season (January to August). Alam *et al.* (2016) reported that the price of aquarium fishes varied due to size of each species ranged from 30 BDT to 800 BDT per pair.

Conclusion

The ornamental fish industry is growing in popularity in Bangladesh, *B. dario* has the potential to generate a lot of foreign currency each year by exporting it as it has beautiful color pattern. Therefore special attention should be given because this fish is reducing day by day from the natural environment. So we should know more about it such as habitat, ecology, reproductive physiology (including, gonodo somatic index, breeding season, length at maturity and fecundity), etc. for its conservation purpose.

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