Fish and Shellfish Marketing Structure at the Retail Markets of Coastal Villages

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Abstract: This study was carried out to explore the fish marketing system and species combination in five village fish markets of Paikgachha Upazila, Bangladesh. Nine marketing channels were found in the retail markets and the shortest channel was observed when consumers directly bought fish from the producers. Most of the retailers were 30-45 years old whereas, 40% had no opportunity to receive institutional education though all of them can sign their name. In the retail markets, most of the fishes were sold without ice. Moreover, a total of 93 species were found whereas 65.59, 10.75, 9.68 and 13.98% were inland fish, marine fish, exotic fish and crustacean species, respectively. Perciformes (29.03%) outnumbered the other 11 orders and Cyprinidae was represented as dominant following 38 families. Most of the fish and shellfishes were (73.12%) available from capture fisheries and the fishes were harvested from nearby rivers of the study area. In the markets 37, 10, 8 and 6 inland species were in the least concern, near threatened, endangered and vulnerable category, respectively in the aspect of their biodiversity status in Bangladesh. Among the inland fishes, 39 species were small indigenous fish species (SIS) and demands for riverine fishes were higher than the culture fishes. The price of most of the fish and shellfishes were within 251 to 500 BDT per kg whereas, the maximum price of *Tenualosa ilisha* was higher than 750 BDT kg^{-1}. Thirteen major constraints in the fish markets were identified by the fish traders.

Key words: Coastal Village · Fish Trading · Market Chain · Retailers · Demand

INTRODUCTION

Rising income and urbanization in developing nations are changing the food habit of people from conventional staple cereals to nutrients rich rations [1]. Fish has a critical role in human health, growth and immunity as it is rich in umpteen nutrients like protein, essential fat, vitamin and minerals. It is one of the major sources of animal protein in Bangladesh which is blessed with the capture fishery and aquaculture potential due to favorable geographic position, sub-tropical climate, sea area, long coastline and active deltas fed by three major mighty rivers - the Padma, the Meghna and the Jamuna [2-4]. Modern technologies, their extension and adaptation result in the mushrooming growth of fish farms and increasing fish production in this country. Historically, people of Bangladesh strongly prefer fish and almost all the households used to consume fish at least once a week [5]. Fisheries is playing a significant role in supporting the livelihood and food security of millions

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of people in Bangladesh and more than 11% of the population are directly and indirectly related to the fisheries sector such as- farming, marketing, processing, transporting, exporting and so on [6-11]. It is a flourishing food sector for the availability of diverse fish species from both capture and culture fisheries [10, 12, 13]. At present, Bangladesh is self-sufficient in fish production and getting world recognition as a fish producing country [9]. After harvesting, most of the fishes are marketed for national consumption and highly valued fish and shellfishes are exported. The fish market is a bridge between fishermen or fish farmers and consumers and it is the place where fish and fishery products are sold. Private traders control fish market channel traditionally through a chain of the village market, town market, assemble center, wholesale market and retail market [14]. The difference between the fish consumption of rural and urban households is significant and the amount of fish consumption by the rural households is higher compared to the similar type of urban households [5]. This might be due to enhanced aquaculture production, lower prices at rural markets and easy access to inland water bodies like rivers, canals, beels and floodplains [3, 5]. Generally, fish price in the production and harvest area is low which is raised by the middlemen at the consumer phase. According to Kaygisiz and Eken [15], marketing efficiency is high for commercially important fishes and intermediaries grab a significant share of consumers' expenditure. Fish marketing is not only confined to selling fish in local areas but also in distant and interior markets. At the fish market, price varies according to availability, size, freshness and source of fish [16]. Moreover, in the coastal areas, both fish and crustacean species are available in the natural water and culture system. Due to favorable geographical features, shrimp and prawns are being cultured in the southern coastal areas traditionally [17]. There have been several studies on fish markets of Bangladesh [14, 16], but no studies have been carried on retail market of coastal villages. For ensuring increased food security and quality life of the local communities, proper monitoring and management of fish stock, commerce channel, activities of fish traders and consumers are needed to be implemented. The main objective of the present study is to assess the trading system and combination of species in the retail markets of coastal villages. Such study will assist the policymakers and researchers to understand the rural market structure in coastal environment and make long-term management policies for the coastal communities and fisheries resources.

MATERIALS AND METHODS

Study Area: Paikgachha Upazila is a well-known sub-district of 411.19 km^2 under Khulna district and it is consisted of ten unions [18]. The present study was conducted from January to December, 2019 in five fish retail markets from five unions of Paikgachha Upazila namely Kapilmuni, Haridhali, Gadaipuir, Raruli and Sholadana (Figure 1).

Data Collection: Fundamental data were collected based on questionnaire interview, focus group discussion (FGD) and crosscheck interviews with key informants (KI) such as Upazila Fisheries Officer (UFO) and NGOs staffs. Twenty fish retailers from each market (total 100) were interviewed at the market, home and working place. Six focus group discussion sessions of the participants were performed where each group consisted of 8 members. Moreover, identification of fish and shellfishes was carried out following IUCN [19], Jayaram [20] and Rahman [21].
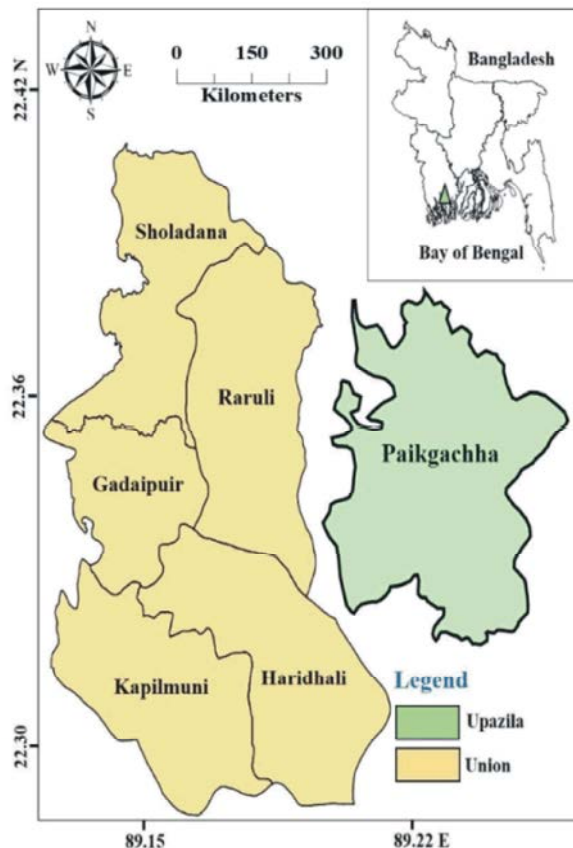

Fig. 1: Geographical map of the study area in Paikgaccha Upazila

Data Analysis: After completing survey, both qualitative and quantitative data such as fish species, origin, source, demand, availability, biodiversity status of the species, marketing channel and problems in the fish markets were entered into computer using Microsoft Excel version 2013. Moreover, for assessing the influence of socio-economic condition of retailers on the marketing system, related factors were categorized into several groups. After that, the results were presented using tables and graphs. The geographical locations of the study area were presented using Arc GIS software (Version 10.00).

RESULTS AND DISCUSSION

Existing Marketing Channel: Fish marketing channel plays an important role to fisheries as, using this pathway fishes are sent to the consumers from producer level. The quality and price of fish also depend on the number of middlemen. The marketing channel from farmers to consumers passed through a number of intermediaries such as local agents, arotdar, wholesalers and retailers [16]. During study, nine marketing channels were found in the markets of Paikgachha Upazila (Figure 2). The longest channel was fishermen or fish farmers-local agent-arotdar-wholesaler-retailer-consumer. Moreover, the shortest channel was the passage of fish from farmer or fishermen to the consumer where no middleman was involved. Similar channel was found by Uddin *et al.* [22], Hossain *et al.* [23] and Hossen *et al.* [24]. In Istanbul Province of Turkey, most common channel was fishermen-broker-retailer-consumer [15].

Condition of Fish Retailer: Socio-economic factors of the fish retailers were categorized into several groups to find out their effect on market structure, freshness of fish and price (Table 1). From the study, it was found that most of the retailers (55%) were 30-45 years old whereas, 45% respondents had 16-25 years experiences of fish retailing in the markets. Moreover, 33% and 27% retailers completed primary and secondary education, respectively. Rest of the respondents (40%) had no institutional knowledge but all of them can sign their name. Percentage of permanent retailer (21%) outnumbered temporary retailers (79%). The temporary retailer used to sell fish seasonally and in other season they used to involve in other occupation. Most of the respondents (58%) spent 5-8 hr for their routine task in the market but on special market day all the retailers spend more time. In the study area, Sunday and Thursday were specified for the special market day which is locally called 'Hat-bar'. The retailers used bamboo basket (33%), plastic basket (45%), steel bowl (20%) and polythene sheet (12%) for displaying the fish and shellfishes. Ten percent (10%) retailers used no weighing machine as they sold the raw items on the basis of their idea and experience. Only 15% respondents used ice during retailing who sold high valued species (*Tenualosa ilisha*, *Macrobrachium rosenbergii* and *Penaeus monodon*). Daily income of most of the retailer (50%) was 200-600 BDT and only 15% earned more than 1000 BDT daily. In Galachipa fish market of Patuakhali, 35-44 aged retailers outnumbered other age group which was similar to the present study area [25]. According to Alam [26], high valued fish and shellfishes are adequately iced at markets but for the coastal people's perception or prejudice ice is not used during display. Fish retailers of Patuakhali involved in business, agricultural activities, fishing, day laboring and fish farming activities besides fish retailing [25]. Moreover, temporary fish retailers had to face harassment from the local authority as they did not have specific shelter in the market and trade illegally [27]. Hossain *et al.* [23] found that, daily income of most of the fish retailers in Dinajpur was 300-400 BDT which was close to the present findings. In the retail market of Tamil Nadu, fishermen directly sold fishes from Aliyar Reservoir and besides retailing they got extra charge from local consumers by cutting fish [28].

Available Species in Market: In the local retail markets, 93 species were recorded including 61 inland fishes (65.59%), 13 crustaceans (13.98%), 10 marine fishes (10.75%) and 9 exotic fishes (9.68%) (Table 2, 3, 4 and 5). Moreover, 12 orders and 38 families were found in the studied markets whereas, Perciformes (29.03%) was the most dominant order followed by Cypriniformes (18.28%), Siluriformes (15.05%), Decapoda (13.98%), Clupeiformes (8.60%), Synbranchiformes (4.30%), Anguilliformes (3.23%), Mugliformes (2.15%), Osteoglossiformes (2.15%), Cyprinodontiformes (1.08%), Myliobatiformes (1.08%) and Pleuronectiformes (1.08%) (Figure 3 and 4). The species number under Cyprinidae order (17) was higher than the other families. Haldar *et al.* [16] found 74 species in the Manikganj city market which was lower than the present outcome and it might be due to the avilability of more species in the sorrounding water-bodies of Paikgachha Upazila. In the local markets of Patuakhali, 11 crustacean species were found which was little bit lower than the present study [14]. Moreover, in Bogura town, 30% exotic fish species were found which was much higher than the present study [22]. It might be due to the low demand for exotic species and lower culture practice of those species in the commercial ponds of Khulna region. Mukul *et al.* [29] listed 16 exotic fishes and majority were from Cyprinidae.
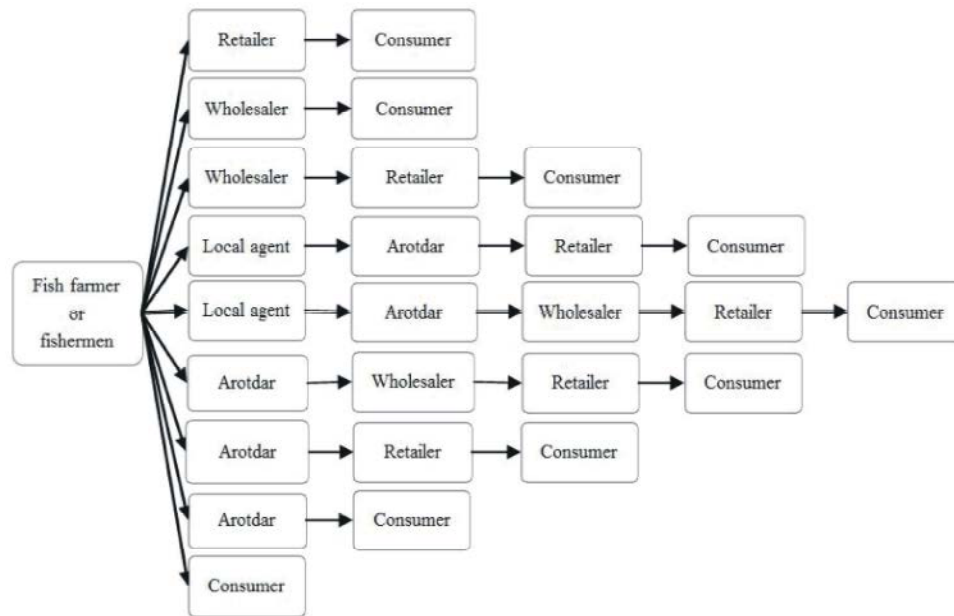
Fig. 2: Existing marketing channels in the studied fish retail markets

Table 1: Socio-economic factors influencing fish retailing at the coastal villages

Variables	Categories	Percentage (%)
Age	15-30 years	25
	30-45 years	55
	Above 45 years	20
Experience of retailing	5-15 years	17
	16-25 years	45
	26-35 years	25
	Above 35 years	13
Education	No institutional education	40
	Primary level (class I-V)	33
	Secondary level (class VI- X)	27
Type of retailer	Temporary	21
	Permanent	79
Routine time spent in market	Less than 5 hr	16
	5 to 8 hr	58
	Above 8 hr	26
Display container	Bamboo basket	33
	Plastic basket	45
	Steel bowl	20
	Polythene sheet	12
Weighing system	No scale or machine	10
	Manual weighing scale	25
	Electronic balance	65
Preservation	No preservation	85
	Icing	15
Daily income (BDT)	200-600	50
	601-1000	35
	Above 1000	15

Table 2: Available inland fish species in the retail markets of Paikgachha Upazila

Order	Family	Scientific name	Size	Origin	Biodiversity status	Availability	Retailing type	Demand	Price range (BDT kg⁻¹)	Division of source
Anguilliformes	Anguillidae	*Anguilla bengalensis*	Large	Capture	VU	Very rare	Both	Low	150-250	Khulna
	Ophichthidae	*Pisodonophis cancrivorus*	Large	Capture	LC	Few	Both	Low	150-200	Khulna
		Pisodonophis boro	Small	Capture	LC	Common	Both	Low	150-200	Khulna
Clupeiformes	Clupeidae	*Corica soborna*	Small	Capture	LC	Common	Mixed	Medium	120-200	Khulna
		Gudusia chapra	Small	Capture	VU	Common	Mixed	High	150-200	Khulna
		Tenualosa ilisha	Large	Capture	LC	Common	Individual	High	500-1200	Barishal, Chittagong
		Tenualosa toli	Large	Capture	LC	Few	Individual	High	250-450	Khulna, Chittagong
	Engraulidae	*Coilia dussumieri*	Small	Capture	LC	Common	Mixed	High	100-200	Khulna
		Setipinna phasa	Large	Capture	LC	Few	Both	Medium	150-220	Khulna
		Thryssa purava	Small	Capture	LC	Few	Both	Medium	150-220	Khulna
Cypriniformes	Cyprinidae	*Amblypharyngodon mola*	Small	Capture	LC	Few	Mixed	High	150-200	Khulna
		Catla catla	Large	Both	LC	Common	Individual	High	300-400	Khulna
		Cirrhinus cirrhosus	Large	Both	NT	Common	Individual	High	200-250	Khulna
		Labeo bata	Large	Both	LC	Common	Both	High	200-400	Khulna
		Labeo calbasu	Large	Both	LC	Few	Individual	Medium	200-300	Khulna
		Labeo gonius	Small	Capture	NT	Very rare	Mixed	Low	200-300	Khulna
		Labeo rohita	Large	Both	LC	Common	Individual	High	200-300	Khulna
		Osteobrama cotio	Small	Capture	NT	Few	Mixed	High	150-250	Khulna
		Pethia ticto	Small	Capture	VU	Rare	Mixed	Medium	150-200	Khulna
		Puntius sophore	Small	Capture	LC	Rare	Mixed	Low	150-200	Khulna
		Systomus sarana	Small	Capture	NT	Few	Both	Low	150-250	Khulna
Cyprinodontiformes	Aplocheilidae	*Aplocheilus panchax*	Small	Capture	LC	Rare	Mixed	Low	100-150	Khulna
Mugliformes	Mugilidae	*Liza parsia*	Small	Capture	LC	Common	Individual	High	300-450	Khulna
		Rhinomugil corsula	Large	Capture	LC	Common	Both	High	150-200	Khulna
Osteoglossiformes	Notopteridae	*Chitala chitala*	Large	Capture	EN	Rare	Individual	High	300-400	Khulna
		Notopterus notopterus	Large	Capture	VU	Few	Individual	High	300-400	Khulna
Perciformes	Ambassidae	*Chanda nama*	Small	Capture	LC	Rare	Both	Medium	150-250	Khulna
		Pseudambassis baculis	Small	Capture	NT	Very rare	Both	Low	150-250	Khulna
	Anabantidae	*Anabas testudineas*	Small	Capture	LC	Common	Individual	High	400-500	Khulna
	Belonidae	*Xenentodon cancila*	Small	Capture	LC	Rare	Both	Low	150-250	Khulna
	Channidae	*Channa marulius*	Large	Capture	EN	Very rare	Both	Low	300-500	Khulna
		Channa orientalis	Small	Capture	LC	Common	Both	High	120-250	Khulna
		Channa punctatus	Small	Capture	LC	Common	Both	High	150-300	Khulna
		Channa striatus	Large	Capture	LC	Common	Individual	High	200-400	Khulna
	Gobiidae	*Apocryptes bato*	Small	Capture	LC	Common	Individual	High	250-400	Khulna
		Brachygobius nunus	Small	Capture	LC	Rare	Mixed	Medium	400-600	Khulna
		Glossogobius giuris	Small	Capture	LC	Common	Both	High	400-600	Khulna
		Odontamblyopus rubicundus	Small	Capture	LC	Common	Mixed	Medium	200-300	Khulna
	Hemiramphidae	*Zenarchopterus ectuntio*	Small	Capture	DD	Rare	Mixed	Low	300-400	Khulna
	Nandidae	*Nandus nandus*	Small	Capture	NT	Few	Mixed	Medium	200-300	Khulna
	Osphronemidae	*Trichogaster fasciata*	Small	Capture	LC	Rare	Both	High	200-400	Khulna
	Sciaenidae	*Otolithoides pama*	Large	Capture	LC	Few	Mixed	Medium	200-400	Khulna
	Sillaginidae	*Sillaginopsis panijus*	Large	Capture	LC	Few	Mixed	Medium	300-400	Khulna
Siluriformes	Bagridae	*Mystus bleekeri*	Small	Capture	LC	Few	Both	Low	200-400	Khulna
		Mystus gulio	Small	Capture	NT	Common	Both	Medium	250-450	Khulna
		Mystus tengara	Small	Both	LC	Few	Both	Medium	200-400	Khulna
		Mystus vittatus	Small	Both	LC	Common	Individual	High	300-400	Khulna
		Rita rita	Large	Capture	EN	Very rare	Individual	Medium	400-600	Khulna
	Claridae	*Clarias batrachus*	Small	Both	LC	Common	Both	High	350-500	Khulna
	Heteropneustidae	*Heteropneustes fossilis*	Small	Both	LC	Common	Individual	High	350-500	Khulna
	Pangasiidae	*Pangasius pangasius*	Large	Capture	EN	Common	Individual	High	120-200	Khulna
	Plotosidae	*Plotosus canius*	Small	Capture	NT	Few	Both	High	400-500	Khulna
	Schilbeidae	*Ailia coila*	Small	Capture	LC	Common	Both	High	350-450	Khulna
		Clupisoma garua	Small	Capture	EN	Rare	Mixed	Low	300-500	Khulna
	Siluridae	*Ompok pabda*	Small	Capture	EN	Rare	Individual	High	400-600	Khulna
		Ompok bimaculatus	Large	Capture	EN	Very rare	Mixed	Low	400-600	Khulna
		Wallago attu	Large	Capture	VU	Very rare	Individual	High	400-600	Khulna
Synbranchiformes	Mastacembelidae	*Macrognathus aculeatus*	Small	Capture	NT	Common	Mixed	Low	300-400	Khulna
		Macrognathus pancalus	Small	Capture	LC	Few	Mixed	Low	300-400	Khulna
		Mastacembelus armatus	Small	Capture	EN	Common	Individual	High	300-450	Khulna
	Synbranchidae	*Monopterus cuchia*	Large	Both	VU	Common	Individual	High	100-250	Khulna

Here, LC indicates least concern species; VU means vulnerable species, EN indicates endangered species and NT means near threatened species

Table 3: Available exotic fish species in the studied retail markets of Paikgachha Upazila

Order	Family	Scientific name	Size	Origin	Availability	Sell type	Demand	Price range (BDT kg^{-1})	Division of source
Cypriniformes	Cyprinidae	*Banbonymus gonionotus*	Large	Culture	Common	Individual	Low	150-200	Khulna
		Ctenopharyngodon idella	Large	Culture	Common	Individual	Medium	120-200	Khulna
		Cyprinus carpio	Large	Culture	Common	Individual	Medium	150-220	Khulna
		Cyprinus carpio var. *specularis*	Large	Culture	Common	Individual	Medium	150-250	Khulna
		Hypophthalmichthys molitrix	Large	Culture	Common	Individual	High	100-200	Khulna
		Hypophthalmichthys nobilis	Large	Culture	Common	Individual	Low	150-250	Khulna
Perciformes	Anabantidae	*Pangasianodon hypophthalmus*	Large	Culture	Common	Individual	High	100-150	Khulna
	Cichlidae	*Oreochromis mossambicus*	Small	Culture	Common	Both	High	80-100	Khulna
		Oreochromis niloticus	Small	Culture	Common	Individual	High	100-150	Khulna

Table 4: Available marine fish species in fish markets of Paikgachha Upazila

Order	Family	Scientific name	Size	Origin	Availability	Sell type	Demand	Price range (BDT kg^{-1})	Division of source
Clupeiformes	Clupeidae	*Sardinella fimbriata*	Small	Capture	Few	Individual	Medium	200-300	Khulna
Myliobatiformes	Dasyatidae	*Himantura uarnak*	Large	Capture	Very rare	Individual	Low	400-600	Khulna
Perciformes	Haemulidae	*Pomadasys hasta*	Large	Capture	Few	Both	High	350-450	Khulna
	Latidae	*Lates calcarifer*	Large	Capture	Common	Individual	High	400-500	Khulna
	Lobotidae	*Labotes surinamensis*	Large	Capture	Rare	Mixed	Low	300-500	Khulna
	Polynemidae	*Eleutheronema tetradactylum*	Large	Capture	Very rare	Mixed	Low	300-400	Khulna
		Polynemous paradiseus	Large	Capture	Common	Both	Medium	200-300	Khulna
	Scatophagidae	*Scatophagus argus*	Large	Capture	Few	Mixed	Medium	300-400	Khulna
	Sciaenidae	*Johnius argentatus*	Large	Capture	Rare	Mixed	Low	300-500	Khulna
Pleuronectiformes	Cynoglossidae	*Cynoglossus macrostomus*	Small	Capture	Rare	Mixed	Low	200-400	Khulna

Table 5: Available crustacean species in the retail fish markets of Paikgachha Upazila

Order	Family	Scientific name	Origin	Biodiversity status	Availability	Sell type	Demand	Price range (BDT kg^{-1})	Division of source
Decapoda	Palaemonidae	*Macrobrachium rosenbergii*	Both	LC	Common	Individual	High	400-700	Khulna
		Macrobrachium villosimanus	Capture	LC	Common	Mixed	High	350-500	Khulna
		Macrobrachium lamarrei	Capture	LC	Common	Mixed	High	300-400	Khulna
		Macrobrachium rude	Capture	LC	Few	Mixed	Medium	400-700	Khulna
	Penaeidae	*Metapenaeus monoceros*	Both	LC	Common	Mixed	High	250-500	Khulna
		Metapenaeus lysianassa	Capture	LC	Common	Mixed	High	200-450	Khulna
		Metapenaeus brevicornis	Capture	LC	Common	Mixed	Medium	250-400	Khulna
		Penaeus monodon	Both	LC	Common	Individual	High	550-750	Khulna
		Penaeus indicus	Both	LC	Common	Individual	High	250-400	Khulna
		Penaeus semisulcatus	Capture	LC	Common	Mixed	Medium	250-450	Khulna
		Penaeus styliferus	Capture	LC	Few	Mixed	Medium	200-400	Khulna
	Portunidae	*Scylla serrata*	Both	LC	Common	Individual	High	500-700	Khulna
		Scylla olivacea	Both	LC	Common	Mixed	Medium	350-500	Khulna

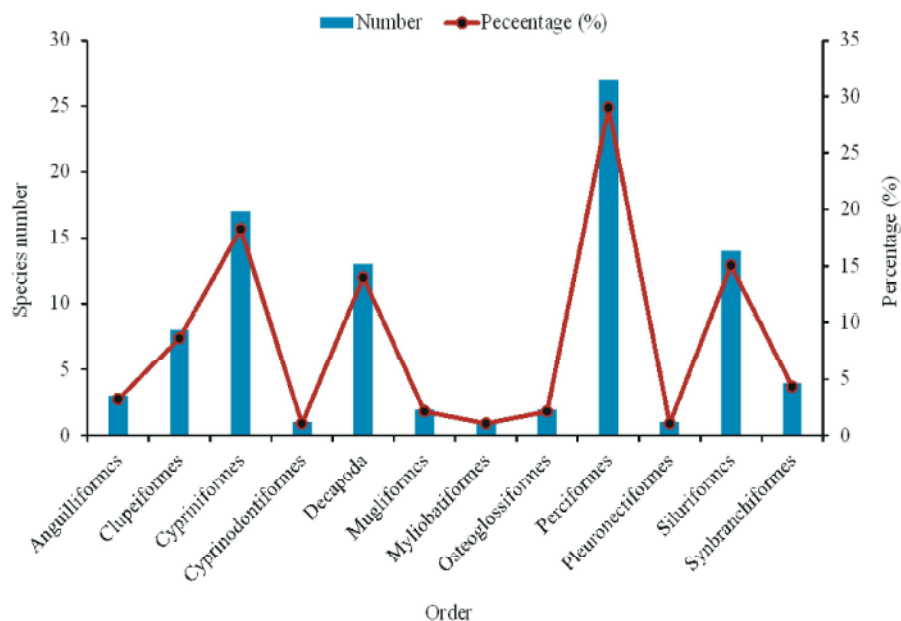Here, LC indicates least concern species

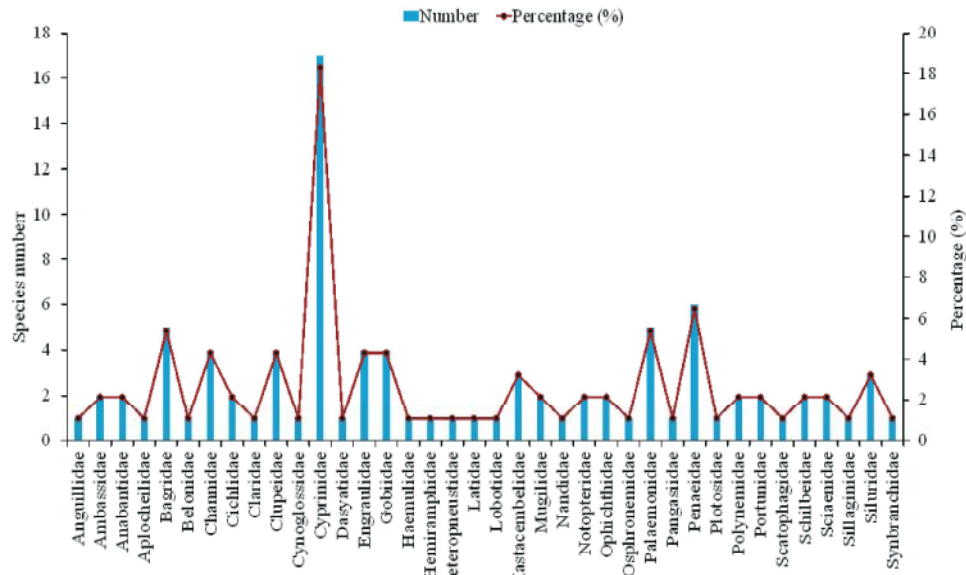Fig. 3: Orders of available species in the village fish markets

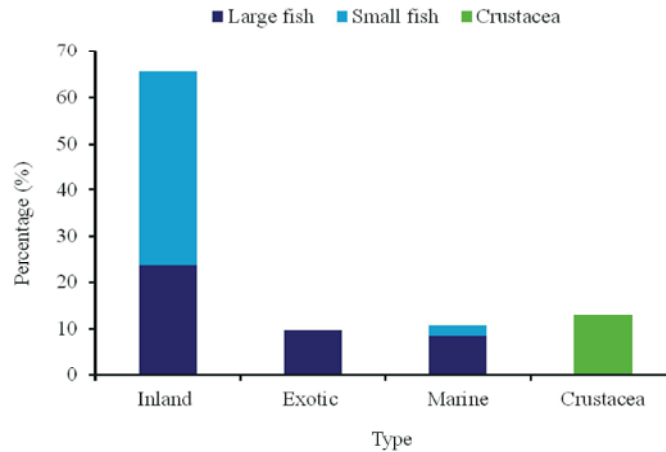Fig. 4: Families of available species in the coastal fish markets

Fig. 5: Types of species available in the village fish markets

Species Type: On the basis of total length, the fishes were categorized into two groups such as- small fishes those cannot reach more than 25 cm at their maturity and large fishes were more than 25 cm (Figure 5). From the study it was found that, most of the inland and marine fishes in the markets were in the small size category (41.94% inland; 2.15% marine), whereas, all the exotic fishes were large fish. According to Tsikliras and Polymeros [30], market price of fish is related to fish size and in case of larger individual, market value become higher than the medium and small-sized counterparts. Saha *et al.* [31] found 22 small fishes in the rural fish markets of West Bengal, India which was lower than the coastal markets of the present study. Shamsuzzaman *et al.* [3] stated that there are more than 40 small indigenous fish species those can grow at maturity to maximum 25 cm.

Origin of the Fish and Shellfishes: Capture species include the fish and shellfishes harvested from rivers, estuaries, beels, flood plains and marine water-bodies. In the study area, most of the species were harvested from open waters (73.12%) (Figure 6). Sixteen species (17.20%) were from both capture and culture fisheries including *Catla catla*, *Cirrhinus cirrhosis*, *Clarias batrachus, Heteropneustes fossilis, Labeo calbasu*, *Labeo bata*, *Labeo rohita*, *Macrobrachium rosenbergii*, *Metapenaeus monoceros*, *Monopterus cuchia*, *Mystus vittatus*, *Mystus tengara*, *Penaeus indicus*, *Penaeus monodon*, *Scylla olivacea* and *Scylla serrata.* Whereas, rest of the culture species (9.68%) were the exotic fish species. Ali *et al.* [14] found that, most of the fishes were from culture pond in the local markets of Patuakhali which was dissimilar to the present finding. It indicated that,
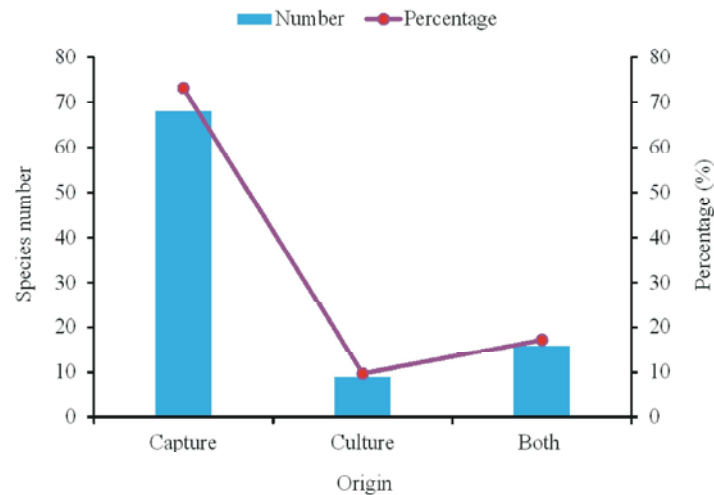
Fig. 6: Origin of fish and shellfishes found in the studied markets
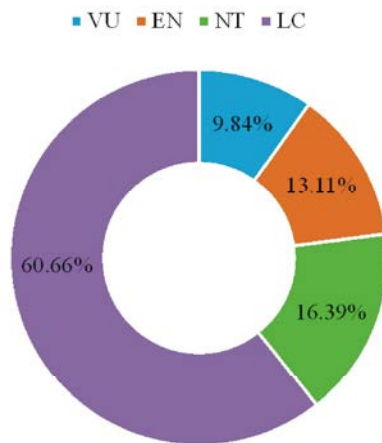

Fig. 7: Biodiversity status of 61 native species according to IUCN (2015) red list of Bangladesh

demanded fish and shellfishes in the nearby natural water-bodies were available in the study area and small scale fisheries sector in Khulna region was sufficient to meet the basic needs of the rural coastal people. Shamsuzzaman *et al.* [7] reported that, the pressure on the inland capture fisheries is increasing due to high demand and overexploitation from the water-bodies.

Biodiversity Status: The status of biodiversity of the inland species was identified following the IUCN [19] red list of Bangladesh (Table 2, Table 5). Among 61 inland fish species, 9.84% vulnerable (VU), 13.11% endangered (EN), 16.39% near threatened (NT) and 60.66% least concern (LC) species were found from the study (Figure 7). The vulnerable species were *Anguilla bengalensis*, *Gudusia chapra*, *Pethia ticto*, *Notopterus notopterus*, *Wallago attu* and *Monopterus cuchia*.

Roy *et al.* [32] found 6 vulnerable species in the Shibsa River at Paikgachha Upazila. From the study, all the recorded shellfishes were in the least concern (LC) category (Table 5). Crustaceans of Penaeidae and Portunidae families spend most of their life stages in the coastal environments. As a result, the culture of *Macrobrachium rosenbergii*, *Penaeus monodon*, *Scylla serrata* and *Scylla olivacea* has dramatically increased in Bangladesh recently for their demand in local, national and international markets [17, 33].

Species Availability and Demand: Four categories such as- common, few, rare and very rare were used to identify the availability of the species in the markets. In the study sites, 49 common (52.69%), 21 few (22.58%), 14 rare (15.05%) and 9 very rare (9.68%) species were found (Figure 8). Among 10 marine fishes, *Lates calcarifer* and *Polynemous paradiseus* were common in the markets whereas, all the exotic fishes were also common. Moreover, most of the fish and shellfishes were highly demanded (50.53%) and except *Macrobrachium rude* and *Penaeus styliferus* other 11 crustacean species were common in the studied markets. Market demand for fisheries products indirectly influences the fish population abundance, size of fish catch and revenue [34]. Haldar *et al.* [16] reported that all the exotic species were common in the studied city market. According to Galib [35], exotic fishes are available throughout the year for higher growth and fecundity though those species create adverse impact on biodiversity by competing with the native species. Though, *Monopterus cuchia* is a vulnerable species, it was common with high demand in the study area as it is largely cultured in Khulna division and also available in the coastal rivers [32, 36].
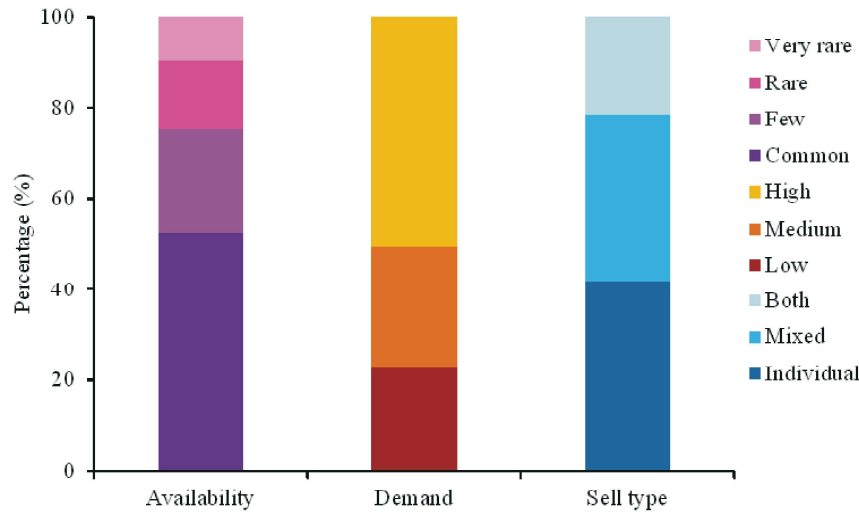
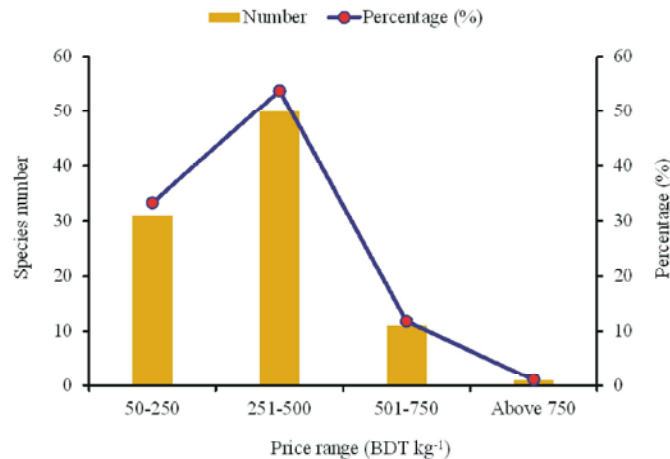Fig. 8: Species availability, demand of consumers and selling type of the fish and shellfishes

Fig. 9: Fish and shellfish categories based on price (BDT) per kg

Selling Type: In the retail markets, the species were sold in three patterns such as- single species (individual), combination of two or more species (mixed); and both single and combined item (both). It was found that, the individual (41.94%) sell type outnumbered the other two types (Figure 8). Selling pattern in the studied market depended on fish size and amount whereas, most of the large fishes were sold individually.

Retailing Price: Price range of fish and shellfish was presented in the Table (2-5) and categorized into four groups such as 50-250 BDT, 251-500 BDT, 501-750 BDT and above 750 BDT on the basis of the price per kg (Figure 9). In the studied markets, the highest price of most of the items ranged from 251-500 BDT kg^{-1} (53.76%). Only the maximum price of *Tenualosa ilisha* was above

750 BDT kg^{-1} (1.08%). Distance from fishing to retail market, distribution channels, price at landing center, number of involved middleman, season and fish size are the factors affecting the price at retail market [34, 37]. Though the production of *Tenualosa ilisha* has increased in Bangladesh, the price was found the highest in the study area which might be due to transportation cost, season and size variation [38-39]. For immense social and cultural significance, its price is enhanced during social and festive events though the demand and price remain higher than other species [40-41]. In the study area, price of exotic fishes were lower than the other native culture fishes whereas, the captured fishes were more costly than the other fishes. Ali *et al.* [14] stated that, in the market fish price of *Clarias batrachus*, *Heteropneustes fossilis*, *Pangasius pangasius*, *Anabas testudineas*,
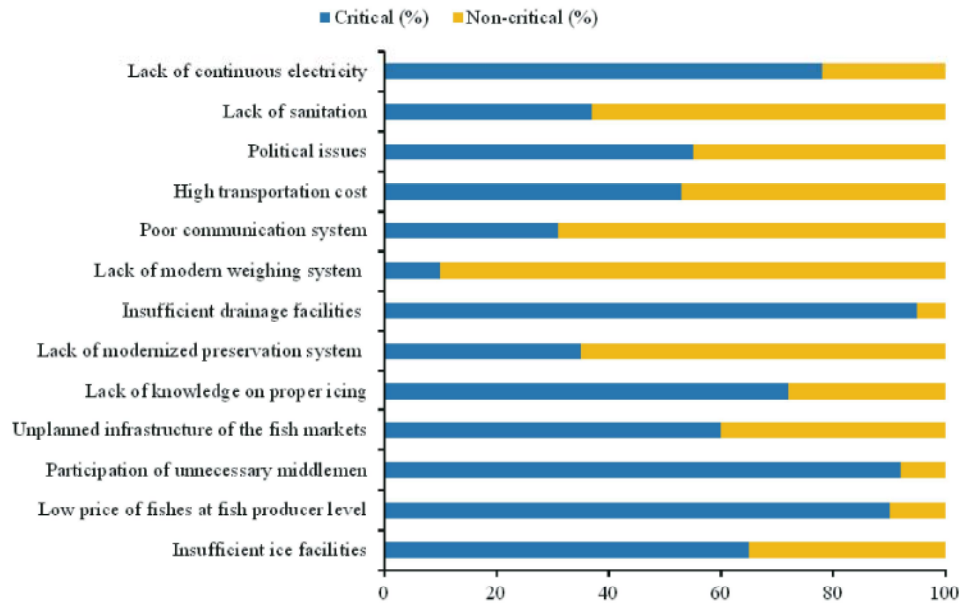
Fig. 10: Constraints in the fish retail markets faced by the retailers

Channa striatus, *Channa punctatus* and *Channa marulius* was depended on their live or death condition. Haldar *et al.* [16] also found similar result in the city market of Manikganj and they reported that for lower demand of exotic carps to the consumers, price is lowered in the retail market. Hossain *et al.* [42] observed that, among the Indian major carps, the price of *Catla catla* was the highest in the retail market of Rajshahi city which was similar to the present study.

Fish and Shellfish Source: In the present study, it was observed that source of most of the native fishes, marine fishes, exotic fishes and crustaceans were from Khulna division (Table 2-5). Only *Tenualosa ilisha* and *Tenualosa toli* were brought from Barishal and Chittagong divisions. Both capture and culture fish and shellfish are available in the districts under the Khulna division. Moreover, in Bagerhat, Khulna and Satkhira districts shrimp, prawn and crabs are widely cultured. In Manikganj city market, 70% species were freshwater riverine fishes and most of the culture fishes (20%) come from Mymensingh division [16]. Whereas, Ali *et al.* [14] found that, 80% fishes of the local markets of Dumki Upazila at Patuakhali were bought from nearby areas of same district and rest of the fishes were from different districts.

Constraints Associated with Fish Markets: During the study, 13 major problems in the markets were identified and degree of those problems were marked using two parameters such as critical and non-critical (Figure 10).

According to the respondents, the problems in critical conditions were- lack of continuous electricity, inadequate drainage facility, lack of proper knowledge on icing, unplanned market infrastructure, insufficient ice facilities, low price of fishes at fish producer level and participation of unnecessary middlemen. Ninety five percent (95%) respondents identified improper drainage system as their critical problem whereas, only 10% marked lack of modern weighing system as critical. The constraints were in line with the findings of Ali *et al.* [14], Uddin *et al.* [22] and Husen [43]. Moreover, Kaygisiz and Eken [15] found that, one of the most important constraints of fish marketing in Istanbul was lack of fishermen's organization which eventually triggered the problem of uncontrolled price at consumer level. Fish price during auction at landing center is correlated to the retail price [15]. Co-operative is a special weapon to economic development [44]. So, Madugu and Edward [45] recommended a strong co-operative society of the marketers by changing the brokerage system and they also stated that, providing license to the fish traders by the government can manage the supply chain of fishes.

CONCLUSION

In the studied fish markets, nine marketing channels were found whereas, intermediaries were related to eight channels. The majority of retailers were 16-25 years experienced in fish retailing and most of them were permanent. Moreover, 50% retailer earned 200-600 BDT daily. From the study, 93 fish and shellfish species from

38 families under 12 orders were recorded. Most of them were captured inland fishes brought from Khulna division whereas, the number of small fishes outnumbered larger fishes. Moreover, 37 inland fish and all the crustaceans were in the least concern category. From the study it was observed that, coastal people were dependent on fish as a source of animal protein due to their availability and affordable price. In the coastal village markets, most of the fishes and shellfishes were from nearby water-bodies, gher and ponds. But in the markets, several problems existed and among them few problems were critical those were barriers to maintain the quality of raw products. It can be concluded that, considering the existing problems, the markets should be provided with modern fish landing center, ice factories and drainage facilities. Moreover, fish quality and hygiene practice can be ensured through the training of all the fish traders and personnel related to fish market. Further study on the village markets of other environments and region is needed to compare the local market structures before making and implementing management policies.

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