



Monitoring of Fish and Shellfish Biodiversity and Marketing Channels in Fish Landing Centre, Noakhali, Bangladesh

**Smriti Chakraborty^{1*}, Debasish Saha¹, Swapan Chandra Dey²
and Rahima Yasmin¹**

¹Department of Fisheries and Marine Science, Noakhali Science and Technology University,
Noakhali-3814, Bangladesh.

²Department of Fisheries, Bangladesh.

Authors' contributions

This work was carried out in collaboration among all authors. Author DS designed the study, performed the statistical analysis. Author SC wrote the first draft of the manuscript. Authors SC and SCD managed the analysis of the study. Also, authors RY and DS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted to know the species diversity and marketing channels of fish and shellfishes in Chairman Ghat Fish Landing Center, Noakhali. The diversity status of fish and shellfishes was assessed by collecting samples from the study area for a period of one year. Collected samples are identified in the laboratory of Noakhali Science and Technology University. Only 32 fish species, 4 prawn and 1 shrimp species under 22 families were found during the study period. The highest number of species (4) was found from the family Engraulidae and Palaemonidae. Among the species of fishes found, twenty-four (24) species were considered as not threatened (NO), three (3) as critically endangered (CR), and ten (10) as data deficient (DD). The non-availability and less availability of fish species indicate the alarming decline of the biodiversity of fishes in the study area and in the country as a whole. Apart from this, general pattern of marketing

*Corresponding author: E-mail: smriti_2009@ymail.com;

channels in the Chairman Ghat Fish Landing Center is - after buying fish from fishermen, middlemen bring to the wholesale market and sell to the wholesaler. The retailers buy fish from wholesaler through auction with a highest bid. The retailers then bring the fish to particular market where they usually sell the fish to the consumers. But consumers can buy fish directly from fisherman or from arottdar, or may be from beparies. Therefore, in depth long-term investigation of fish is urgently needed not only for the conservation and rehabilitation, but also for creating the awareness among the policy makers of the government and non-government organizations, groups and general mass. Finally, the outputs from this study can be applied in the development of national biodiversity strategies, biodiversity conservation planning and in integration of biodiversity information within the development and environmental planning process.

Keywords: Shrimp; prawn; critically endangered (CR); data deficient (DD).

1. INTRODUCTION

Bangladesh is a country of rivers, beels, haors, baors and wetlands. The country has vast and diversified water resources of 4.72 million ha [1]. According to the World Bank [2], Bangladesh has the water resources diversified aquatic wealth and climate suitable for high yields and considerable increase in fish production. The major river systems (the Padma, the Brahmaputra and the Jamuna) flow into the sea through Bangladesh.

As a riverine country, the economy of Bangladesh depends upon agriculture, livestock and fisheries. Fish and fisheries sector play a significant role in the economy of Bangladesh in terms of animal protein supply, employment, foreign currency earning and poverty alleviation. This sector contributes 3.50 % to Gross Domestic Product (GDP) and 1.50 % of export earnings and 60 % of the total protein supplies in the diet of the people of Bangladesh. The present per capita annual fish intake is about 22.84 kg against the actual demand of 21.90 kg [1].

As a result of the plentiful availability of inland-water fish production, fish constituted the second most important component of the Bengali's diet next to rice. Bengali people have been known to be made up of 'rice and fish' [3]. Inland water resources of Bangladesh are considered to be one of the richest resources in the world both in area and potential for Fisheries Development [4]. According to Rahman [5], 260 species of finfish belonging to 55 families occur in the inland open water of Bangladesh. Among them, 143 may be considered as small indigenous species (SIS). Among the 260 freshwater fish species, many species are threatened in Bangladesh. The biodiversity of these fishes is categorized under different levels of threat, such

as, vulnerable (VU), endangered (EN) and critically endangered (CR) and so on. IUCN Red List (2020) revealed 54 threatened freshwater fish species in Bangladesh, of which 12 are critically endangered, 28 are endangered and 14 are vulnerable.

The study area (Chairman Ghat Fish Landing Centre, Noakhali) is about 40 km far from the Maijdee town in Noakhali district. The area is under Hatiya upazilla. Nuruzzaman, [6] found that the fish market in our country always remained in the control of influential persons of the surrounding area, depending on a wide range of socio-economic and political factors.

The marketing system or channel comprises a market, marketing channel along with packaging, transportation and storage facilities. The consumers are to depend on an effective fish marketing system through which fishes will be available to them. Presently, the marketing system of our country is important because it is often considered to be a limiting factor for fisheries development.

The principal objective of the present study was to collect and preserve available fish species of the study area and identify (based on taxonomic and morphological traits) them up to species level, to know the present status of diversity of fishes and shellfishes in the study area, and to know the marketing chain of the study site.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted for a period of one year in the Chairman Ghat Fish Landing Center (Fig. 1). The Chairman Ghat Fish Landing Center is under Hatiya Upazilla of Noakhali district in the Southern region of Bangladesh. The site was

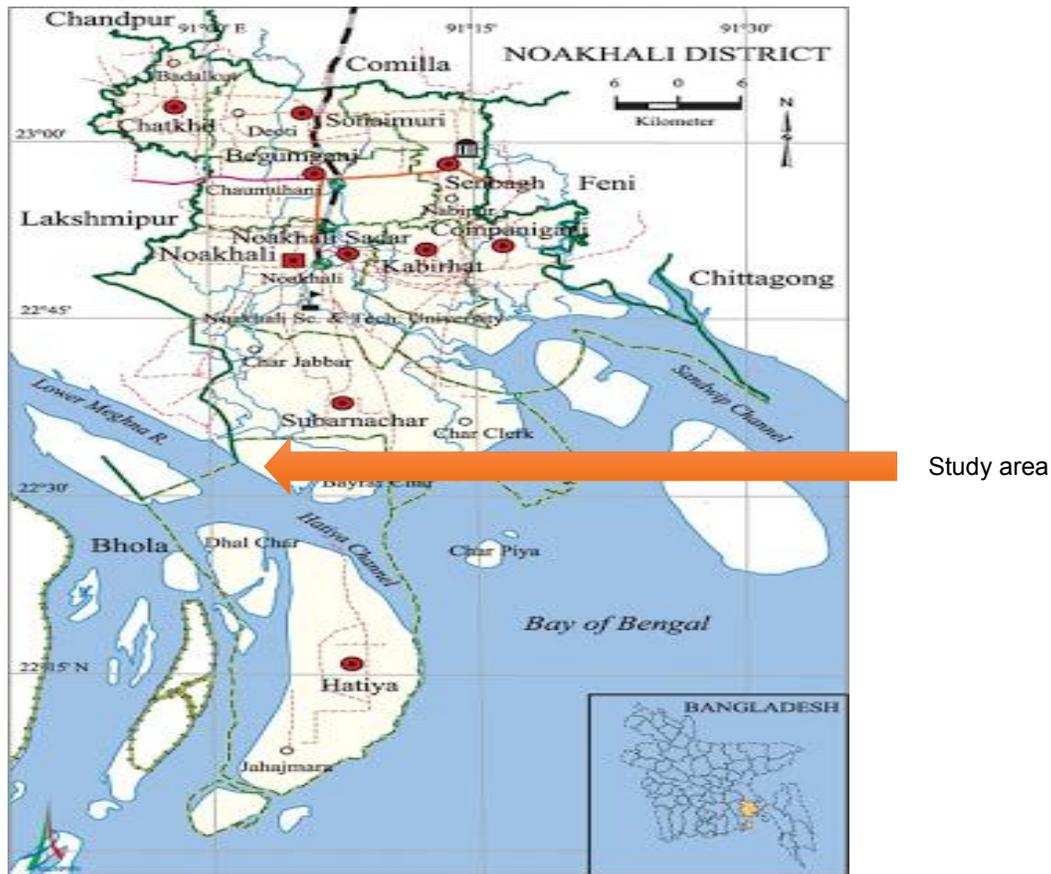


Fig. 1. Geographical location of the study area

selected for study purpose because it is a most important landing centre in Noakhali district. To study the biodiversity status of the selected Fish Landing Center, various activities were carried out using different survey tools and specific methodology.

2.2 Data Collection

The study was based on survey and data were collected from wholesaler/aratdar and retailers by on spot data collections methods. The data were collected emphasizing to know the species diversity of fish. For that, data were collected about the species availability, abundance, seasonal variation of fishes. The activities were also to know the biodiversity, marketing channel, involved in the total process.

Primary data were collected from the local people through questionnaires. The questionnaires were prepared in terms of the objectives of the study. Relevant data such as local name, distribution, availability of the

species was collected from the study sites. Published and unpublished relevant documents were also collected from various sources for collection of secondary data. Research papers on the fish fauna of Bangladesh were also consulted towards compiling the past data of abundance & availability for assessing biodiversity status.

After collecting data, it was cross checked with key informants such as Upazilla Fisheries Officer (UFO), District Fisheries Officers (DFO) and NGO workers.

2.3 Sample Collection and Preservation

Fish samples were collected from the landing centre and bought to the laboratory at Noakhali Science & Technology University, Noakhali and preserved with 10% formalin for further identification. Each of the species was identified and then separated in plastic container carefully. Morphometric and meristic traits of the collected species were studied in the laboratory of the

Department of Fisheries and Marine Science. Measurements for total length, standard length, height of body, snout length, eye diameter, depth of caudal peduncle etc. were taken for each species. The counts of meristic characters such as number of scales, number of fin rays etc. were also done. The taxonomic guide by Rahman [7] and Freshwater Fishes of Bangladesh and Encyclopedia of Flora and Fauna of Bangladesh were also used for their identification.

2.4 Data Analysis

The data that were collected during the study period, are summarized carefully to assess the biodiversity status. Then, the data was entered in computer. By using Microsoft Excel Version 2019, the final data was processed and analyzed.

3. RESULTS AND DISCUSSION

3.1 Fish Diversity

During the study period, a total of 32 finfish species under 5 orders and 20 families and a total of 5 shellfish species (4 prawn and 1 shrimp) under 1 order and 2 families were identified from the study area. The available fish species and the distribution of collected fish species are shown in Table 1.

Family based no. of fish species that was found in the study area shown in Fig. 2. Among them, 10 species are found on marine environment, others comprise freshwater or brackish water or

both. Marine fish comprises 27 % of total fish available in the study area and freshwater or estuarine fish were 73 % as shown in Fig. 3.

A total of 20 sampling yielded 82 individuals representing 37 species from 22 families. The most abundant fish species in number was *Polynemus* spp in the area. The second, third and fourth most abundant species was *Sillaginopsis panijus*, *Lates calcarifer*, & *Rhinomugil corsula* in the study area. It is clear that *Gonialosa manmina*, *Gudusia chapra*, and *Clupisoma garua* showed less species variability within the year. The national fish of Bangladesh (Hilsha) showed higher abundance during the seasonal period. Opposite trends have been observed in case of *Eutropiichthys vacha* and *Glossogobius giuris*. In the site, *Coilia* spp., *Macrobrachium* spp., *Penaeus* spp., showed the similar results.

According to IUCN 2020 Bangladesh National Categories, there were three (3) critically endangered (CR) species, with twenty-four (24) not threatened (NO), & ten (10) data deficient (DD) spp found during study period as shown in Table 2 and Fig. 4. In Table 3, three (3) critically endangered (CR) species were shown. The biodiversity status of each collected fish species was assigned based on IUCN categorization [8].

Ahmed (1997) observed that seasonal fluctuation in the fish species is a normal phenomenon. Abundance of fish in winter was comparatively higher than the rest of the year as the water level in freshwater bodies decreases in this season.

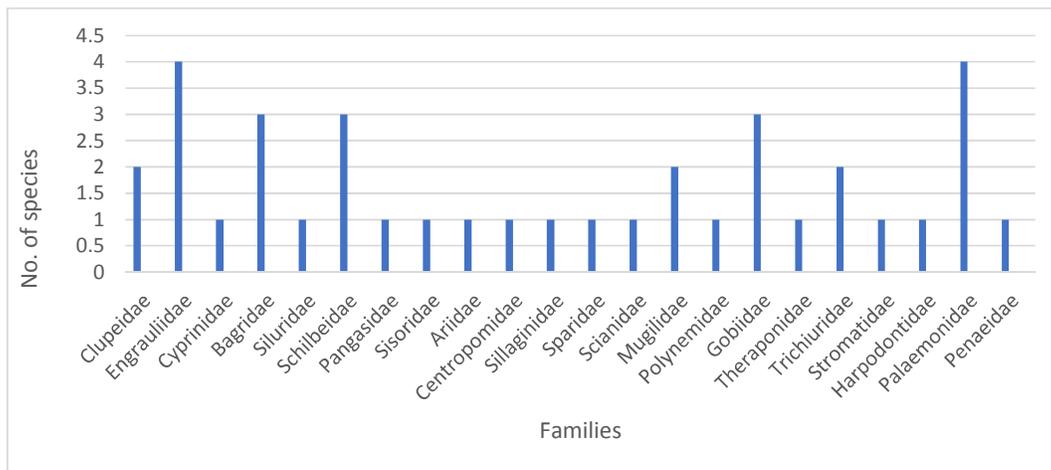


Fig. 2. Family wise species diversity found in the study area

Table 1. The available fish in the chairman ghat fish landing centre found during the study period

Sl. No.	Local Name	English name	Scientific name	Distribution
1	Chapila	Ganges River Gizzard Shad	<i>Gonialosa manmina</i>	Rivers and Estuaries
2	Ilish	River Shad	<i>Tenualosa ilisha</i>	Marine water
3	Olua	Gold spotted Grenadier Anchovy	<i>Coilia dussumieri</i>	Estuaries and the Bay of Bengal
4	Chapila	Indian River Shad	<i>Gudusia chapra</i>	Rivers, ponds, beels
5	Phasa	Gangetic Hairfin Anchovy	<i>Setipinna phasa</i>	Rivers and Estuaries
6	Teli phasa	Scaly Hairfin Anchovy	<i>Setipinna taty</i>	Coastal water, Rivers
7	Rui	Rohu	<i>Labeo rohita</i>	Beels, ponds, rivers and streams
8	Batasi	Tista Batasio	<i>Batasio batasio</i>	Rivers and canals
9	Gang Tengra	Menoda catfish	<i>Hemibagrus menoda</i>	Rivers, tributaries, and ponds
10	Nuna Tengra	Gulio catfish	<i>Mystus gulio</i>	Brackish waters
Sl. No	Local Name	English name	Scientific name	Distribution
11	Boal	Freshwater shark	<i>Wallago attu</i>	Large rivers, beels, lakes, tanks
12	Gagra	Garua Bacha	<i>Clupisoma garua</i>	Large freshwater bodies and tidal rivers
13	Muri Bacha	Murius Bacha	<i>Eutropiichthys murius</i>	Rivers, streams, and canals
14	Bacha	Batchwa Bacha	<i>Eutropiichthys vacha</i>	Fresh and tidal rivers and lakes
15	Pangas	Yellowtail Catfish	<i>Pangasius pangasius</i>	Large rivers and estuaries
16	Ghorakata	Gangetic Gagata	<i>Gagata gagata</i>	Seas, estuaries and tidal rivers
17	Ghagra	Gagora catfish	<i>Arius gagora</i>	Estuaries and the Bay of Bengal
18	Koral	Sea Bass	<i>Lates calcarifer</i>	Rivers and estuaries
19	Tular Dandi	Gangetic Sillago	<i>Sillaginopsis panijus</i>	River mouths and estuaries
20	Datina	Yellow Seabream	<i>Acanthopagrus latus</i>	Rivers and estuaries
21	Poa	Pama	<i>Otolithoides pama</i>	Rivers and estuaries
22	Khalla Bata	Goldspot Mullet	<i>Liza parsia</i>	Shallow coastal waters and estuaries
23	Bata	Corsula Mullet	<i>Rhinomugil corsula</i>	Seas, bays, gulfs and rivers
24	Taposi	Paradise Threadfin	<i>Polynemus paradiseus</i>	Rivers and estuaries
25	Chewa Bele	Goby	<i>Apocryptes bato</i>	Rivers, canals, estuaries and seas
26	Bele	Tank Goby	<i>Glossogobius giuris</i>	Rivers, canals, estuaries, and seas
27	Chiring	Goby	<i>Parapocryptes batoides</i>	Streams, estuaries and lagoons
28	Barguni or gugu	Breanded terapon perch	<i>Terapon jarbua</i>	Rivers and estuaries
29	Loitta	Bombey duck	<i>Harpodon nehereus</i>	Bay of Bengal and estuaries
30	Champa	Indian Mackerel	<i>Rastrelliger kanagurta</i>	Bay of Bengal
31	Maitta	Spanish Mackerel	<i>Scomberomorus guttatus</i>	Bay of Bengal

Sl. No.	Local Name	English name	Scientific name	Distribution
32	Churi	Small head hairtail Ribbon fish	<i>Lepturacanthus savala</i>	Bay of Bengal
33	Golda Icha	Freshwater Prawn	<i>Macrobrachium rosenbergii</i>	Rivers, canals and estuaries
34	Kathalia Icha	Prawn	<i>Macrobrachium villosimanus</i>	Rivers and estuaries
35	Goda Icha	Prawn	<i>Macrobrachium dolichodactylus</i>	Rivers, canals and ponds
36	Lotia Icha	Prawn	<i>Macrobrachium mirabilis</i>	Rivers, canals and ponds
37	Bagda Chingri	Tiger Shrimp	<i>Penaeus monodon</i>	Bay of Bengal and estuaries

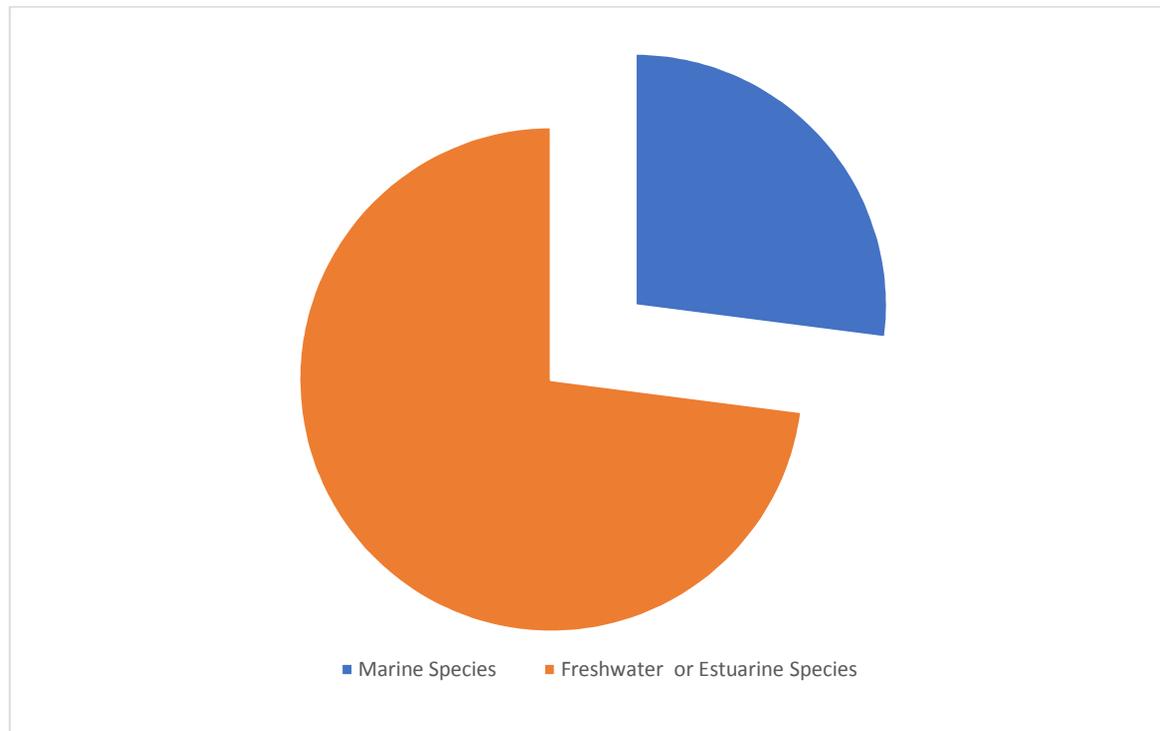


Fig. 3. Comparative shares of freshwater or estuarine and marine fish species found in the study area

Table 2. National biodiversity status of collected species (Red Book, IUCN, [8]). CR: Critically endangered; EN: Endangered; VU: Vulnerable; NO: Not threatened; & DD: Data deficient

Sl. No.	Local Name	Scientific Name	Biodiversity status
1	Chapila	<i>Gonialosa manmina</i>	NO
2	Ilish	<i>Tenualosa ilisha</i>	NO
3	Olua	<i>Coilia dussumieri</i>	NO
4	Chapila	<i>Gudusia chapra</i>	NO
5	Phasa	<i>Setipinna phasa</i>	NO
6	Teli phasa	<i>Setipinna taty</i>	NO
7	Rui	<i>Labeo rohita</i>	NO
8	Batasi	<i>Batasio batasi</i>	NO
9	Gang Tengra	<i>Hemibagrus menoda</i>	NO
10	Nuna Tengra	<i>Mystus gulio</i>	DD
11	Boal	<i>Wallago attu</i>	NO
12	Gagra	<i>Clupisoma garua</i>	CR
13	Muri Bacha	<i>Eutropiichthys murius</i>	NO
14	Bacha	<i>Eutropiichthys vacha</i>	CR
15	Pangas	<i>Pangasius pangasius</i>	CR
Sl. No.	Local Name	Scientific Name	Biodiversity status
16	Ghorakata	<i>Gagata gagata</i>	NO
17	Ghagra	<i>Arius gagora</i>	NO
18	Koral	<i>Lates calcarifer</i>	NO
19	Tular Dandi	<i>Sillaginopsis panijus</i>	NO
20	Datina	<i>Acanthopagrus latus</i>	NO
21	Poa	<i>Otolithoides pama</i>	NO
22	Khalla Bata	<i>Liza parsia</i>	NO
23	Bata	<i>Rhinomugil corsula</i>	NO
24	Taposi	<i>Polynemus paradiseus</i>	NO
25	Chewa Bele	<i>Apocryptes bato</i>	NO
26	Bele	<i>Glossogobius giuris</i>	NO
27	Chirimg	<i>Parapocryptes batoides</i>	NO
28	Barguni or gugu	<i>Terapon jarbua</i>	NO
29	Loitta	<i>Harpodon nehereus</i>	DD
30	Champa	<i>Rastrelliger kanagurta</i>	DD
31	Maitta	<i>Scomberomorus guttatus</i>	DD
32	Churi	<i>Lepturacanthus savala</i>	DD
33	Golda Icha	<i>Macrobrachium rosenbergii</i>	DD
34	Kathalia Icha	<i>Macrobrachium villosimanus</i>	DD

Sl. No.	Local Name	Scientific Name	Biodiversity status
35	Goda Icha	<i>Macrobrachium dolichodactylus</i>	DD
36	Lotia Icha	<i>Macrobrachium mirabilis</i>	DD
37	Bagda Chingri	<i>Penaeus monodon</i>	DD

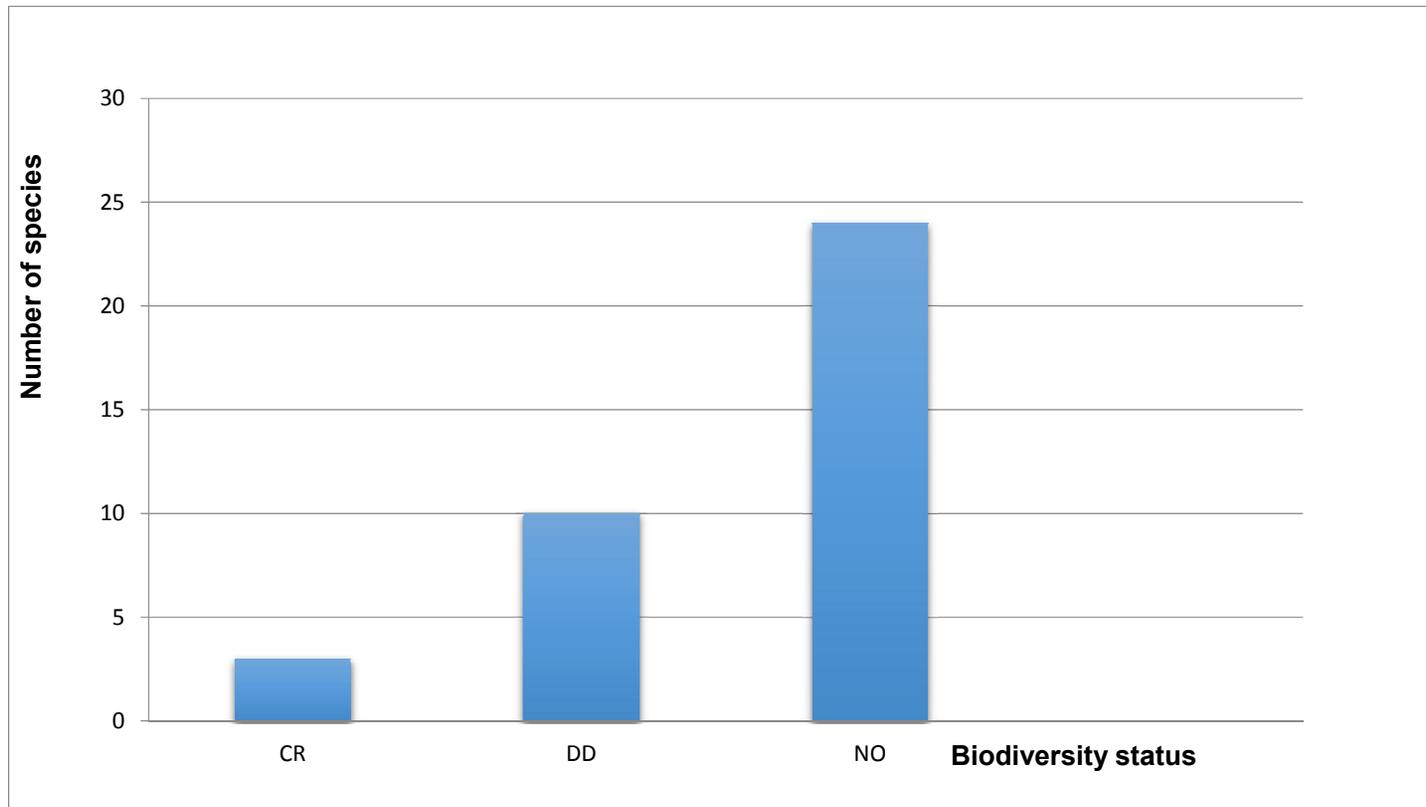


Fig. 4. Biodiversity status of the fish species found in the study area (based on IUCN national categories [8])

It was found that the availability of fishes has been declined due to various reasons. Fish habitat destruction by roads, embankments, drainage & flood control, & natural siltation along with over-fishing, have been commonly cited as causes of the deterioration of the country's resources [9,3].

Table 3. Threatened fish species detected during the study period. CR: Critically Endangered

Sl. No.	Local Name	Scientific Name	Biodiversity status
1	Gagra	<i>Clupisoma garua</i>	CR
2	Bacha	<i>Eutropiichthys vacha</i>	CR
3	Pangas	<i>Pangasius pangasius</i>	CR

The Fish and shellfish species details are presented in Table 4

A study was conducted to investigate the present status of ichthyofauna of the river Halda, Chattogram, Bangladesh. Eighty-three species of finfish belonging to 13 Orders, 35 Families, and 69 genera including three exotic species, and 10 species of shellfish (crustaceans) under one order, 3 families and 3 genera were identified from the River Halda during September 2004 to December 2011. Thus, a total of 93 species of Ichthyofauna (finfish and shellfish) were recorded from this river during the seven years (2004-2011) of investigation [10].

Pandit et al. [11] conducted a study in Dekhar Haor, Sunamgonj to identify fish biodiversity. Among the available species, 9 of carps, 16 of catfishes, 10 of barbs and minnows, 1 of clupeid, 4 of snakeheads, 4 of eels, 11 of perches, 1 of featherback, 3 of loaches and other miscellaneous 6 species including 3 species of prawns were found.

A study was conducted to investigate the present status of fish biodiversity and abundance of fish fauna of an Indo-Bangladesh common river Talma in Northern part of Bangladesh. A total of 56 species of fishes have been recorded belonging to eight orders, 21 families and 37 genera by Rahman et al. [12].

Ullah et al. [13] found that there were 33 species of fishes available in Chairmanghat fish landing centre.

In general, the total number of fish found in the different research is very poor compared to the total number of fish available in the country (264). It was not expected that all 264 species would be found in our survey. But a few numbers of fish species found declares the alarming rate of biodiversity degradation. Due to human intervention and environmental modification, effective breeding and feeding grounds, survival rate of many indigenous fish species has been declining severely. So, appropriate attempts should be taken to prevent the loss of fish biodiversity and thus to meet the protein demand of the people of Bangladesh.

Chairman Ghat Fish Landing Centre although is a big and important landing centre, but number of species that was found in the study period was not impressive. Smaller number and quantity of fish were found in the landing centre because most of the caught fish in and around the area comes to the adjacent landing centre. In general, the total number of fishes found in the study site is very poor compared to the total number of fish available in the country (264). None the less, an area like my study area which is near of Meghna river, have ponds and ditches, found 37 fish only prove the alarming decline of the biodiversity of fish in the surveyed area and in the country as a whole.

If effective conservation measures are not taken at this moment, many of these fishes will be extinct near future. Improvement of fish habitat, strengthening & enforcing fishing law is essential to conserve the valuable fish species of our country. Considering the importance & biodiversity values, quantitative & qualitative study on the availability of fishes & thorough & countrywide habitat study are undeniable. In depth, long term investigation is urgently needed not only for the conservation & rehabilitation but also for creating awareness among the people. This will pave the way for better-protected biodiversity of fishes. Biodiversity is a cross-sector activity where the contribution of each institution is important. Therefore, the Government, NGO's, national & international organizations should come forward to conserve our biodiversity.

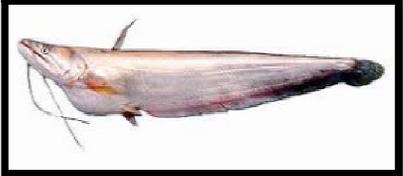
3.2 Marketing Channels of Fish

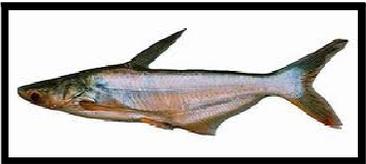
There is no specific marketing channels for fish in the study area. The general pattern of marketing channel is - after buying fish from fish farmer/ fishermen, middlemen (locally known as

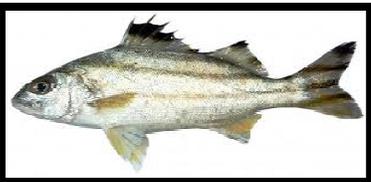
Foria) bring to the wholesale market and sell to the wholesaler. The retailers buy fish from wholesaler through auction with a highest bid. The retailers then bring the fish to particular market where they usually sell the fish to the consumers. Fish farmers/fishermen can sell fish directly to the wholesaler or even to the consumers. The marketing channel of Chairmanghat Fish Landing Centre is shown in Fig. 5.

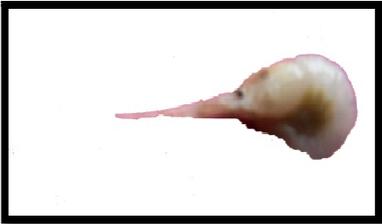
Table 4. The fish and shellfish species details

Family	Fish and shellfish species details	Photograph
Clupeidae	<i>Gonialosa manmina</i> (Hamilton, 1822), Local name: Chapila, English name: Ganges River Gizzard Shad, Total length: 14.1 cm Taxonomic formula: D.3/12-13; P ₁ .14-15; P ₂ .8; A.24-25	 Chapila
	<i>Tenulosa ilisha</i> (Hamilton, 1822), Local name: Ilish, English name: River Shad, Total length: 23 cm, Taxonomic formula: D. 3/14-16; P ₁ . 14-16; P ₂ . 1/7; A. 2-3/16-20; C. 19	 Ilish
Engraulidae	<i>Coilia dussumieri</i> (Valenciennes, 1848), Local name: Olua, English name: Gold spotted Grenadier Anchovy, Total length: 12 cm, Taxonomic formula: D. 1/13-14; P ₁ .6/10-11; P ₂ . 7; A. 95-105	 Olua
	<i>Gudusia chapra</i> (Hamilton, 1822), Local name: Chapila, English name: Indian River Shad, Total length: 10 cm, Taxonomic formula: D. 3/11-12; P ₁ . 1/12; P ₂ . 7; A. 2/21-23	 Chapila
	<i>Setipinna phasa</i> (Hamilton, 1822), Local name: Phasa, English name: Gangetic Hairfin Anchovy, Total length: 20 cm, Taxonomic formula: D. 1+2-3/12- 13; P ₁ .1/12-13; P ₂ . 1/6; A. 64-72	 Phasa
	<i>Setipinna taty</i> (Valenciennes, 1848), Local name: Teli Phasa, English name: Scaly Hairfin Anchovy, Total length: 15.3 cm, Taxonomic formula: D. 1+2/10- 12; P ₁ .1/11-12; P ₂ . 1/6; A. 54-57	 Teli Phasa

Family	Fish and shellfish species details	Photograph
Cyprinidae	<i>Labeo rohita</i> (Hamilton, 1822), Local name: Rui, English name: Rohu, Total length: 20 cm, Taxonomic formula: D. 3/12-13; P ₁ . 1/17; P ₂ 1/8; A. 2/5	
		Rui
Bagridae	<i>Batasio batasio</i> (Hamilton, 1822), Local name: Batasi, English name: Tista Batasio, Total length: 10 cm, Taxonomic formula: D.II/7; P ₁ . I/7-8; P ₂ .1/5; A.3-4/9-10	
		Batasi
	<i>Hemibagrus menoda</i> (Hamilton, 1822), Local name: Gang Tengra, English name: Menoda catfish, Total length: 15 cm, Taxonomic formula: D.II/7; P ₁ . I/7-8; P ₂ . 6; A.11	
		Gang Tengra
	<i>Mystus gulio</i> (Hamilton, 1822), Local name: Nuna Tengra, English name: Gulio catfish, Total length: 10 cm, Taxonomic formula: D.II/7; P ₁ . I/8-9; P ₂ .6; A.12-15	
		Nuna Tengra
Siluridae	<i>Wallago attu</i> (Schneider, 1801), Local name: Boal, English name: Freshwater shark, Total length: 60 cm, Taxonomic formula: D.5; P ₁ . I/13-14; P ₂ .10; A.85-89	
		Boal
Schilbeidae	<i>Clupisoma garua</i> (Hamilton, 1822), Local name: Gagra, English name: Garua Bacha, Total length: 30 cm, Taxonomic formula: D.II/7; P ₁ . I/11; P ₂ .6; A.3/21-50	
		Gagra
	<i>Eutropiichthys murius</i> (Hamilton, 1822), Local name: Muri Bacha, English name: Murius Bacha, Total length: 20 cm, Taxonomic formula: D. I/7; P ₁ . I/13; P ₂ . 6; A. 3/35-37	
		Muri Bacha

Family	Fish and shellfish species details	Photograph
	<i>Eutropiichthys vacha</i> (Hamilton, 1822), Local name: Bacha, English name: Batchwa Bacha, Total length: 20 cm, Taxonomic formula: D.I/7; P1.I/13-14; P2.1/5; A.3-4/46-48	
		Bacha
Pangasiidae	<i>Pangasius pangasius</i> (Hamilton, 1822), Local name: Pangas, English name: Yellowtail Catfish, Total length: 15 cm, Taxonomic formula: D.I/7; P1.I/12; P2.6; A.3-4/26-29	
		Pangas
	<i>Gagata gagata</i> (Hamilton, 1822), Local name: Ghorakata, English name: Gangetic Gagata, Total length: 19.3 cm, Taxonomic formula: D.I/6; P1.I/9; P2.1/5; A.3-4/13	
		Ghorakata
Ariidae	<i>Arius gagora</i> (Hamilton, 1822) Local name: Ghagra, English name: Gagora catfish, Total length: 27 cm, Taxonomic formula: D.I/7; P1.I/10; P2.6; A.5/13	
		Ghagra
Centropomidae	<i>Lates calcarifer</i> (Bloch, 1790), Local name: Korai, English name: Sea Bass, Total length: 20 cm, Taxonomic formula: D.7+I/11-12; P1.16-17; P2.I/6; A.3/ 8-9	
		Korai
Sillaginidae	<i>Sillaginopsis panijus</i> (Hamilton, 1822), Local name: Tular Dandi, English name: Gangetic Sillago, Total length: 27.5 cm, Taxonomic formula: D1.9; D2.I/26-27; P1.23-24; P2.I/5; A.2/ 25-26	
		Tular Dandi
Sparidae	<i>Acanthopagrus latus</i> (Houttuyn, 1782), Local name: Datina, English name: Yellow Seabream, Total length: 30 cm, Taxonomic formula: D.XI/10-11; P1.15; P2.I/5; A.III/8	
		Datina
Sciaenidae	<i>Otolithoides pama</i> (Hamilton, 1822), Local name: Poa, English name: Pama, Total length: 30 cm, Taxonomic formula: D. IX-X+I/40-43; P ₁ . 19; P ₂ . I/5; A. III/ 7	
		Poa

Family	Fish and shellfish species details	Photograph
Mugilidae	<i>Liza parsia</i> (Hamilton, 1822), Local name: Khalla Bata, English name: Goldspot Mullet, Total length: 21.2 cm, Taxonomic formula: D ₁ .IV; D ₂ .I/8; P ₁ .14; P ₂ .I/5; A. III/ 9	
		Khalla Bata
	<i>Rhinomugil corsula</i> (Hamilton, 1822), Local name: Bata. English name: Corsula Mullet, Total length: 22 cm, Taxonomic formula: D ₁ .IV; D ₂ .I/7-8; P ₁ .15-16; P ₂ .I/5; A.III/ 9	
		Bata
Polynemidae	<i>Polynemus paradiseus</i> (Linnaeus, 1758), Local name: Taposi, English name: Paradise Threadfin, Total length: 23 cm, Taxonomic formula: D ₁ .VII; D ₂ .I/15-17; P ₁ .16-17+7; P ₂ .I/5; A.II/ 12	
		Taposi
Gobiidae	<i>Apocryptes bato</i> (Hamilton, 1822), Local name: Chewa Bele, English name: Goby, Total length: 15.4 cm, Taxonomic formula: D ₁ .V; D ₂ . I/21-23; P ₁ .22-23; A.I/ 21-24; C.23	
		Chewa Bele
	<i>Glossogobius giuris</i> (Hamilton, 1822), Local name: Bele, English name: Tank Goby, Total length: 19.2 cm, Taxonomic formula: D ₁ .VI; D ₂ . I/9; P ₁ .17-18; A.I/ 9	
		Bele
	<i>Parapocryptes batoides</i> (Day, 1876), Local name: Chiring, English name: Goby, Total length: 16 cm, Taxonomic formula: D ₁ .VI; D ₂ .I/22; P ₁ .21-22; A.I/22-23; C.15	
		Chiring
Teraponidae	<i>Terapon jarbua</i> (Forsk.) (Forsk.), Local name: Barguni or Gugu, English name: Breanded terapon perch, Total length: 100 mm, Taxonomic formula: D.X-XII/9-10; P ₁ .13; P ₂ .I/5; A.III/8-9	
		Barguni

Family	Fish and shellfish species details	Photograph
Trichiuridae	<i>Rastrelliger kanagurata</i> (Cuvier, 1816), Local name: Champa, English name: Indian Mackerel, Total length: 15 cm, Taxonomic formula: D.VII-VIII/11+V; P ₁ .19; P ₂ .I/5; A.X/12+V; C.24	
		Champa
	<i>Lepturacanthus savala</i> (Cuvier, 1829), Local name: Churi, English name: Small head hairtail Ribbon fish, Total length: 100 cm, Taxonomic formula: D.120; P.11	
		Churi
Stromatidae	<i>Scomberomorus guttatus</i> (Bloch & Schneider, 1801), Local name: Maitta, English name: Spanish Mackerel, Total length: 82 cm, Taxonomic formula: D. XV-XVII/16+VII-IX; P ₁ .21; P ₂ .I/5; A.IV/17+IX; C.26	
		Maitta
Harpodontidae	<i>Harpodon nehereus</i> (Hamilton- Buchanan, 1822), Local name: Loitta, English name: Bombay duck, Total length: 245 mm, Taxonomic formula: D.12-13; P ₁ .11-12; P ₂ .9; A.II(12-13)	
		Loitta
Palaemonidae	<i>Macrobrachium rosenbergii</i> (De Man, 1879), Local name: Golda icha, English name: Freshwater Prawn, Total length: 266.5-340 mm, Rostrul formula: 13- 15/12-13	
		Golda icha
	<i>Macrobrachium villosimanus</i> (Tiwari, 1947), Local name: Kathalia icha, English name: Prawn, Total length: 116-132 mm, Rostrul formula: 12-13/8- 9	
		Kathalia icha

Family	Fish and shellfish species details	Photograph
	<i>Macrobrachium dolichodactylus</i> (Hilgendorf, 1878), Local name: Goda icha, English name: Prawn, Total length: 62-70 mm, Rostral formula: 13-14/2	
	<i>Macrobrachium mirabilis</i> (Kemp, 1917), Local name: Lotia icha, English name: Prawn, Total length: 81-86 mm, Rostral formula: 12-16/1-2	
Penaeidae	<i>Penaeus monodon</i> (Fabricius, 1798), Local name: Bagda Chingri, English name: Tiger Shrimp, Total length: 210-228 mm, Rostral formula: 7-9/2-4	

Fishes were more or less available round the year. But all the species were not available in all seasons

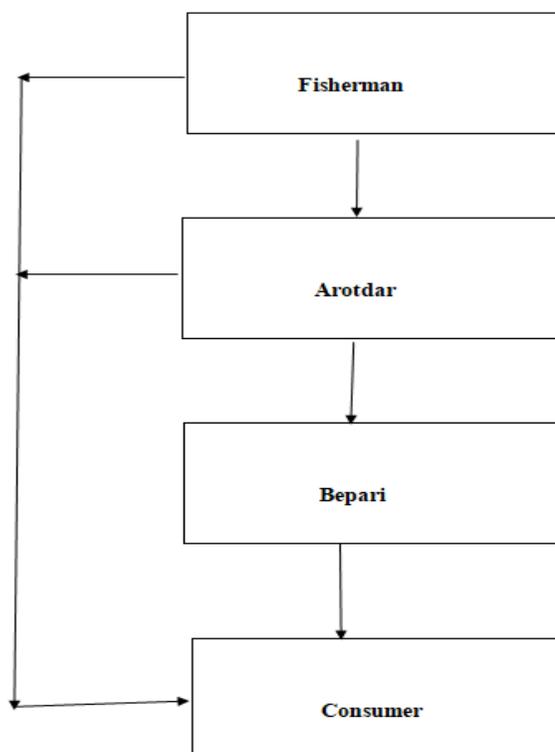


Fig. 5. Marketing channel of chairmanghat fish landing center

By the analysis of livelihood strategy of fishermen in the fish landing centre, it was found that socio-economic constraints such as low income, poor educational background, low economic status, absence of own net & boat, and lack of capital are the main problems for them. Most of them proposed that arrangement should be made by government so that the producers can get reasonable and stable price throughout the year.

4. CONCLUSION

During the study period, a total of 32 finfish species under 5 orders and 20 families and a total of 5 shellfish species (4 prawn and 1 shrimp) under 1 order and 2 families were identified from the study area.

Among them, 10 species are found on marine environment, others comprise freshwater or brackish water or both. Marine fish comprises 27 % of total fish available in the study area and freshwater or estuarine fish were 73 %. Common habitat of these fishes are rivers, canals, estuaries and Bay of Bengal. All fish species are not available at all seasons. This non-availability of fishes indicates alarming rate of declaration of species. This decline is mainly due to over fishing, siltation in the rivers and the indiscriminate use of agrochemicals, introduce of exotic species causing serious damage either directly or indirectly to the fish population in terms of fish mortality, fish diseases and decreased fecundity.

There is no specific marketing channel for fish in the study area. The length and component of marketing channel varied from season to season and from one place to another. The general pattern, however, is-after buying fish from fish farmer/fishermen, middlemen (locally known as aratdar) bring to market and sell to the retailers (known as beparies). The retailers buy fish from wholesaler through auction with a higher bid. The retailers then bring the fish to particular market where the usually sell the fish to consumer.

There is no survey of fish biodiversity in Bangladesh occur after 2000 by IUCN Red List. No government & NGO's carried out any attempt to know the present fish biodiversity status of Bangladesh. If now a survey carried out, it will see that the availability of our indigenous fish species has declined to a great extent over the years and many of them are either rare or at the verge of extinction. So, a research on fish

biodiversity is urgently needed for Noakhali district as well as whole country. Because my study area reflects the actual scene of declining fish biodiversity of Bangladesh.

This situation gives clear information about the diversity of fish and shellfish, and marketing channels of fish landing centre among fishery biologists, ecologists and politicians. This information would create awareness among the researchers, policy makers and fisherman for the better conservation of aquatic biodiversity and the need to protect valuable fish genetic resources in this country. In this regard, it is now crucial time to initiate a team approach to research among the scientists of research institutes and universities concerned on the breeding and culture of threatened small indigenous species of fish to ensure their conservation and rehabilitation.

The alarming rate of declining fish biodiversity of the site reflects a need to study biodiversity of fishes as well as other flora & fauna in Bangladesh; because as a result of this, we will know about the present status of fish biodiversity of Bangladesh. And this will enable us to compare & make study of our valuable resources before extinction.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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