Original Research Article

MONITORING OF FISH AND SHELLFISH BIODIVERSITY AND

MARKETING CHANNELS IN FISH LANDING CENTRE, NOAKHALI,

BANGLADESH.

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 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 arotdar, 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.

Key words: Fish, 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 (DoF, 2019). According to the World Bank (1991), Bangladesh has the water resources (rivers, floodplains, ponds, beels, haors and a long coastline) 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 (DoF, 2019).

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' (Ali 1997). 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 (Islam, 1989). According to Rahman (1989), 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 264 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 (2000) 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, (1993) 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 present investigation was carried out to know the ichthyofauna (finfish and shellfish species) and their status (endangered, critically endangered, vulnerable) in the Chairman Ghat Fish Landing Centre, Noakhali and the findings might be useful for the researchers, planners and biologists.

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 characteristics) 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 & 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 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.



Figure 1: Geographical location of the study area.

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 characters 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 (2005) 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.

Table 1. The available fish in the Chairman Ghat Fish Landing Centre found during the study period.

SI.	Local	English name	Scientific name	Distribution
No.	Name			
1	Chapila	Ganges River	Gonialosa manmina	Rivers and
		Gizzard Shad		Estuaries
2	llish	River Shad	Tenualosa ilisha	Marine water
3	Olua	Gold spotted	Coilia dussumieri	Estuaries and the
		Grenadier Anchovy		Bay of Bengal
4	Chapila	Indian River Shad	Gudusia chapra	Rivers, ponds,
				beels
5	Phasa	Gangetic Hairfin	Setipinna phasa	Rivers and
		Anchovy		Estuaries
6	Teli phasa	Scaly Hairfin	Setipinna taty	Coastal water,
	Y	Anchovy		Rivers
7	Rui	Rohu	Labeo rohita	Beels, ponds,
				rivers and streams
8	Batasi	Tista Batasio	Batasio batasio	Rivers and canals
9	Gang	Menoda catfish	Hemibagrus menoda	Rivers, tributaries,
	Tengra			and ponds
10	Nuna	Gulio catfish	Mystus gulio	Brackish waters
	Tengra			

SI.	Local	English name	Scientific name	Distribution
No	Name			
	D!		Wallago attu	Large rivers,
11	Boal	Freshwater shark	J. J	beels, lakes, tanks
12	Gagra	Garua Bacha	Clupisoma garua	Large freshwater
			, 3	bodies and tidal
				rivers
13	Muri Bacha	Murius Bacha	Futropiichthys murius	Rivers streams
			Lad opnoning o manao	and canals
14	Bacha	Batchwa Bacha	Eutropiichthys vacha	Fresh and tidal
				rivers and lakes
15	Pangas	Yellowtail Catfish	Pangasius pangasius	Large rivers and
				estuaries
16	Ghorakata	Gangetic Gagata	Gagata gagata	Seas, estuaries
				and tidal rivers
17	Ghagra	Gagora catfish	Arius gagora	Estuaries and the
				Bay of Bengal
18	Koral	Sea Bass	Lates calcarifer	Rivers and
				estuaries
19	Tular Dandi	Gangetic Sillago	Sillaginopsis panijus	River mouths and
				estuaries
20	Datina	Yellow Seabream	Acanthopagrus latus	Rivers and
				estuaries
21	Poa	Pama	Otolithoides pama	Rivers and
				estuaries
22	Khalla Bata	Goldspot Mullet	Liza parsia	Shallow coastal
	\searrow			waters and
				estuaries
23	Bata	Corsula Mullet	Rhinomugil corsula	Seas, bays, gulfs
				and rivers
24	Taposi	Paradise Threadfin	Polynemus paradiseus	Rivers and
				estuaries
25	Chewa Bele	Goby	Apocryptes bato	Rivers, canals,
				estuaries and seas

26	Bele	Tank Goby	Glossogobius giuris	Rivers, canals,
				estuaries, and
				seas
27	Chiring	Goby	Parapocryptes batoides	Streams, estuaries
				and lagoons
28	Barguni or	Breanded terapon	Terapon jarbua	Rivers and
	gugu	perch		estuaries
29	Loitta	Bombey duck	Harpodon nehereus	Bay of Bengal and
				estuaries
30	Champa	Indian Mackerel	Rastrelliger kanagurta	Bay of Bengal
31	Maitta	Spanish Mackerel	Scomberomorus	Bay of Bengal
			guttatus	
32	Churi	Small head hairtail	Lepturacanthus savala	Bay of Bengal
		Ribbon fish		
33	Golda Icha	Freshwater Prawn	Macrobrachium	Rivers, canals and
			rosenbergii	estuaries
34	Kathalia	Prawn	Macrobrachium	Rivers and
	Icha		villosimanus	estuaries
			\mathbf{S}	

35	Goda Icha	Prawn	Macrobrachium	Rivers, canals and
			dolichodactylus	ponds
36	Lotia Icha	Prawn	Macrobrachium mirabilis	Rivers, canals and
	A			ponds
37	Bagda	Tiger Shrimp	Penaeus monodon	Bay of Bengal and
	Chingri			estuaries

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.



Figure 2: Family wise species diversity found in the study area.



Figure 3: Comparative shares of Freshwater or Estuarine and Marine fish species found in the study area.

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 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 (2000).

Table 2. National biodiversity status of collected species (Red Book, IUCN, 2000). CR:Critically endangered; EN: Endangered; VU: Vulnerable; NO: Not threatened; & DD: Datadeficient.

SI. No.	Local Name	Scientific Name	Biodiversity status
		A Y	
1	Chapila	Gonialosa manmina	NO
2	llish	Tenualosa ilisha	NO
3	Olua	Coilia dussumieri	NO
4	Chapila	Gudusia chapra	NO
5	Phasa	Setipinna phasa	NO
6	Teli phasa	Setipinna taty	NO
7	Rui	Labeo rohita	NO
8	Batasi	Batasio batasi	NO
9	Gang Tengra	Hemibagrus menoda	NO
10	Nuna Tengra	Mystus gulio	DD
11	Boal	Wallago attu	NO
12	Gagra	Clupisoma garua	CR
13	Muri Bacha	Eutropiichthys murius	NO
14	Bacha	Eutropiichthys vacha	CR
15	Pangas	Pangasius pangasius	CR
SI. No.	Local Name	Scientific Name	Biodiversity status
16	Ghorakata	Gagata gagata	NO

17	Ghagra	Arius gagora	NO
18	Koral	Lates calcarifer	NO
19	Tular Dandi	Sillaginopsis panijus	NO
20	Datina	Acanthopagrus latus	NO
21	Poa	Otolithoides pama	NO
22	Khalla Bata	Liza parsia	NO
23	Bata	Rhinomugil corsula	NO
24	Taposi	Polynemus paradiseus	NO
25	Chewa Bele	Apocryptes bato	NO
26	Bele	Glossogobius giuris	NO
27	Chirimg	Parapocryptes batoides	NO
28	Barguni or gugu	Terapon jarbua	NO
29	Loitta	Harpodon nehereus	DD
30	Champa	Rastrelliger kanagurta	DD
31	Maitta	Scomberomorus guttatus	DD
32	Churi	Lepturacanthus savala	DD
33	Golda Icha	Macrobrachium rosenbergii	DD
34	Kathalia Icha	Macrobrachium villosimanus	DD
35	Goda Icha	Macrobrachium dolichodactylus	DD
36	Lotia Icha	Macrobrachium mirabilis	DD
37	Bagda Chingri	Penaeus monodon	DD



Figure 4: Biodiversity status of the fish species found in the study area (Based on IUCN National Categories 2000).

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

 Endangered

SI. No.	Local Name	Scientific Name	Biodiversity status
1	Gagra	Clupisoma garua	CR
2	Bacha	Eutropiichthys vacha	CR
3	Pangas	Pangasius pangasius	CR

The Fish and shellfish species details are presented in table 4.

Table 4: The Fish and shellfish species details

Family	Fish and shellfish species	Photograph
	details	

Clupeidae	Gonialosa manmina	
	(Hamilton, 1822), Local	
	name: Chapila, English	
	name: Ganges River Gizzard	Chapila
	Shad, Total length: 14.1 cm	Unaplia
	Taxonomic formula: D.3/12-	~
	13; P ₁ .14-15; P ₂ .8; A. 24-25	
	Tenualosa ilisha	
	(Hamilton,1822), Local	Const Villen
	name: Ilish, English name:	
	River Shad, Total length: 23	Ilish
	cm, Taxonomic formula: D.	
	3/14-16; P _{1.} 14-16; P _{2.} 1/7; A .	
	2-3/16-20; C. 19	
Engrauliidae	Coilia dussumieri	
	(Valenciennes, 1848), Local	
	name: Olua, English name:	
	Gold spotted Grenadier	
	Anchovy, Total length: 12	Olua
	cm, Taxonomic formula: D.	
	1/13-14; P ₁ .6/10-11; P ₂ . 7; A .	
$\langle \rangle^{\gamma}$	95-105	
	Gudusia chapra (Hamilton,	
	1822), Local name: Chapila,	
	English name: Indian River	
	Shad, Total length: 10 cm,	
	Taxonomic formula: D. 3/11-	Chapila

	12. D . 1/12. D . 7. A 2/21-23	
	12, F1, 1/12, 12, 1, F, L/L = 20	
	Setipinna phasa (Hamilton,	
	1822), Local name: Phasa,	
	English name: Gangetic	A C
	Hairfin Anchovy, Total	
	length: 20 cm, Taxonomic	Phasa
	formula: D. I+2-3/12-13;	
	P ₁ .1/12-13; P ₂ . 1/6; A . 64-72	
	Setipinna taty (Valenciennes,	
	1848), Local name : Teli	- Reaching
	Phasa, English name: Scaly	
	Hairfin Anchovy, Total	
	length: 15.3 cm, Taxonomic	Teli
	formula: D. I+2/10-12;	Phasa
	P _{1.} 1/11-12; P _{2.} 1/6; A . 54-57	
Cyprinidae	Labeo rohita (Hamilton,	
	1822), Local name: Rui,	
	English name: Rohu, Total	No.
	length: 20 cm, Taxonomic	
	formula: D. 3/12-13; P ₁ . 1/17;	Rui
	P _{2.} 1/8; A . 2/5	
Bagridae	Batasio batasio (Hamilton,	
	1822), Local name : Batasi,	A
	English name: Tista Batasio,	Carles C
	Total length: 10 cm,	
	Taxonomic formula: D.II/7;	Batasi
	P ₁ . I /7-8; P ₂ .1/5; A .3-4/9-10	

	Hemibagrus menoda	
	(Hamilton, 1822), Local	
	name: Gang Tengra, English	16 - Contraction of the second
	name: Menoda catfish, Total	Cons Tonoro
	length: 15 cm, Taxonomic	Gang Tengra
	formula: D.I/7; P ₁ . I/7-8; P ₂ . 6;	~
	A. 11	
	<i>Mystus gulio</i> (Hamilton,	
	1822), Local name: Nuna	
	Tengra, English name: Gulio	the second second
	catfish, Total length: 10 cm,	
	Taxonomic formula: D.I/7;	Nuna Tengra
	P ₁ , I /8-9; P ₂ .6; A .12-15	
Siluridae	Wallago attu (Schneider,	
	1801), Local name: Boal,	
	English name: Freshwater	Cr.
	shark, Total length: 60 cm,	
	Taxonomic formula: D.5; P ₁ .	Boal
	l/13-14; P₂. 10; A .85-89	
Schilbeidae	Clupisoma garua (Hamilton,	
	1822), Local name: Gagra,	- Anno - A
	English name: Garua Bacha,	
	Total length: 30 cm,	
	Taxonomic formula: D.I/7;	Gagra
	P1. I/11; P2 .6 ; A. 3/21-50	

	Eutropiichthys murius	
	(Hamilton, 1822), Local	- Alexandre
	name: Muri Bacha, English	Service State
	name: Murius Bacha, Total	Muri Bacha
	length: 20 cm, Taxonomic	
	formula: D. I/7; P1. I/13; P2.	4
	6; A . 3/35-37	
	Eutropiichthys vacha	
	(Hamilton, 1822), Local	San and a state
	name: Bacha, English name:	and the second s
	Batchwa Bacha, Total	
	length: 20 cm, Taxonomic	Bacha
	formula: D.I/7; P1.I/13-14;	Dacha
	P2. 1/5; A. 3-4/46-48	
Pangasiidae	Pangasius pangasius	
	(Hamilton, 1822), Local	Pangas
	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	
	Gagata gagata (Hamilton,	
	1822), Local name:	A
	Ghorakata, English name:	and the second s
	Gangetic Gagata, Total	Ghorakata
	length: 19.3 cm, Taxonomic	
	formula: D.I/6; P1.I/9; P2.1/5;	

	A. 3-4/13	
Ariidae	Arius gagora (Hamilton,	
	1822) Local name: Ghagra,	4
	English name: Gagora	STATISTICS .
	catfish, Total length: 27 cm,	
	Taxonomic formula: D.I/7;	Ghagra
	P1.I /10; P2. 6; A .5/13	
Centropomidae	Lates calcarifer (Bloch, 1790),	
	Local name: Koral, English	
	name: Sea Bass, Total	
	length: 20 cm, Taxonomic	
	formula: D.7+I/11-12; P1.16-	Koral
	17; P2 .I/6; A. 3/ 8-9	
Sillaginidae	Sillaginopsis panijus	
	(Hamilton, 1822), Local	- A Contraction
	name: Tular Dandi, English	
	name: Gangetic Sillago, Total	Tular Dandi
	length: 27.5 cm, Taxonomic	
	formula: D1.9; D2.1/26-27;	
	P1. 23-24; P2 .I/5; A. 2/ 25-26	
Sparidae	Acanthopagrus latus	
	(Houttuyn, 1782), Local	Ville
	name: Datina, English	AL
	name: Yellow Seabream,	
	Total length: 30 cm,	Datina
	Taxonomic formula:	Datina

	D. XI/10-11; P1 .15; P2 .I/5;	
	A. III/8	
Sciaenidae	Otolithoides pama (Hamilton,	
	1822), Local name: Poa,	and the state of the
	English name: Pama, Total	and the second s
	length: 30 cm, Taxonomic	
	formula: D. IX-X+I/40-43; P ₁ .	Poa
	19; P₂. I/5; A . II/ 7	
Mugilidae	Liza parsia (Hamilton, 1822),	
	Local name: Khalla Bata,	- the second second
	English name: Goldspot	
	Mullet, Total length: 21.2 cm,	
	Taxonomic formula: D1.IV;	Khalla Bata
	D2 .I/8; P1 .14; P2 .I/5; A. III/ 9	
	Rhinomugil corsula (Hamilton,	
	1822), Local name: Bata.	
	English name: Corsula	Dec. 20
	Mullet, Total length: 22 cm,	
	Taxonomic formula: D ₁ .IV;	Bata
	D ₂ . I /7-8; P ₁ .15-16; P ₂ . I /5; A . II /	
$\mathbf{N}_{\mathbf{x}}$	9	
Polynemidae	Polynemus paradiseus	
	(Linnaeus, 1758), Local	
	name: Taposi, English	
	name: Paradise Threadfin,	Tapasi
	Total length: 23 cm,	ιαμυδί

	Taxonomic formula: D1.VII;	
	D2 .I/15-17; P1. 16-17+7;	
	P2. I/5; A. II/ 12	
Gobiidae	Apocryptes bato (Hamilton,	
	1822), Local name: Chewa	A - Company
	Bele, English name: Goby,	Contraction of the second seco
	Total length: 15.4 cm,	
	Taxonomic formula: $D_1.V$;	Chewa Bele
	D ₂ . I/21-23; P ₁ .22-23; A .I/ 21-	
	24; C. 23	
	Glossogobius giuris	
	(Hamilton, 1822), Local	
	name: Bele, English name:	Carlos De Carlos
	Tank Goby, Total length:	A BERLEY AND AND AND
	19.2 cm, Taxonomic	Bele
	formula: D _{1.} VI; D ₂ . I/9; P ₁ .17-	
	18; A. I/ 9	
	Parapocryptes batoides	and a second
	(Day,1876), Local name:	1944 10012
	Chiring, English name:	
\sim	Goby, Total length: 16 cm,	
	Taxonomic formula: D_1 .VI;	Chiring
	D _{2.} I /22; P ₁ .21-22; A . I /22-23;	
	C .15	
Teraponidae	Terapon jarbua (Forskal),	
	Local name: Barguni or	

	Guau English name:	
	Ougu,Englishname:Breandedteraponperch,Totallength:100mm,Taxonomicformula:D.X-XII/9-10:P4 13:P21/5:A.III/8-9	Barguni
Trichiuridae	Rastrelliger kanagurata	
	(Cuvier, 1816), Local name:	
	Champa, English name :	
	Indian Mackerel, Total	
	length: 15 cm, Taxonomic	Champa
	formula: D.VII-VIII/11+V;	
	P _{1.} 19; P ₂ I/5; A. X/12+V; C. 24	
	Lepturacanthus savala	
	(Cuvier, 1829), Local name:	
	Churi, English name: Small	
	head hairtail Ribbon fish,	Y 4
	Total length: 100 cm,	Churi
	Taxonomic formula: D.120;	
	P.11	
Stromatidae	Scomberomorus guttatus	Maitta
	(Bloch & Schneider, 1801),	and the
	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	
Harpodontidae	Harpodon nehereus	
Tarpodontidae	(Lapiltan Duchanan (1990)	
	(Hamilton-Buchanan, 1822),	
	Local name: Loitta, English	3 months
	name: Bombay duck, Total	
	length: 245 mm, Taxonomic	Loitta
	formula: D .12-13; P _{1.} 11-12;	
	P ₂ .9; A. II(12-13)	
Palaemonidae	Macrobrachium rosenbergii	
	(De Man, 1879), Local name:	the second
	Golda icha, English name:	
	Freshwater Prawn, Total	Colda isha
	length: 266.5-340 mm,	Golda Icha
	Rostrul formula: 13-15/12-13	
	Macrobrachium villosimanus	
	(Tiwari, 1947), Local name:	
	Kathalia icha, English name:	
	Prawn, Total length: 116-132	
	mm, Rostrul formula: 12-	Kathalia icha
	13/8-9	
	Macrobrachium	
	deliebedeetulue (Hilgenderf	1.
	1878), Local name: Goda	
	icha, English name: Prawn,	
	Total length: 62-70 mm,	Goda icha
	Rostral formula: 13-14/2	

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	Macrobrachium mirabilis	
	(Kemp, 1917), Local name:	
	Lotia icha, English name:	- ALCONTRACT
	Prawn, Total length: 81-86	
	mm, Rostral formula: 12-	Lotia icha
	16/1-2	4
Penaeidae	Penaeus monodon (Fabricius,	
	1798), Local name: Bagda	Talle
	Chingri, English name: Tiger	
	Shrimp, Total length: 210-228	
	mm, Rostral formula: 7-9/2-4	Bagda Chingri

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

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.

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 (Hughes *et al*, 1994; Ali, 1997).

Pandit *et al.*, (2015) 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.*, (2015).

Ullah *et al.*, (2016) 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.

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. Strengthening law-enforcing agencies in the area is suggested by many of the aratdar as well. Among the several other points suggested by them notables are construction of cold storage, preservation facility for fish at the site, improvement of road and communication, facility of electricity, improvement of physical facilities and reduction of market chain. It is essential to improve socio-economic condition of them such as financial supports as well as increase of credit facilities, raising of their standard of living, health and sanitation condition, housing condition, children education, drinking water facilities etc. Without concrete and significant changes in the process of accessing fisheries resources for fishermen, ensuring their tenure and financial, technological and marketing support, little positive change can be expected in the living condition of fishing



Figure 5: Marketing Channel of Chairmanghat Fish Landing Center

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.

REFERENCES

Ahashan MRU. A study of fish biodiversity & marketing system in chalan beel, MS Thesis, Department of Fisheries Biology & Genetics, Bangladesh Agricultural University. Mymensingh. 2008.

Ahmad N. Fish Fauna of East Pakistan. Pakistan J. Sci.1953;5(1):18-24.

- Ahmed KU. Plant, animal, bird and fish wealth (in Bengali). Sharbajanin Granthelaya, New Market, Dhaka;1984;660.
- Ahmad N. Marketing of fish from selected floodplains in Bangladesh. In: Open water Fisheries of Bangladesh. The University Press Limited, Dhaka -1000;1997;72.

Ali MY. Fish, water and people. University Press Ltd., Dhaka;1997.

- Ali MY, Salim GM, Mannan MA, Rahman MM, Sabbir W, Murshida A. Fish species availability observed in the fish landing centers of Khulna district in Bangladesh. J. Biol. Sci., 2004;4 (5): 575-580.
- Bhuiya MSH. Survey on fisheries in Itna Upazilla Kishoreganj and their management practices. An
 M.S. thesis, submitted to the Department of Fisheries Management, Bangladesh Agricultural
 University, Mymensingh. 2002;40-50.
- Biswas PK. Fish Marketing in Some Selected Areas of Netrokona District. MS Thesis, Department of Co-operative and Marketing, Bangladesh Agricultural University, Mymensingh. 1990;52.
- Biswas H. Dried Marine fish marketing in greater Chittagong district. MS Thesis, Department of Cooperative and Marketing, Bangladesh Agricultural University, Bangladesh. 2001;119.
- Chowdhury JAR. Transportation and Marketing system of native and exotic major carps of Rajshahi district. M. Sc Thesis, Department of Zoology. University of Rajshahi, Rajshahi. 1996;1-33.

- DoF (Department of Fisheries). Fish Fortnight Compendium, Department of Fisheries, Ministry of Fisheries and Livestock, Government of People's Republic of Bangladesh, Dhaka, Bangladesh. 2019;148.
- FAO. Fishery Credit and Marketing Development. A Workshop Organized by FAO Regional Office for Asia and the Pacific, Bangkok, Thailand, November 1989;13-17.
- Gupta SD. Status of Fish Marketing in Fulpur Upazila, Mymensingh. M.S Thesis. Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh. 2004;63.
- Groombridge B. Global Biodiversity Status of the Earth's Living Resources. Chapman and Hall, London. 1992.
- Halder GC, Mazid MA, Haque MKI, Huda MS, Ahmed KK. A review on the fisheries fauna of the Kaptai Reservoir. Bangladesh J. Fish.1991;14:127-135.
- Harrison IJ, Stiassny MJ. "The Quiet Crisis: A Preliminary Listing of the Freshwater Fishes of the World that are Extinct or Missing in Action." in R.D.E. MacPhee, (ed.), *Extinctions in Near Time*. New York, U.S.A.: Kluwer Academic/Plenum Publishers.1999;271-331
- Hossain MS, Ehshan MA, Mazid MA. Fish Biodiversity Study of Three Floodplains in Bangladesh. *In:* Middendor, H.A.J., Thompson, P.M. and Pomeroy, R.S. (eds.). Sustainable Inland Fisheries
 Management in Bangladesh, ICLARM Conf. Proc. 1999;58:229-233.
- Hughes R, Adnan S, Dalal-Clayton B. Floodplains or flood plans? International Institute for Environment and Development, and Research and Advisory Services, London. 1994.
- Islam MS. Fish seed production in Bangladesh. *In*: Proceeding of the SARRC, Workshop on fish seed production. FRI. Mymensingh. 1989;1-2.
- Islam MS, Mazid MA, Shah MS, Quddus MA. Length-weight relationship and condition factor of black carp (Mylopharyngodon species, Richardson) in Bangladesh. Bangladesh J. Fish. Res.1999;3 (1): 103-106.
- IUCN Bangladesh. Red Book of Threatened Fishes of Bangladesh. Islam MA, Ameen M, Nishat A. (Eds.). The World Conservation Union, Dhaka, Bangladesh. 2000.
- Jayaram KC. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Srilanka. Zoological Survey of India, Calcutta: XXII. 1981;473.

- Jhingran AG, Talwar PK. Inland Fisheries of India and Adjacent Countries. Vol. I. Oxford and IBH Publishing Co. PVT. LTD. Calcatta. 1991;541.
- Kabir MR. A study of present biodiversity status of freshwater loaches of Bangladesh. MS Thesis, Department of Fisheries Biology & Genetics, Bangladesh Agricultural University, Mymensingh, 2007;81.
- Mazid MA, Hossain MS. Development of fisheries resources in floodplains. FRI Publication No.12. Fisheries Research Institute, Mymensingh, Bangladesh (In Bangla). 1995;16.
- Mia MGF. A study of production and marketing of culture fishes by the selected pond owners in Mymensingh District. MS Thesis, Department of Co-operative and Marketing, Bangladesh Agricultural University, Mymensingh, 1996;119.
- Moyle PB, Leidy RA. "Loss of biodiversity in aquatic ecosystems: evidence from fish faunas." *In*: Fiedler, P.L. and Jain, S.K. (Eds.). Conservation biology: the theory and practice of nature conservation, preservation, and management.New York, NY: Chapman and Hall. 1992;127-169.
- Moyle PB, Williams JE. Biodiversity loss in the temperate zone: decline of the native fish fauna of California. Conserv. *Biol.*, 1990;4(3): 275-284.
- Nuruzzaman AKA. Cluster of ideas and action for fisheries development in Bangladesh. Published by Fish Publishers, Dhaka, Bangladesh, 1993;261.
- Nuruzzaman AKM. Inland fisheries resources of Bangladesh: its management and development strategies. Paper presented at the seminar on Fisheries Resources of Bangladesh at the Department of Zoology, University of Dhaka. 1997;30.
- Pandit D, Kunda M, Rashid A, Sufian M, Mazumder S. Present Status of Fish Biodiversity in Dekhar Haor, Bangladesh: a Case Study. World Journal of Fish and Marine Sciences., 2015;7 (4): 278-287.
- Panikkar KKP, Sathiadhas R. Marine fish marketing trend in Kerala. J. Mar Viol. Assoc. India. 1989; 31(1-2): 239-246.

Rahman AKA. Freshwater fishes of Bangladesh. Zoological Society of Bangladesh, Dhaka. 1989;342.

- Rahman AKA. Fish marketing in Bangladesh: status and issues. *In*: Open Water Fisheries of Bangladesh, the University Press Limited, Dhaka-1000. 1997;99-114.
- Rahman AKA. Freshwater fishes of Bangladesh. 2nd ed., Zoological Society of Bangladesh, Dhaka. 2005;86-87.
- Rahman MA, Mondal MN, Hannan MA, Habib KA. Present Status of Fish Biodiversity in Talma River at Northern Part of Bangladesh. International Journal of Fisheries and Aquatic Studies. 2015; 3(1): 341-348.
- Rahman MM. Status of Fish Marketing in Gazipur, Bangladesh. M.S. Thesis, Department of Fisheries Management, BAU, Mymensingh. 2003.
- Rokeya JA, Ahmead SS, Bhuiyan AS, Alam MS. Marketing system of native and exotic major carps of Rajshahi District. Bangladesh J. Fish., 1997;20 (1-2): 99-103.
- Shafi M, Quddus MMA. Bangladesh Mathsya Shampad (Fisheries of Bangladesh). (In Bengali). Bangla Academy, Dhaka. 1982;444.
- Shafi M, Quddus MMA. Bangopasagarer Mathsya Shampad (Fisheries of Bangladesh). (In Bengali). Bangla Academy, Dhaka. 2005;374-383.
- Siddiqu KU, Islam MA, Kabir SMH, Ahmed M, Ahmed ATA, Rahman AKA, Haque EU, Ahmed ZU, Begum ZNT, Hassan MA, Khondker M, Rahman MM. (eds.). Encyclopedia of Flora & Fauna of Bangladesh, Vol. 23. Freshwater Fishes. Asiatic Society of Bangladesh, Dhaka. 2007;300.
- Ullah MA, Uddin MN, Hossain MS, Hossain MB, and Hossain MA. Fish Diversity in Three Selected Areas of Mid-Coastal Region, Bangladesh. J. Fish. Aquat. Sci., 2016; 11(2):174-184.

WB (World Bank). Bangladesh Fisheries Sector Review, Report No 8830-BD, Dhaka. 1991;120.

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