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## Kaptai Lake and fisheries: Gears, species and marketing channel with management practices

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### Abstract

What is the status of Fisheries at Kaptai Lake - mainly, types of fishing gears used, species composition and marketing channel with Existing management practices; this study was conducted for a period of 24 weeks from January to June, 2015 using personal observation and other participatory methods such as questionnaire interview, Focus Group Discussion (FGD) and cross-check interview. A total of 37 fish species under 6 common groups were identified from the lake. Among them 7 species of carps, 7 species of catfishes, 4 species of snakeheads, 2 species of eel, 11 species of perch and 6 species of barbs & minnows were recorded. Three types of fishermen such as professional fishermen, seasonal fishermen and subsistence fishermen are engaged in fishing in Kaptai Lake during the fishing season using various types of nets such as Jhaki jal, Kechki jal, Current jal, Bhasa jal, Thela jal and wounding gear such as Borshi and Koch. In present study, it was found that the lake fishing was totally closed during the spawning season (May-August). The market chain from farmers to consumers passes through a number of intermediaries such as, local fish traders, agents, wholesalers, BFDC pontoon and retailers. Various recommendations and measures have been suggested to improve the fish biodiversity in the Kaptai Lake.

**Keywords:** Kaptai lake, gears, species composition, marketing channel, management practices

### Introduction

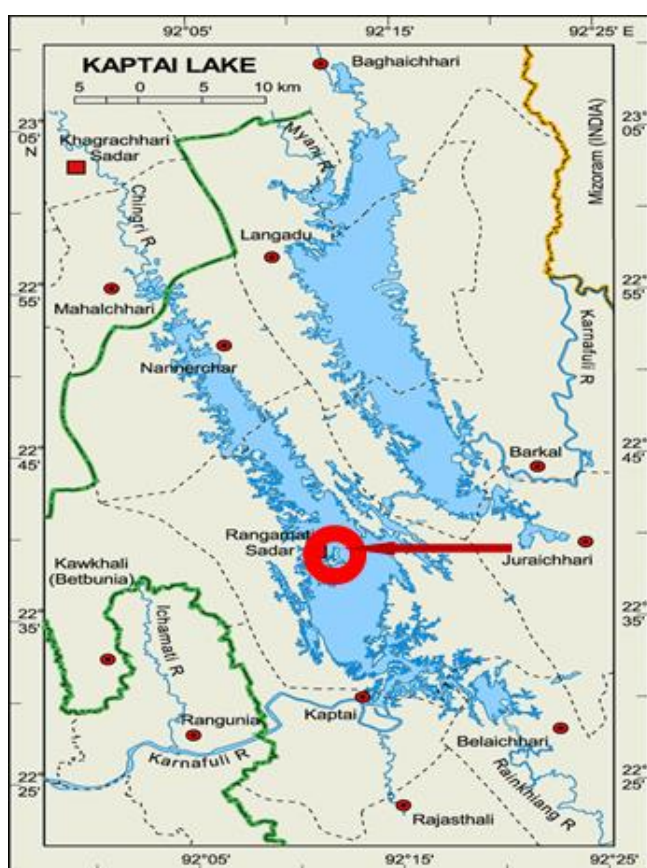
Bangladesh is enriched with extensive potential water resources distributed all over the country. Inland water body has an area of 46, 99, 394 hectare, among them the open water area is 39, 10, 053 hectare and closed water area is 7, 89, 341 hectare. Total inland production is 19, 56, 925 metric tonnes and 9,95,805 metric tonnes that come from open water body <sup>[1]</sup>. Besides, closed water fisheries shrimp production were 1, 76,120 mt. This production level reflects per capita per year availability of 19.30 kg of fish where the minimum requirement is about 21.90 kg per year <sup>[1]</sup>. The inland water bodies of Bangladesh are known to be the habitat of 266 species of indigenous fish, 13 exotic fish and 24 prawns. The marine water bodies (200 nautical miles along the coast) are also remarkable for being habitat of 475 species of fish. There are at least 36 species of marine shrimps and 24 live in freshwater, are found Bangladesh <sup>[2]</sup>. There are 266 freshwater, 475 marine fish species, 24 freshwater prawn and 36 marine shrimp and 12 exotic species in Bangladesh. Kaptai lake (Lat. 22°20' - 23°18'N Long. 92°00' - 92°26'E) is one of the important fisheries resource in Bangladesh. It was evolved due to damming across the Karnaphuli River at Kaptai region in Rangamati district for hydroelectric power generation which subsequently turned to a suitable habitat of various fish species of commercial importance. The lake has an approximate area of 68,800 hectares and contributes a substantial proportion of total national fish production every year. The average water area of the lake is approximately 58,300 ha and 68,800 ha at full surface level <sup>[3]</sup>. The maximum and minimum depths of the lake are 35m and 9m respectively. A study by <sup>[4]</sup> shows that 74 freshwater fish species and 2 prawn species are available in the Kaptai Lake. The lake contains 76 freshwater fish species, of which 68 are indigenous and the rest are exotic, in addition, there are also a few species of freshwater prawn <sup>[5]</sup>. Natural breeding of the Indian major carps in the lake was reported for the first time in 1983-84 and subsequently, reconfirmed by <sup>[7]</sup>. In addition to about 300 small breeding spots, 4 rich natural breeding grounds of Indian major carps have been identified under changed circumstances in the upstream areas of (i) Kassalong, (ii) Karnafuli, (iii) Chengi and (iv) Rhyngiong channels. Besides the Indian major carps, brood fish killing of other commercially important species is also noticeable particularly in the torrential narrow channels in the up- stream areas where

specified gear like "Behundi net", "Shua jal", "Kharki jal", "Fala" etc. are used. In spite of short time operation their harmful effect is very high because of killing of the egg bearing fishes in the migration channels. The other fishing gears used in Kaptai Lake are "Kechki jal", "Dhaka jal", "Current jal", "Bhasa jal", "Dharma jal", "Thela jal" "Borshi", "Koch" etc [7]. The overall objective of the study is to provide a comprehensive analysis of technical, social and economic factors related to Kaptai reservoir fisheries that may serve as a rational basis for devising a sustainable management strategy.

## Materials and Methods

### Selection of the study area

Selection of the area is an important step for the study. Based on the concentration of total fish production, Kaptai Lake of Rangamati district was considered for this study. This study area covers a large water body (68,800ha) producing huge amount of different types of fish. At first, primary information for the fisheries resources in the Kaptai Lake was collected from Rangamati BFDC, Fishermen regarding the concentration of the area for fishing activities in the Kaptai Lake and on the basis of this information, a preliminary survey was conducted in the study area. Assessment of gear and catch composition were conducted to the adjacent areas of BFDC. Finally decision was taken for the study of fisheries resources of this reservoir.



**Fig 1:** Map of Kaptai reservoir (Source: Google Map)  
Data collection period

The data were collected in respect of fishery especially fisheries biodiversity in the Kaptai Reservoir, fishing activities, fishing gears, catch assessment survey etc. for six months from January 1 to June 30, 2015. Data were collected every 2 weeks interval during the period of study.

### Questionnaire designs

For collection of information regarding crafts and gear types, fish composition, catch records of various fish species of Kaptai Reservoir were designed keeping in mind the specific objectives of the study. Questionnaires were filled up through direct observation of crafts, gears and their catch and also interviewing of the fishers community. The structured questionnaires were administered to collect information on following board categories of fishing gear.

### Collection of data

Collection of information from the field was done properly. In order to collect relevant information, interview technique was followed. By this technique the information were collected from the fishermen and the fish marketing officer of BFDC. For this study a combination of questionnaire interview, Participatory Rural Appraisal (PRA) tool such as Focus Group Discussion (FGD) and cross-check interviews with key informants were used for fishermen.

### Editing, processing and tabulation of data

After collection of data from the field these were verified to eliminate errors and inconsistencies. The first step was to look into data of each and every interview schedule to ensure consistency and simultaneously, processing and editing of the data were done. After completing the pre-tabulation task, processed data were transferred to a master sheet to facilitate tabulation. Finally, relevant Tables were prepared in accordance with the objectives of the study. Data presented mostly in the Tabular form because it is simple in calculation, widely used and easy to understand.

### Analysis of data

All the collected information was accumulated and binded according to the collection of data. Then the data were presented in textual, tabular and graphical forms to understand the present status of exploitation of Kaptai Lake fishery easily. Lastly conclusion, problems and improvement suggestions were made on the total obtained results.

## Results

### Fishing gears

The Kaptai Lake is very important in the South-eastern part of Bangladesh, and it is rich in fish biodiversity. Some of the threatened fish species listed by IUCN are easily available in this lake. The lake ecosystems play vital role in sustaining the biodiversity of fish fauna and contribute to the development of overall economy of the country through fish production. Different kinds of fish fauna such as Carps, Catfishes, Barbs, Eels, Minnows, Perches, Snakeheads and miscellaneous groups are found in the lake.

**Table 2:** Operational period for selective and non-selective gears used in fishing of Kaptai Reservoir

Types of gear	Period of operation	Closed period	Selective/Non selective gear	Gear used commercially
<b>Gill net</b> Large meshed gill net Small meshed gill net	Sep-Apr Sep-Apr	May-Aug May-Aug	Selective Selective	Yes Yes
<b>Lift net</b>	Sep-Apr	May-Aug	Non selective	Yes
<b>Cast net</b>	Sep-Apr (Pick, September-October)	May-Aug	Non selective	No
<b>Seine net</b> Small meshed seine net Mosquito seine net	Sep-Apr Sep-Apr	May-Aug May-Aug	Selective Selective	Yes Yes
<b>Hook and line</b> Cluster hooks Long line Reel line Hand line	ep-Apr Sep-Apr Sep-Apr Sep-Apr (Pick, February-April)	May-Aug May-Aug May-Aug May-Aug (Most illegal Fishing occur during this time)	Selective Selective Selective Selective	Yes Yes Yes Yes
<b>Wounding gear</b> Koch	Sep-Apr (Pick, May-August)	May-Aug (But most illegal Fishing occur this time)	Selective	No

**Present status of fish biodiversity**

During the study period, different species of fish were caught by the fishers in Kaptai reservoir including Carps, Barbs and

minnows, Catfish, Perch, Snakehead and Eels those represented 19%, 16 %, 19%, 30%, 11% and 5%, respectively (Table 3).

**Table 3:** Major groups of fishes and percentage of fish groups of the Kaptai Lake

Major groups of fishes	Percentage
Catfish	19
Carps	19
Perch	30
Eels	5
Snakehead	11
Barbs & Minnows	16

Among 37 species of fish and crustaceans in this river, few species were very common such as Chapila (*Gudusia chapra*), Kachki (*Corica soborna*), Air (*Sperata aor*), Rui (*Labeo rohita*), Kalibaus (*Labeo calbasu*), Puntii (*Puntius sophore*), Tengra (*Mystus tengara*), Taki (*Channa punctatus*), Baim (*Mastacembelus armatus*), Guchi (*Mastacembelus*

*aculeatus*), Icha (*Macro brachium lamarrei*), Mola (*Amblypharyngodon mola*), Bata (*Labeo bata*). Some fish species were moderate in availability. Some fish species were very rare (Table 13) such as Rita (*Rita rita*) and Poa (*Pama pama*). There are 37 fish species those were found in this lake have been shown in Table 4.

**Table 4.** The species of fishes caught in different months

Fish group	Local name	Common name	Scientific name
Carps	Mrigal	Mrigal	<i>Cirrhinus mrigala</i>
	Carpio	Common carp	<i>Cyprinus carpio var specularis</i>
	Kalibaus	Black rohu	<i>Labeo calbasu</i>
	Rui	Indian major carp	<i>Labeo rohita</i>
	Bata	Minor carp	<i>Labeo bata</i>
	Silver carp	Silver carp	<i>Hypophthalmichthys molitrix</i>
	Catla	Indian major carp	<i>Catla catla</i>
Barbs and Minnows	Chapila	Indian river shad	<i>Gudusia chapra</i>
	Mola	Barb	<i>Amblypharyngodon mola</i>
	Dhela	Barb	<i>Rohtee cotio</i>
	Jat puti	Spot fin swamp barb	<i>Puntius sophore</i>
	Kachki	Ganga river sprat	<i>Corica soborna</i>
	Darkina	Top minnow	<i>Esomus danricus</i>
Snakehead	Shol	Snakehead murrel	<i>Channa striatus</i>
	Taki	Spotted snakehead	<i>Channa punctatus</i>
	Chang/raga	Asiatic snakehead	<i>Channa orientalis</i>
	Gajar	Giant snakehead	<i>Channa marulius</i>
Catfish	Gulsha Tengra	Long whiskered	<i>Mystus gulio</i>
	Kajoli	Gangeti cailia	<i>Ailia coila</i>
	Tengra	Striped dwarf catfish	<i>Mystus vittatus</i>
	Pabda	Pabdah catfish	<i>Ompok pabda</i>

	Batashi	River catfish	<i>Pseudeutropius atherinoides</i>
	Air	Long whiskered catfish	<i>Sperata aor</i>
	Boal	Fresh water shark	<i>Wallago attu</i>
Eels	Guchi baim	Striped spiny eel	<i>Mastacembelus spancalus</i>
	Tara baim	One striped spiny eel	<i>Macrognathus aculeatus</i>
Perch	Kholisha	Striped gourami	<i>Colisa fasciatus</i>
	Kata chanda	Round glass perchlet	<i>Chanda baculis</i>
	Lal chanda	Indian glass perch	<i>Chanda ranga</i>
	Foli	Feather back	<i>Notopterus Notopterus</i>
	Gutum	Guntea loach	<i>Lepidocephalus guntea</i>
	Bailla	Bar-eyed goby	<i>Glossogobious giuris</i>
	Chitol	Humped feather back	<i>Notopterus chitala</i>
	Gura chingri	River prawn	<i>Macro brachium lamarrei</i>
	Koi	Climbing perch	<i>Anabas testudineus</i>
	Veda	Gangetic Leaf fish	<i>Nandus nandus</i>
	Shing	Catfish	<i>Heteropneustes fossilis</i>

Percentage contribution of different groups of fish recorded during the period of study in Kaptai Lake is given following period According to record of the study area the highest percentages of fishes were Perch (30%) and the lowest (5%) were eels.

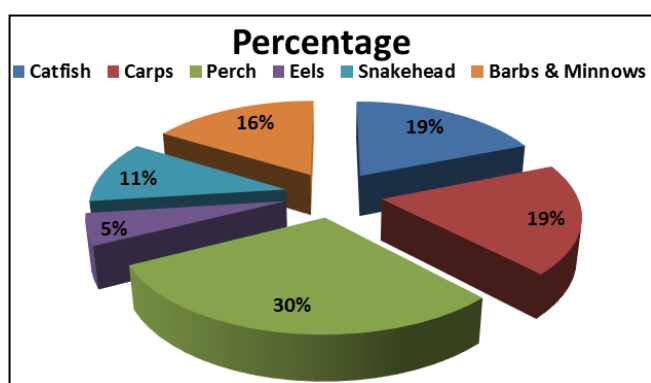


Fig 2: Different types of fish groups recorded during the study

Kaptai Reservoir is surrounded by high hills and there were only two (Chittagong-Rangamati and Chittagong-Kaptai) across points to the reservoir from the plains. Hence, BFDC established three fish-landing centers, one at Rangamati, second one at Mohalchari and the third one at Kaptai for royalty collection and for the management of the lake. In the Kaptai Reservoir fisheries, there are relatively complicated marketing channels (Figure 3). Obviously this might be due to geographical location of the reservoir, complicated communication system between catching point and markets, lack of any co-operative system for facilitating market display of the catches and in some cases exploitation of dependent fishers by fish traders. A number of middlemen are involved between fishermen and consumers in fish marketing system in Rangamati town. The market chain from fishermen to consumers passes through a number of intermediaries such as: local fish traders (Paikers), wholesalers and retailers. The fishermen operating in different fishing areas usually sell their catch to the commission agents or to the fish traders or to the local retailers and never come to the landing centers. There are more than 250 fish traders engaged directly or indirectly for marketing of such commodities although all are not enlisted officially to BFDC by taking licenses. At the landing centers, fish traders first settle the royalty with the BFDC and again sell or transport the fish to different city markets. The small fish traders collect fish by manually propelled boats locally called sampan. They sell all the fish to the master traders since their quantity is small and they lack faculties to

transport the fish to the city markets.

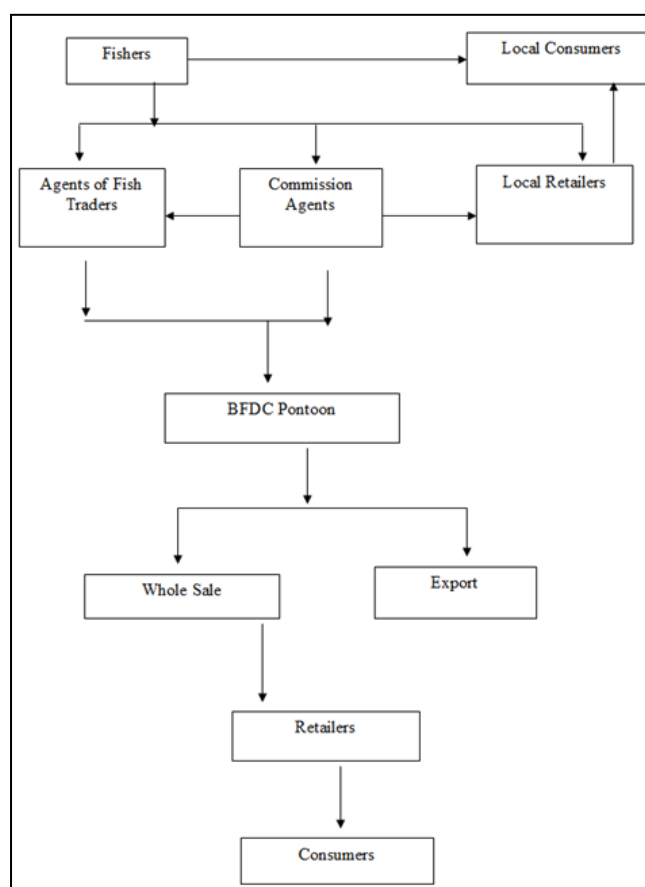


Fig 3: Fish marketing channel of Kaptai Reservoir.

In general the high income groups buy large fish and the lower and middle-class group are able to afford medium-sized and small fishes. Smaller restaurants and hotel also buy fish but most of the fish is consumed by the households. Daily supply of fish in Tabalchari bazar, Reserve bazar, Banarupa bazar and municipal market had been estimated to be 1-2 tones, 2-3 tone and 5-6 tones, respectively. Virtually most of the fish (95%) are supplied to the different areas of the other districts. According to the Upazila Fisheries Officer, fish supply to the markets was not satisfactory during 1990s. Nevertheless, it is probably safe to say that compared to some 10 years ago, the market volume has increased and a lot of businessmen are involved with this fish landing center. It is estimated that about half of the fish regularly sold in markets are major carps. Besides the carps, other fish such as Catfish,



Tilapia, Small Indigenous Species (SIS) and prawn are sold in the landing center.

### Existing management practices

From 1961 to 1963, the management of the lake was under the Directorate of Fisheries (DoF). Since 1964, it has been managed by the Bangladesh Fisheries Development Corporation (BFDC), which directs the exploitation and management of the lake's resources.

Kaptai Reservoir fisheries management basically pertains to implementing closed seasons, issuing licenses, fish act implementation and stocking. To protect natural recruitment, fishing is prohibited from April to mid-August every year because June-July is the peak-breeding season. However, in distant places it is almost impossible to ban fishing completely during the breeding season. Subsistence fishermen and tribal people fished at that time for their own consumption and local marketing.

But in the recent years, the production of fish is decreasing day by day because there is no specific management techniques followed for fishing. There are some basic regulations are followed for all inland water fisheries in Bangladesh. These regulations are also imposed for this reservoir.

The regulations which are used for the lake fishery are given below:

To protect the mother stocks for facilitating natural spawning, fishing is strictly prohibited from first week of April through mid-August.

The minimum legal size of fish to be caught is not less than 23 cm or 9 inch (for all fishes).

The minimum permissible mesh size for gill nets is 7.62 cm (3 inch).

1. Current jal is an extremely effective net and has been banned by the government. It is one of the most harmful nets and is responsible for the decline in fish populations in reservoir. The Fish Act 1950 places a penalty of Taka 1000 with 1 to 6 months in prison for a first offence by any person using this net in any kind of habitat. The second offence has a penalty of Taka 2000 with 2 months to 1 year in prison.
2. Jak fishery is strictly prohibited in the reservoir to reduce the catch of mother stocks.
3. Nursery grounds (stocking grounds) are declared as sanctuaries and fishing is banned.
4. Illegal fishing and their transportation is prohibited.
5. Increase the incentive on the illegal fishing materials like forfeited fishes, other fishing materials etc.
6. These fishing regulations are not strictly enforced. Although continuous effort is given to increase major carp, tilapia etc. fry and fingerlings, yield has decreased. The recapture rate from lakes and reservoirs is assumed to be 20-25% of the total stocking, but for Kaptai Reservoir this target has never been achieved, and is less than 1%. The reasons behind this may be due to undersized fingerlings being stocked, carrying fish and fingerlings from distant places, high rate of predation and under reporting. The BFRI suggested stocking the reservoir with major carp fingerlings of greater than 23 cm, but this was not followed up because of scarcity of appropriate sized fingerlings.

### Management recommendations

Population parameters of different fish species in Kaptai Lake

should immediately be studied. Assessment of maximum sustainable yield of this fish stock should urgently be undertaken in order to suggest the highest amount of fish that could be taken from the lake per year to the fishers.

1. A step-by-step management policy should be prepared with regard to stock behavior and status which lead to the adoption of regulations to be imposed on the stock.
2. Fishing regulations should be strictly implemented.
3. Efficacy of gear with all types of nets at all depths and habitats are to be determined for gear selectivity as well as for tilapia recruitment.
4. All sorts of fishing should be suspended from the first week of April/May through mid-August to protect the mother stock for facilitating natural spawning.
5. Peak spawning run and egg deposition period of fish species should be determined to find out the exact closed seasons.
6. Fry and fingerlings of carps in the principal tributaries should be saved until they are invulnerable to most of the predators.
7. Effort should be made to clarify the current uncertainty over the quantity and species composition of the unrecorded catch (local consumption) from Kaptai Lake which will be helpful to the fishery statisticians for stock assessment studies.
8. Special attention should be given to eradication of tilapia; otherwise this sort of fish might be a threat for major carps.
9. Sanctuaries should be increased in number for breeding, spawning, protection and conservation of fish stocks in the reservoir.
10. Government should be taken necessary steps for applying scientific culture techniques of critically endangered fish species.
11. A small ice factory can be constructed in landing area of supplying ice to fishermen.
12. Conducting a feasibility study for more nursery ponds and creek culture by blocking some arms of the lake.
13. Expending and intensifying efforts to obtain length-frequency data by random sampling at BFDC landings.
14. Reservoir management authorities, local administration, law enforcing agencies and research organizations should come forward to formulate an integrated policy to successfully manage the national resource through harvesting of Maximum Sustainable Yield (MSY) and generating hydro-electricity.
15. Government, private sector and the NGOs should come forward to establish some of fish hatcheries to ensure production of quality fry and it should need to take necessary steps for fish stocking in the reservoir.
16. Specific research programs related to fisheries management in Kaptai Reservoir should be undertaken by the BFRI and the Universities.
17. A positive government policy regarding sustainable fish marketing should be developed.
18. Strict regulation of fishing efforts might be undertaken to harvest allowable size of fish with regular check on under meshed fishing through frequent vigilant monitoring by mobile teams of BFDC.

### Discussions

#### Fishing gears

In the study area various types of fishing gears were found. These were nets like Gill net (Current jal), Cast net (Jhaki jal),

Mosquito seine net (Kechki jal), Large meshed gill net (Bhasa jal), Push net (Thela jal) and Wounding gear such as Borshi and Koch. [8] Mia (2009) observed various types of fishing gears were found to operate in the Jamuna river, among them, a total of six types of fishing nets were used by the fishermen. The gears recorded were Seine net (Ber jal), Cast net (Jhaki jal), Gill net (Current jal), Fixed lift net (Khora jal), Purse dredge (Moiya jal) and Push net (Thela jal).<sup>[9]</sup> Hasan *et al.* (2015) Eleven types of net and two types of trap were found in Meghna river. In the study period a total number of 24 species of fishes were noted in the catch of Gill net.<sup>[10]</sup> Mahmud (2007) recorded a total of 26 species with Gill net which was similar to the present findings. The dominant group of Gill net was miscellaneous (54.05%) which were not similar to the findings of<sup>[10]</sup> Mahmud (2007) stated that the dominant species were *Puntius ticto* (10.76%) and *Puntius sophore* (7.65%). In the study period a total number of 12 species were recorded in the catches of Koch.<sup>[10]</sup> Mahmud (2007) recorded a total of 15 species with Koch which was similar to the present findings. Among different fish groups Carps the highest which contributed about 68.89% which was opposite to the findings of<sup>[10]</sup> Mahmud (2007) implied the highest species was found to be miscellaneous (58.29%).

#### Present status of fish biodiversity

In the study area 37 species of the including prawn were recorded. Among them 7 species of Carps, 7 species of Catfishes, 11 species of Perches, 2 species of Eels, 4 species of Snakeheads, 6 species of Barbs and minnows. During the period of investigation, different species of fish were caught by the fishers in Kaptai Lake including Carps, Barbs and minnows, Catfish, Perch, Snakehead, and Eels those represented 19%, 16%, 19%, 30%, 11% and 5% respectively.<sup>[11]</sup> Islam (2009) observed, about 13-15 major groups of 35 fish in the Kali river. Most of them were found all the year round except Carps, Perch and Murrells.<sup>[12]</sup> Rahman *et. al* (2017) found 66 species under 08 orders and 23 families were recorded from the Chalan beel. Changes in availability of fish species of the Kaptai Reservoir in last 10 years<sup>[13]</sup> (BFDC, 2015) can be categorized into 4 major groups. These groups are introduced, disappeared, dwindling and dominant. Of the 16 fishes whose abundance was declining and is under much threat have been categorized based on<sup>[14]</sup> IUCN (2000) method as endangered and critically endangered. Species recorded as endangered are *Rohtee cotio*, *Heteropneustes fossilis*, *Puntius sarana*, *Rita rita*, *Ailia coila*, *Clupisoma garua*, *Tetraodon cutcuttia*. Critically endangered are *Labeo gonius*, *Channa marulius*, *Chela cachius*, *Botia dario*, *Eutropiichthys bacha*, *Ompok pabda*, *Sperata aor*, *Rasbora elanga*.<sup>[15]</sup> Mazid (2003) reported that many of these valuable fish have been threatened or endangered. According to<sup>[14]</sup> IUCN (2000), *Puntius sarana* is critically endangered but it is moderately abundant in the study area.

#### Fish market and marketing channels

The study was conducted to know the present situation of the fish marketing system in Sadar Upazilla, Rangamati. Due to highly perishability, fish undergoes rapid spoilage if not disposed of in due time. This results not only in lower prices but also poses health hazards. As such, it demands special care in handling, packaging and transportation before being placed to the consumers for sale. Though fish farming is regarded as industry in many countries of the world but the fish farmers in our country do not communicate directly with

the consumers. As such, fish market chains from the producers to ultimate consumer are in operation. This chain passes through a number of intermediaries such as, local fish trader, beparies, aratdar, whole sellers and retailers. It was found that total fish landing in the landing center varied from time to time. During winter season quantity of fish landed was higher than in other seasons. During January, February and March higher quantities of fish were landed than April, May and June.<sup>[16]</sup> Rahman (2003) reported that in Gazipur the market chain from farmers to consumers consisted of a number of intermediaries such as, local fish traders, agents, whole sellers and retailers.<sup>[17]</sup> Quddus (1991) also identified a similar market chain in Mymensingh district. The above observations are in conformity with our findings. Three types of supply chains were identified as selling fish through super shops were identified by<sup>[18]</sup> Rahman *et al.* (2017).

#### Conclusions

The fish population of Kaptai lake has been declining very fast. The fishermen and local elites reported that some species of fish were less common due to change in water current, depth of water, over fishing, temperature etc. From the survey, a total of 37 species were identified. Among these 37 species, 7 species of Catfish, 7 species of Carp, 4 species of Snakehead, 2 species of Eel, 6 species of Barbs and Minnows, 10 species of Perch and 1 species of prawn. The use of fishing gear and operation time depends mainly on habitat type, water depth, type of fisherman and abundance of fish. Kaptai Reservoir fisheries management basically pertains to implementing closed seasons, issuing licenses, fish act implementation and stocking. To protect natural recruitment, fishing is prohibited from April to mid-August every year because June-July is the peak-breeding season. However, in distant places it is almost impossible to ban fishing completely during the breeding season. Subsistence fishermen and tribal people fished at that time for their own consumption and local marketing.

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