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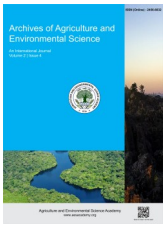

ORIGINAL RESEARCH ARTICLE

# Status of fish and shellfish diversity and their decline factors in the Rupsa River of Khulna in Bangladesh

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**ABSTRACT**

The study was aimed to find out the present status and causes of fish and shellfish diversity reduction in the Rupsa River of Bangladesh. Studies were conducted for a period of 6 months from July to December 2016. Focus group discussions (FGD), questionnaire interviews (QI) and key informant interviews (KII) were done to collect appropriate data from the local fishers and resource persons. A total of 62 species of fish and shellfish from 23 families were found in the river and 9 species disappeared in last 10 years. The species availability status was remarked in three categories and obtained as 14 species were commonly available, 28 species were moderately available and 20 species were rarely available. The highest percentage of fishes was catfishes (24.19%). There was a gradual reduction in the species diversity from previous 71 species to present 62 species with 12.68% declined by last 10 years. Average fish catch per fishermen per day reduced from 8.35 kg to 2.95 kg in last 10 years. Combined effects of some manmade and environmental factors are responsible for the loss of biodiversity. Majority of the respondents (90%) agreed that two manmade factors namely overfishing and navigation are mainly responsible for the loss of fish and shellfish diversity in the river followed by use of illegal fishing gears (86%), pollution (72.5%) and urbanization (64%). During the survey, 93.25% respondents reported water depth reduction as the main environmental factor followed by siltation and sedimentation (91%), temperature (61.75%) and turbidity (56%). The present work recommends preventing water pollution, maintaining fishing gears, increasing fishers' awareness, implementing fisheries laws and establishing fish sanctuary to conserve finfish and shellfish diversity in the river. Moreover, counter and random surveys are also recommended to crosscheck the fishes' status and decline causes for ensuring their proper management and conservation.

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## INTRODUCTION

Bangladesh is gifted with vast water resources. About 700 rivers including tributaries flow through the country constituting a waterway of total length around 24,140 km (Banglapedia, 2012). There is about 4.7 million hectares inland open waters in this country which contributes 83.85% to the fisheries sector (DoF, 2017). According to the World Bank (1991), Bangladesh has various water resources including streams, floodplains, ponds, canals, beels, haors and a long coastline that are suitable for high yields and considerable increase in fish production. In the last five decades, world fish food supply has overtaken global population growth and today fish constitutes a significant source of healthy food and animal protein for much of the world's residents (FAO, 2012). Fish and fisheries are the indispensable part of life and livelihood of the people of Bangladesh

since immemorial time. It is an element of the country's cultural heritage (DoF, 2017).

Riverine capture fisheries in the form of common property and open access resources constitute a vital component of the agro-ecosystem of rural Bangladesh. Bangladesh has predominately four major river systems such as the Brahmaputra-Jamuna, the Ganges-Padma, the Surma-Meghna and the Chittagong region river systems (Banglapedia, 2012). The Rupsa River is a river in southwestern Bangladesh and a distributary of the Ganges. It is one of the most important rivers of Bangladesh. It flows by the side of Khulna and connects to the Bay of Bengal through Poshur river at Mongla channel. It forms from the union of the Bhairab and Atrai rivers and flows into the Pasur River. Its entire length is influenced by tides (Chowdhury, 2012). Near Chalna, it changes its name to Pasur River and flows into the Bay of Bengal. The length of the river Rupsa is about 70 km. Among of this length 35 km are known as Bhairab and rest is known as Rupsa. The average width of the river was found as 0.25 km and average depth 7-8 m but their depth varied from place to place. A significant number of fisheries, dockyards, shipyards and factories are situated on the bank of this river. A momentous number of families depend on catching fish in the river all over the year.

According to IUCN Bangladesh (2015), about 64 freshwater species are threatened condition in Bangladesh. Among them, 9 species are listed as critically endangered, 30 as endangered and 25 as vulnerable. Overfishing, rapid extraction of fish seed and brood stock, destructive and unregulated fishing practices, pollution, introduction of exotic species, loss of aquatic habitat due to siltation, dam construction and other anthropogenic activities are the main causes of fish diversity reduction. Losses of this magnitude impact the entire ecosystem, depriving valuable resources used to provide food, medicine and industrial materials to human beings. Run off from agricultural and urban areas, the invasion of exotic species and the creation of dams and water diversion have been identified as the greatest challenges to freshwater environments (Allan and Flecker, 1993).

Biodiversity and its conservation are regarded as one of the major issues of enabling sustainable use of natural resources. Maintaining biodiversity is important because it is not always possible to identify which individual species are critical to aquatic ecosystems sustainability. Many fish species may provide genetic material and may serve as ecological indicators. Aquatic conservation strategies support sustainable development by protecting biological resources in ways that will preserve habitats and ecosystems (Jenkis and Williamson, 2003). Considering the above facts and situation the following objectives were set for the present study: to assess the present status of fish and shellfish diversity in the Rupsa River and causes of loss of biodiversity in the Rupsa River of Bangladesh.

## MATERIALS AND METHODS

The present research was carried out to assess the fish and shellfish diversity and factors affecting the biodiversity of Rupsa River in Khulna.

### Description of the study sites

The study has conducted from Rupsa Ghat to Chalna Bandar of the Rupsa River. The study area was divided into 5 sites based on availability of the fishermen. The sampling sites were Rupsa Ghat, Botiaghata, Phultola, Pankhali Ghat and Chalna Bandar. The Rupsa River is a river in southwestern Bangladesh and flows by the side of Khulna. It forms from the union of the Bhairab and Atrai river. Its entire length is influenced by tides. Near Chalna, it changes its name as Pasur River and flows into the Bay of Bengal at Mongla channel. Its latitude is 22°45'17.24" and longitude is 89°33'15.47". It is one of the most important rivers of Bangladesh (Figure 1).

### Data collection

During collection of data, both primary and secondary sources have considered. Primary data were collected from fishermen through FGD, key informant interview (KII) and questionnaire interviews (QI). The secondary information were collected from Rupsa and Phultola upazila fisheries offices, district fisheries office of Khulna, projects of World Fish in Khulna, books and journals.

### Focus group discussions (FGD)

Six focus group discussions (FGD) were arranged at different places of 5 selected sites each with 8 to 12 members. The places were Mokampur, Hazigram, Noshkarpur, Modhupur, Shoilpur and Mollikpur where Upazila Fisheries Officer (UFO), union parishad Chairman and Members, Leader of the fishers' community, fishermen, fish market leader, fish traders, fry traders and community people were joined in different meetings.

### Questionnaire interviews (QI)

In the study, a total 60 fishermen randomly selected for questionnaire interviews from surrounding the 5 selected sites. Under those sites, Mokampur, Hazigram, Noshkarpur, Modhupur, Chondonimohol, Shoilpur and Mollikpur villages were selected for this study. The questionnaire interviews were done at homestead, during fishing in the river and market places depending on the presence of the fishermen.

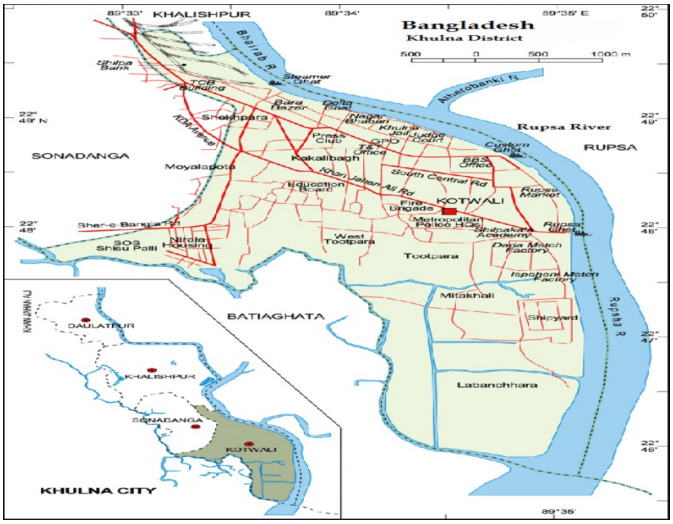


**Figure 1.** *Map of the study area (Rupsa River).*

### Cross-checking of information

Cross-check interviews were conducted with key resource persons such as Upazila Fisheries Officer (UFO), District Fisheries Officer (DFO), school teachers, local leaders and NGO workers. The interviews (KII) of the respondents have conducted in their office during office hour.

### Statistical analysis

Data were analyzed depending on collected data according to the questionnaire using Microsoft Office Excel 2010 and SPSS statistical software (20 version). Table, pie-charts and graphs were used for data presentation.

## RESULTS AND DISCUSSION

### Present status of fish and shellfish diversity in the Rupsa River

According to the availability of fish species, they were categorized into 3 groups like commonly available (CA), moderately available (MA) and rarely available (RA) species. According to the statement of local fishermen, a total of 62 fish species under 23 families were found during the period of investigation and 9 species were not available in the study area. These include carps, catfishes, barbs and minnows, clupeids, snakeheads, perches, eels, shrimps and others miscellaneous fish species which are discussed below:

#### *Carps*

During the period of present investigation, 7 species of carps were recorded where Ruhu and Kalibasu were commonly available and Catla, Mrigal and Gonia were moderately available. On the other hand, Bata and Bhangan were found as rarely available species (Table 1).

#### *Catfishes*

Fifteen species of catfishes were recorded whereas Tengra, Pabda and Shing were commonly available species. Golsha, Nuna tengra, Batashi and Modhu Pabda were moderately available species and other 8 species were rarely available (Table 2).

#### *Barbs and minnows*

In the present investigation, 6 species barbs and minnows were listed in the study area where 2 species were moderately available and 4 species were rarely available in the study area (Table 3).

#### *Clupeids*

In case of clupeids, one species (Chapila) was commonly available but Kachki and Chadana were rarely available and Ilish was found moderately available in the study area (Table 4).

#### *Snakeheads*

Different 4 species of snakeheads were present in the study area, where Taki was commonly available, Cheng and Shol were moderately available and Gozar was rarely available during the study (Table 5).

#### *Eels*

During the study period 4 species of eel were identified by the fishermen where Cuchia, Bamosh and Boro baim were moderately available species (Table 6).

#### *Perches*

There were 9 species of perches recorded from the Rupsa River where 1 species noticed commonly available and other 8 species were moderately available (Table 7).

#### *Featherbacks*

During the present investigation, two featherback species were recorded. Among them Chital was rarely available species and Foli was moderately available species in the river (Table 8).

#### *Loaches*

Two species were recorded during study period where Bou Rani was moderately available and Gutum was commonly available species (Table 9).

#### *Shrimps and prawns*

A few numbers of shrimp species were found in the Rupsa River. Among the 6 identified species Harina, Chama, Bagda and Golda chingri were commonly available. Among Khoira and Shada icha were moderately available species (Table 10).

#### *Miscellaneous fish species*

During the study period, 3 miscellaneous species were recorded where Kakila and Potka were rarely available and Tulardani was moderately available species (Table 11).

From the present survey, it was found that 14 species were commonly available, 28 species were moderately available and 20 species were rarely available. In percentage, there were 23% commonly available, 45% were moderately available and 32% rarely available species of fishes (Figure 2). During the study, it is identified that rarely available fishes were found only one or two times during the study period in the river. According to the local fishermen, those species might be disappeared very soon. Among 62 available fish species, the highest percentage of fishes was catfishes (19.56%) and lowest were feather backs (3.23%) and loaches (3.23%). Among other groups, there were perches (14.52%), carps (11.29%), barbs and minnows (9.68%), shrimps (9.68%), clupeids (6.45%), snakeheads (6.45%), eels (6.45%) and miscellaneous (4.84%) (Figure 3).

### Changes in fish and shellfish species availability in the Rupsa River

According to the statement of local fishermen, there were 71 species of fishes before 10 years which included carps (8), catfishes (16), barbs and minnows (7), clupeids (5), snakeheads (4), eels (5), perches (10), feather backs (3), loaches (3), Shrimps (7) and other miscellaneous (3).

It revealed that there was gradual reduction in the biodiversity from the earlier 71 species to present 62 species (12.68%

declined) in the Rupsa River (Table 12). This situation reflects the current scenario of fishes and shellfishes in the open water bodies of Bangladesh that fish biodiversity is rapidly decreasing day by day. Average fish catch per fishermen per day was also reduced from 8.35 kg to 2.95 kg in the river (Figure 4). It was clearly indicated that not only numbers of species were reduced but also harvest was declined in the river.

The present finding represents the status of fishes and shellfishes on some specific points of the Rupsa River that is clearly representing the declining trends of riverine fishes of Bangladesh. The status of fishes in inland water was much appreciable in the last century namely: Doha (1973) reported 106 species from Mymensingh and Tangail district; Islam and Hossain (1983) recorded 110 species from the river Padma near Rajshahi, whereas the status of fishes declined after twentieth century: 33 species are reported from Chitra and Fatki rivers (Hasan, 2007); 75 species from Pagla River (Zafar *et al.*, 2007); 73 species from Padma River near Rajshahi (Bhuiyan *et al.*, 2008) and 59 species from Bangali River near Bogra (Moumita *et al.*, 2011). According to Afrose (2013), 39 species of fishes were found in the Old Brahmaputra River from the interview with 30 fishers whereas 10-12 years ago it was recorded 60 to 65 fish species. Fish habitat destruction by roads, embankments, aquaculture, drainage and flood control and natural siltation along with overfishing, are the causes of reduction of fisheries resources (Ali, 1997). The findings of the present study especially the statuses of fishes clearly focusing the declining trends of fish diversity in the study area which alerting the gradual declination of fish diversity of Bangladesh.

## Factors affecting the fish and shellfish diversity in the Rupsa River

Biodiversity of the river is decreasing day by day due to various manmade and environmental factors that are described below:

### Manmade causes

According to the response of local fishermen, overfishing and navigation are the main manmade factors followed by use of illegal fishing gears (86%), wastage pollution (72.5) and urbanization (64%) were mainly responsible for loss of fish biodiversity in the Rupsa River (Figure 5).

Islam *et al.* (2011) found similar results where 91% of the households commented that over exploitation of resources were the main threat to Hakaluki Haor. Islam (2012) carried out related study in the wetland of Sujanagar upazila under Pabna district and recorded overfishing as a major threat to wetland biodiversity. Afrose (2013) identified over exploitation of fishes as the highest threat to the fisheries biodiversity in the Old Brahmaputra River in Mymensing. Chaki *et al.* (2014) commented that due to overfishing abundance of indigenous fish population found less in the Atrai River. So it is clear that overfishing is a harmful factor affecting fish biodiversity. Water way provides the biggest mean of transportation in the river Rupsa of Bangladesh. Mechanized and non-mechanized boats as well as small ships are used for navigational purposes in the Rupsa River but non-mechanized boats mainly used for fishing. The fish habitat is destroyed when it is used as navigation route. Boats pollute the aquatic environment through oil spills, open dumping and also sound pollution. For this reason, fish migrate to another place and fish breeding is badly hampered by navigation. Alam *et al.* (2012) noted that thousands of boats continuously polluted the water of the Tanguar Haor through oil contamination which would ultimately affect the fish production.

Chaki *et al.* (2014) commented that fishing by illegal gears had led abundance of indigenous fish population a stake in the Atrai River. Above all, the proof is that use of illegal fishing gears stands harmful to fish biodiversity. The waste products accumulated from a number of factories that are located on the bank of Rupsha River pollute its water. Agrochemicals including fertilizers and pesticides washed out with the rain water and drained into the river also contaminate the water. These pollutants could harmfully affect the spawning and feeding performance of fishes and shellfishes in the Rupsa River. Rivers surrounding and nearby the townships are highly contaminated. Discharges of untreated sewerage and industrial effluents into the waters have been a concern for aquatic pollution resulting in fish kills in many occasions. Disappearances of many fish species from Buriganga, Turag, Shitalakkha, Meghna, Karnaphuli, Surma and Dhaleswari Rivers have been attributed to pollution of water bodies by industries in many areas of the country (IUCN, 2015). Islam *et al.* (2011) noted that increase in human settlement and habitation were the major threats for this unique ecosystem of the country.

### Natural causes

During this study period, majority of the fishermen (93.25% respondents) opined that water depth reduction is the main environmental factor affecting species abundance and diversity in the river Rupsa whereas siltation and sedimentation (91%) followed by temperature (61.75%) and turbidity (56%) survey (Figure 6). Mohite and Samant (2013) noted that water level fluctuation was one of the major limiting factors of the river system in the Warna River basin of Western Ghats in India where most of the fishermen (46% respondents) opined that decline in fish diversity was due to the water level fluctuation. Hossain (2012) identified siltation as number one threat to fish biodiversity. Allan and Flecker (1993) said that loss of aquatic habitat due to siltation was a great cause of fish species loss in wetlands. Islam (2012) presented that many fishes, plants and other aquatic species going to be disappeared due to siltation and sedimentation of beels. Rahman (2013) noted most of the fishermen thought that high temperature and seasonal fluctuation of temperature affected the fish production. Chaki *et al.* (2014) established correlation between seasonal abundance of fishes and environmental parameters. Very high correlation was found between fish species and physical environmental parameters (air temperature, water temperature and water transparency). Above all, it is clear that combined effects of manmade and environmental factors are responsible for the loss of biodiversity in the Rupsa River.

**Table 1.** A list of carp species as recorded during the period of present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Cyprinidae | Catla | Indian major carp | *Catla catla* | MA | NO |
| 2 | Cyprinidae | Rohu | Indian major carp | *Labeo rohita* | CA | NO |
| 3 | Cyprinidae | Mrigal | Indian Major carp | *Cirrhinus cirrhosus* | MA | NO |
| 4 | Cyprinidae | Gonia | Kuria labeo | *Labeo gonius* | MA | EN |
| 5 | Cyprinidae | Kalibasu | Black rohu | *Labeo calbasu* | CA | EN |
| 6 | Cyprinidae | Bata | Minor carp | *Labeo bata* | RA | EN |
| 7 | Cyprinidae | Bhangan | Boga Labeo | *Labeo boga* | RA | CR |

**Table 2.** A list of catfishes as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Bagridae | Golsha | Long whiskered catfish | *Mystus cavasius* | MA | VU |
| 2 | Bagridae | Tengra | Srriped dwarf catfish | *Mystus vittatus* | CA | NO |
| 3 | Bagridae | Ayre | Long whiskered catfish | *Sperata aor* | RA | VU |
| 4 | Bagridae | Nuna tengra | Long whiskers catfish | *Mystus gulio* | MA | NO |
| 5 | Schilbeidae | Batashi | Indian potasi | *Pseudeutropius atherinoides* | MA | NO |
| 6 | Schilbeidae | Kajoli | Gangetic Ailia | *Ailia coilia* | RA | NO |
| 7 | Schilbeidae | Bacha | Batchaw bacha | *Eutropiichthys vacha* | RA | CR |
| 8 | Schilbeidae | Shilon | Silond catfish | *Silonia silondia* | RA | EN |
| 9 | Siluridae | Boal | Freshwater shark | *Wallago attu* | RA | NO |
| 10 | Siluridae | Modhu pabda | Butter catfish | *Ompok pabda* | MA | EN |
| 11 | Siluridae | Kani pabda | Indian butter catfish | *Ompok bimaculatus* | RA | EN |
| 12 | Siluridae | Pabda | Pabo catfish | *Ompok pabo* | CA | EN |
| 13 | Pangasidae | Deshi pangus | Pungus | *Pangasius pangasius* | RA | CR |
| 14 | Plotosidae | Kyne magur | Canine catfish | *Plotosus canius* | RA | VU |
| 15 | Heteropneustidae | Shing | Stinging catfish | *Heteropneustes fossilis* | CA | NO |

**Table 3.** A list of barbs and minnows as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Cyprinidae | Chela | Finescalerazorbelly minnows | *Chela phulo* | RA | NO |
| 2 | Cyprinidae | Mola | Carplet | *Amblypharyngodon mola* | MA | NO |
| 3 | Cyprinidae | Dhela | Cotio | *Osteobrama cotio* | RA | EN |
| 4 | Cyprinidae | Shar punti | Olive barb | *Puntius sarana* | MA | CR |
| 5 | Cyprinidae | Bhil | Indian trout | *Raiamas bola* | RA | EN |
| 6 | Cyprinidae | Koksha | Vagra baril | *Barilius vagra* | RA | EN |

**Table 4.** A list of clupeids as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Clupeidae | Chapila | Indian river shad | *Guduasia chapra* | CA | NO |
| 2 | Clupeidae | Kachki | Gang river sprat | *Corica soborna* | RA | NO |
| 3 | Clupeidae | Ilish | Indian river shad | *Tenualosa ilisha* | MA | NO |
| 4 | Clupeidae | Chadana | Toli shad | *Tenualosa toli* | RA | VU |

**Table 5.** A list of snakeheads as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Channidae | Taki | Spotted snakehead | *Channa punctatus* | CA | NO |
| 2 | Channidae | Cheng | Asiatic snakehead | *Channa orientalis* | MA | VU |
| 3 | Channidae | Shol | Snakehead murrel | *Channa striatus* | MA | NO |
| 4 | Channidae | Gozar | Giant snakehead | *Channa marulius* | RA | EN |

**Table 6.** A list of eels as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Synbranchidae | Cuchia | Gangetic mud eel | *Monopterus cuchia* | MA | VU |
| 2 | Anguillidae | Bamosh | Indian longfin eel | *Anguilla bengalensis* | MA | VU |
| 3 | Mastacembelidae | Tara baim | One striped spiny eel | *Macrognathus aculeatus* | CA | VU |
| 4 | Mastacembelidae | Baro baim | Two-track spiny eel | *Mastacembelus armatus* | MA | EN |

**Table 7.** A list of perches as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Anabantidae | Koi | Climbing perch | *Anabas testudineus* | MA | NO |
| 2 | Gobiidae | Bele | Bar eyed goby | *Glossogobius giuris* | MA | NO |
| 3 | Gobiidae | Sada Chauia | Burrowing goby | *Trypauchen vagina* | MA | NO |
| 4 | Gobiidae | Chauia | Goby | *Psedapocryptes lanceolatus* | MA | NO |
| 5 | Gobiidae | Gule | Goby | *Apocrptes bato* | MA | NO |
| 6 | Nandidae | Bheda | Gangetic leaffish | *Nandus nandus* | MA | EN |
| 7 | Mugilidae | Khorshula | Corsula mullet | *Rhinomugil corsula* | MA | NO |
| 8 | Mugilidae | Persha | Goldspot | *Liza parsia* | MA | NO |
| 9 | Centropomidae | Vetki | Giant sea perch | *Lates calcarifer* | CA | NO |

**Table 8.** A list of featherbacks as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Notopteriidae | Chital | Humped featherback | *Notopterus chitala* | RA | EN |
| 2 | Notopteriidae | Foli | Bronze featherback | *Notopterus notopterus* | MA | VU |

**Table 9.** A list of loaches as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Cobitidae | Bou rani | Bengal loach | *Botia dario* | MA | EN |
| 2 | Cobitidae | Gutum | Guntea loach | *Lepidocephalichthys guntea* | CA | NO |

**Table 10.** A list of shrimps and prawns as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Palaemonidae | Harina chingri | Ginger shrimp | *Metapenaeus monoceros* | CA | NO |
| 2 | Palaemonidae | Chama chingri | Fiddle prawn | *Penaeopsis stridulans* | CA | NO |
| 3 | Palaemonidae | Bagda chingri | Giant tiger prawn | *Penaeus monodon* | CA | NO |
| 4 | Palaemonidae | Golda chingri | Giant fresh water prawn | *Macrobrachium rosenbergii* | CA | NO |
| 5 | Palaemonidae | Khoira | Uncta shrimp | *Parapenaeopsis uncta* | MA | NO |
| 6 | Palaemonidae | Shada icha | Indian white prawn | *Penaeus indicus* | MA | NO |

**Table 11.** A list of miscellaneous fishes as recorded during the present study.

| S.N. | Family | Local name | Common name | Scientific name | Remarks | IUCN status |
|---|---|---|---|---|---|---|
| 1 | Beloniidae | Kakila | Fresh water gar fish | *Xenentodon cancila* | RA | NO |
| 2 | Silaginidae | Tulardani | Gangetic ghiting | *Sillaginopsis panijus* | MA | NO |
| 3 | Tetraodontidae | Potka | Ocellated puffer fish | *Tetraodon cutcutia* | RA | NO |

**Table 12.** Changes in fish availability in the Rupsa River.

| Name of the groups | No. of available fish and shellfish species before 10 years | No. of species at present in the Rupsa River |
|---|---|---|
| Carps | 8 | 7 |
| Catfishes | 16 | 15 |
| Barbs and minnows | 7 | 6 |
| Clupeids | 5 | 4 |
| Snakeheads | 4 | 4 |
| Eels | 5 | 4 |
| Perches | 10 | 9 |
| Featherbacks | 3 | 2 |
| Loaches | 3 | 2 |
| Shrimps and prawns | 7 | 6 |
| Miscellaneous | 3 | 3 |
| Total | 71 | 62 (12.68% reduced) |

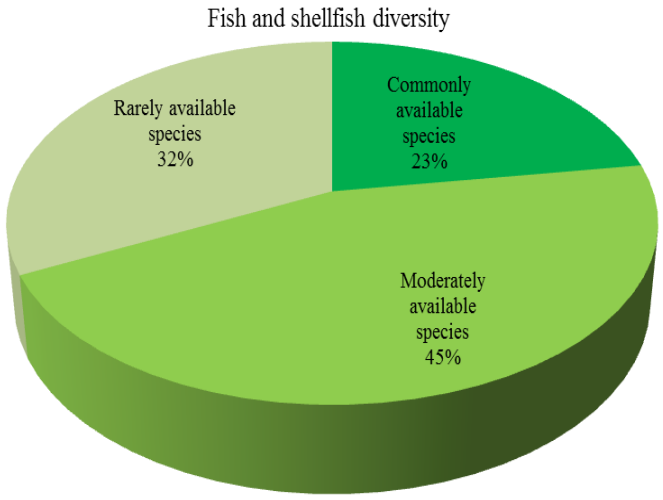


**Figure 2.** *Present status of fish and shellfish diversity in the Rupsa River.*

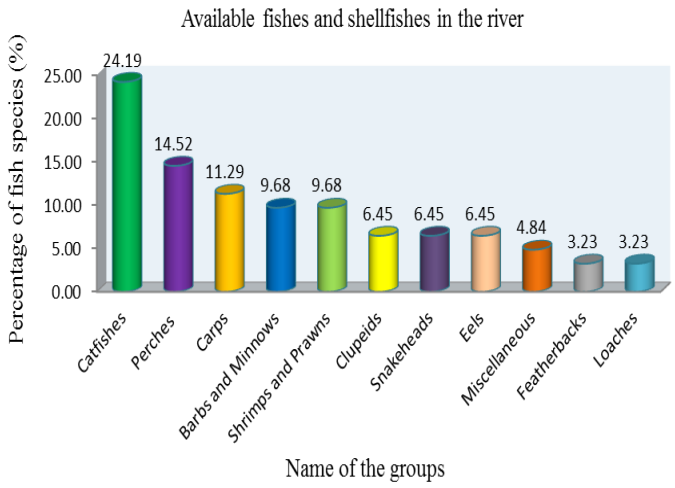


**Figure 3.** *Different types of fish groups recorded during the period of study.*

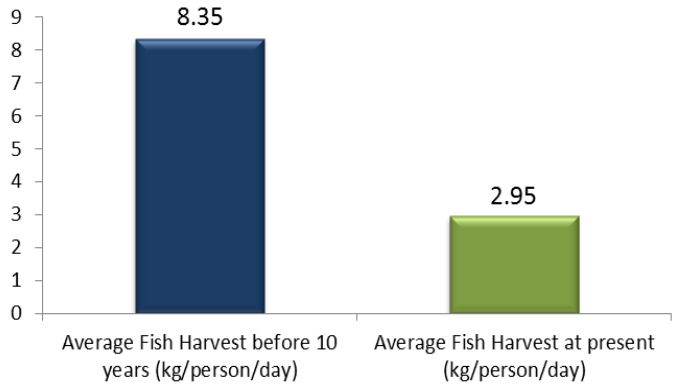


**Figure 4.** *Changes in the harvesting of fish per fisherman per day in the Rupsa River.*

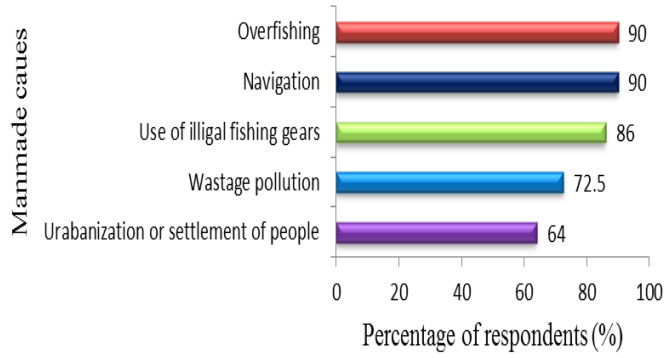


**Figure 5.** *Manmade causes responsible for fish biodiversity loss in the Rupsa River.*

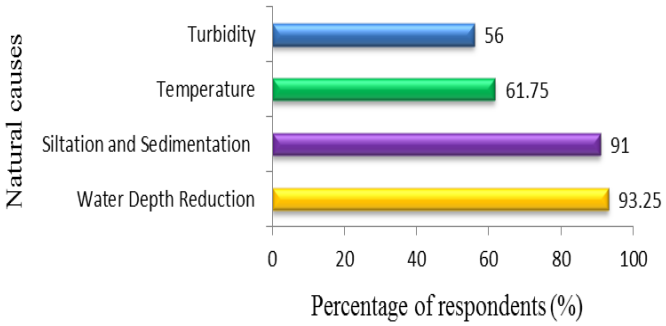


**Figure 6.** *Natural causes responsible for fish biodiversity loss.*

## Conclusion

This study is an initial effort to evaluate the fish and shellfish diversity and their decline causes on some particular points in the Rupsa River of Khulna in Bangladesh. The outcome of the study may not be the actual status of the species diversity of the river as a whole. However, factors identified in this study should be taken seriously and some actions like preventing water pollution, maintaining fishing gears, ensuring water flow, increasing fishermen's awareness, implementing fisheries laws and establishing fish sanctuary have been coming out to conserve the finfish and shellfish diversity of the river. Besides, counter and random surveys are suggested to crosscheck the fishes' status and decline causes for their proper management and conservation.

## Conflict of interest

The authors declare there are no conflicts of interest.

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