# Selectivity of Fishing Gears and Their Effects on Fisheries Diversity of Rabnabad Channel of Patuakhali District in Bangladesh

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## ABSTRACT

*The Rabnabad is a marine channel, harbor of plentiful aquatic resources, situated at southern district of Patuakhali in Bangladesh. An investigation has been carried out on three different selected spots ($S_1$, $S_2$ and $S_3$) of Rabnabad channel to identify fishing gears used for fishing and their potential effects on available fisheries diversity for a period of 8 months from February 2015 to September 2015, employing a prepared questionnaire. The study explored total 21 fishing gears under 8 major groups of net. In total, 54 species of fishes were identified belongs to 10 orders and 27 families in the catches of these gears. The order basis percentage analysis of the fish species executed the highest occurrence belongs to the order Perciformes (31.48%) and lowest for five ordersviz., Aulopiformes, Beloniformes, Osteoglossiformes, Pleuronectiformes and Tetraodontiformes were found in the percentage as 1.85% (for each) of the total fish community. Out of 54 species, 7, 2 and 7 species was recorded as endangered, critically endangered and vulnerable, respectively. Calculated Shannon- Weiner index (H), Gibson's evenness (E), Simpson's dominance index (D), Simpson's index of diversity (1-D) and Margalef's index (d) of fishes ranges between 3.22-3.30, 0.54-0.59, 0.04-0.05, 0.95-0.96 and 5.67-6.10, respectively. It is worse that numerous non-selective and restricted fishing gears are used which lead to unsorted catches, consequently, diversity of fish fauna are decreasing from the channel. For sustainability of these resources, proper management and conservation is crucial to guard the species diversity.*

**Keywords:** Conservation status, fish biodiversity, fishing gears, rabnabad channel

## INTRODUCTION

Bangladesh is exclusively artistic with extremely rich and extensive inland, coastal and marine water resources, which mainly consists of floodplains, haors, baors, beels, rivers, estuaries, coastal belt and vast sea waters. Along with potential water resources, Bangladesh is also rich in the diversity of various fish species and other important aquatic species. Hence, it is ranked fourth (DoF, 2015) [4] in fish biodiversity in Asia behind China, India and Thailand, with approximately 800 species of fresh, brackish and marine waters (Hussain and Mazid, 2001)[9]. Again, Fisheries is a sub-sector of agriculture, having a significant function in poverty alleviation, food security, nutrition supply, sources of income, employment opportunities, foreign exchange earnings and overall on the socio-economic development of Bangladesh. This sector contributes 3.69% in GDP (Gross Domestic Product) and offers 60% of the national animal protein consumption (DoF, 2015)[4].

It is important to get the contribution of different rivers and channels of the country. A vital channel of southern part of Bangladesh is Rabnabad channel, harbor of plentiful aquatic



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resources which support the lifeline of thousands of fishers. A few recent studies on various aspects of fish diversity, fishing gears and hydrographic parameters were executed on different stations of Rabnabad channel. Very first studied was imposed on the Ramnabad river adjacent to Galachipa upazilla (Hasan et al., 2014)[16]for a period of eight months from July 2012 to February 2013. Later (Ali et al., 2015)[15] on four sampling stations of Rabnabad river was studied for a period of one year from March 2013 to February 2014. Further no attempt seems to have been taken so far to study the fishing gears, their mesh size, price of nets, catch composition of different gears, fish diversity and conservation status of available fish species. However, the channel has a considerable significance for countless people directly and indirectly engaged in fishing activities for livelihood and food and also for domestic activities. But at the same time it is worse that numerous restricted, non-selective and irregular mesh sizes fishing gears are used for fishing in the channel on different stations by the fishers community without considering government rules related to fisheries and aquatic biodiversity conservation and management. A lack of understanding about the ecological consequences of the effects of removals of fish and the direct effects of fishing and fishing gear on community and ecosystem functions has produced questions about the sustainability of current levels of fishing. Hence, scientific management based studies on fisheries biodiversity and avoidance of various restricted fishing gears are the most important conservation and sustainable fisheries resource management issues. Limited scientific management based investigation was found on fishing gears and fisheries diversity in the Rabnabad channel due to its remote geographical position and distance from the main centers of fish research institute in the country. Therefore, it would be worth to conduct scientific investigation on available fishing gears and their effects on fish fauna occupied in the Rabnabad channel. Considering all the current issues, the objectives of the study designed as to identify fishing gears with their mesh size and catch composition of respective fishing gears and their effects on fish diversity in Rabnabad channel of Patuakhali district in Bangladesh.

## MATERIALS AND METHODS

### Location of study area

The study site i.e., Rabnabad channel, also recognized as Patua River or Patuakhali River, situated at southern district of Patuakhali in Bangladesh and falls between 21°52'37" N latitude and 90°16'55" E longitude. To obtain higher number of specimens of fishes sampling stations were divided into three different spots including Dhulasar ($S_1$), Lalua ($S_2$) and Dhankhali ($S_3$) (Figure 1).The investigation was conducted for a period of 8 months from February 2015 to September 2015.

### *Gears surveyed*

The fishing gears including their mesh size, price and catch composition of respective fishing gear were surveyed following a prepared questionnaire from the fishers fishing in the three dissimilar spots of Rabnabad channel. The fishing gears were categorized under different major groups followed by Ahmed N.(1971)[2].Freshly caught unsorted samples of different gears was collected and measured using a digital balance (up to 0.01 g) as well as pan balance and numerical data were expressed in kg.

*Fish specimen collection*

Fish specimens were collected from three different selected spots ($S_1$, $S_2$ and $S_3$) of Rabnabad channel. Nine fishermen were hired temporarily three from $S_1$, three from $S_2$ and three from $S_3$to carry out specimen collection process. Specimens were collected using current jal, jagat ber jal and badha jal under the group of gill net, seine net and fixed purse net, respectively as



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these nets are popular throughout the channel. Diversity of fishes were observed following lunar periodicity (full moon and new moon) as during these periods higher abundance of fishes were reported by the fishermen and fish vendors. Fish samples were also collected from the local fish landing centers and fish markets from previously contacted fishermen. Total numbers of individual species were counted in each sampling day from these three stations.

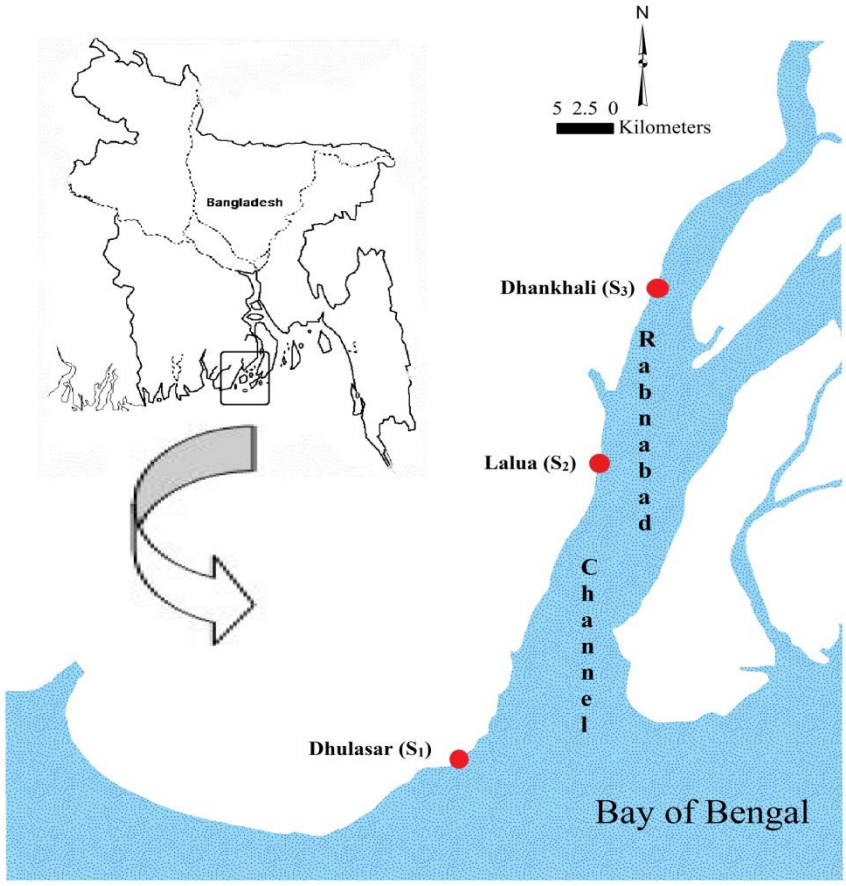


Figure 1: Geographical location of Rabnabad channel with three sampling stations ($S_1$, $S_2$ and $S_3$, manifested as red rounded).

*Laboratory analysis*

Immediately photographs were taken using a digital camera (Canon, IXUS 155) earlier to preservation since formalin decolorizes the fish color on long preservation. For laboratory study, 20% of the total catch was taken from each station in each sampling day and preserved in 10% buffered formalin solution in a previously leveled plastic jars according to size and species. In the laboratory, the collected specimens were identified to species level with the help of standard taxonomic keys followed by (Talwar and Jhingran, 1991[23], Nelson, 1994[17], Rahman, 2005[19], Hossain et al., 2007[8]).

*Biodiversity indexes*

Species diversity was assessed using five indices *viz.*, species richness, Shannon–Wiener index, Evenness and Dominance Indices. The Shannon - Weiner index and Gibson's evenness (Shannon CE and Weaver, W. 1963)[22]was measured to evaluate species diversity. The dominance index like Simpson's dominance index and Simpson's index of diversity was



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calculated to determine whether or not particular species dominate in a particular aquatic system. Margalef index (d) (Margalef, 1968)[12] was used to evaluate species richness.

*Conservation Status*

Bangladesh conservation status and population trend were detected (IUCN, 2000) [10].

*Data analysis*

For the analysis of present findings statistical analyses were carried out using Microsoft Excel 2007 and Statistical Packages for Social Sciences (SPSS) version 16.0.

## RESULTS AND DISCUSSIONS

### Fishing Gears

Generally fishing gear is one kind of equipment which used for harvesting of aquatic resources especially fish. Different types of fishing gears including their mesh size, shape, price and catch composition of individual gear were recorded from Rabnabad channel (Table 1).

**Table 1: Representation of available fishing gears with their mesh size, shape, price and catch composition documented from Rabnabad channel**

| Gear types | Local name | Mesh Size (cm) | *Shape of nets | **Price of Net (BDT) | ***ACC/ Haul/ Day/ Gear (Kg) |
|---|---|---|---|---|---|
| Gill net | Poa jal | 2.54-3.81 | RS | 10000-12000 | 5 |
| | Koral jal | 5.08-10.16 | RS | 35000-40000 | 8 |
| | Shahin jal | 7.62 | RS | 50000-65000 | 7.5 |
| | Current jal | 5.08-7.62 | RS | 35000-80000 | 18 |
| | Chandi jal | 8.89 | RS | 15000-20000 | 12.5 |
| | Khuta jal | 6.35 | RS | 6000-20000 | 7 |
| | Dara jal | 6.45-10.16 | RS | 80000-100000 | 25 |
| | Sutar jal | 10.16 | RS | ++ | 8 |
| Seine net | Jagat ber jal | 0.508 | RS | 2000-12000 | 10 |
| Fixed purse nets | Behundi jal | 0.508 | CS | 20000-35000 | 5 |
| | Badha jal | 2.54 | RS | 10000-30000 | 10 |
| Cast nets | Jhaki jal | 0.508 | CS | 3000-4000 | 0.5 |
| | Bachari jal | 1.02-2.54 | CS | 2000-4000 | 2 |
| Lift nets | Dharma jal | 0.508-1.02 | SS | 1200-2000 | 1.5 |
| Push nets | Moia jal | 0.254 | RS | 500-1000 | 1 |
| | Thela jal | 0.508 | TS | 200-500 | 1 |
| | Duba jal | 5.08 | RS | 30000 | 8.5 |
| Traps | Kholsun | MO: 2-3 | RS | 100-300 | 0.5 |
| | Anta | MO: 2-3 | RS | 120-300 | 0.5 |
| Hooks and line | Chhara Barshi | - | - | 200-500 | 0.5 |
| | Chhip Barshi | - | - | 100 | 0.3 |

*Legends:*

*Shape of nets, RS= Rectangular Shape, SS= Square Shape, CS= Conical Shape, TS= Triangular shaped, MO= Mouth Opening/ **Price of Net (BDT), ++= Government approved/ ***ACC= Average Catch Composition



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From the survey result, total twenty one (21) categories of fishing gear were explored under 8 major groups defined as Gill nets (Poa jal, Koral jal, Shahin jal, Current jal, Chandi jal, Khuta jal, Dara jal and Sutar jal), Seine net (Jagat ber jal), Fixed purse nets (Behundi jal and Badha jal), Cast nets (Jhaki jal and Bachari jal), Lift nets (Dharma jal), Push nets (Moia jal, Thela jal and Duba jal), Traps (Kholsun and Anta) and Hook and line (Chhara Barshi and Chhip Barshi). Among the different 8 major groups of fishing gears, gill net, seine net and fixed purse net were larger in size, mesh size, higher price and catch composition than other gear identified in the research area. A ready to use fishing gear price varied depending on size of the net, target species and the personnel engaged to operate the gear. The maximum size and price of Dara jal was correlated with the maximum catch composition (25 kg/day). The result suggested that gillnet, seine net and purse net considered as commercial fishing and cast net, lift net, push net, fish trap and hook and line gear considered as economic/subsistence fishing gear. The obtained result was supported by earlier studied (Ali *et. al.*, 2015)[15] on four different stations of Ramnabad river. However, total 7 gears separately were recorded from the Baral and Tistariver (F. A. Flowra et al., 2011[6], Belal et al., 2013[13]) which much lower than present finding.

Mesh size of the gears fluctuated depending on target fish species. Maximum (10.16 cm) and minimum (0.254 cm) mesh size was found in case of Sutar jal and Moia jal under the group of gill net and push net, respectively. The mesh size recorded from Rabnabad channel was found similar as mesh size 4 to 4.5 cm for ilish net, 3.5 cm for poa jal, 0.5 to 2.3 cm for jagat ber jal, 0.5 to 1.25 cm for behundi jal, 0.625 to 1.25 cm for jhaki jal and 0.5 to 2 cm for dharma jal in the Meghna river estuary (Siddiqu et al., 2013)[1].

The highest price was observed for Dara jal (80000-100000 BDT) followed by Shahin jal (50000-65000 BDT) and the lowest price were for Chhip Barshi (100 BDT). Construction cost of different nets available in the study area were observed identical from other finding as 300000 to 400000 BDT for ilish jal, 5000 to 100000 BDT for poa jal, 200000 to 300000 BDT for jagat ber jal, 200000 BDT for behundi jal, 5000 to 10000 BDT for jhaki jal and 5000 to 50000 BDT for dharma jal recorded from Meghna river estuary (Siddiqu et al., 2013) [1].

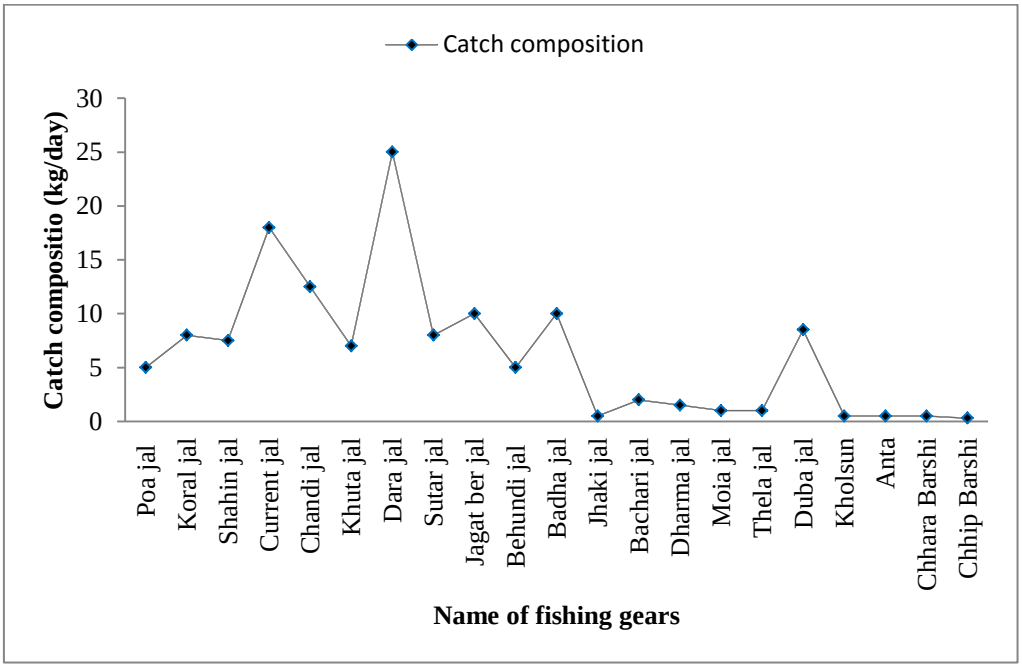


Figure 2: Catch composition of respective fishing gears recorded from Rabnabad channel



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Average catch composition (kg/day) of different fishing gears are presented in Figure 2. The highest catch composition was found for Dara jal was 25 kg/day and lowest for Chhip Barshi was 0.3 kg/day. Maximum uses of gillnet was correlated with the maximum catch composition of net. However, mean CPUE observed from gillnet, jhakijal, seine net, thela jal, lift net, traps, wounding gears, moi jal, hook and line and sutijal was 2.83 ± 0.92, 2.05 ± 0.81, 48.99 ±12.34, 2.60 ± 1.56, 2.66 ± 1.46, 4.69 ± 2.11, 1.83 ± 1.07, 3.03 ± 1.76, 3.11 ± 1.76 and 224.54 ± 126.89 kg, respectively in the Chalan beel (Sayeed et al., 2014)[14].

### *Diversity of fishes*

The present study identified total 54 species of fishes under 10 orders and 27 families from Rabnabad channel which presented with their scientific name, common English, Individual encountered and IUCN red list status of Bangladesh in the Table 2. The order basis percentage analysis of the fish species showed the highest occurrence belongs to the order Perciformes (31.48%), which was followed by 22.22%, 20.37%, 11.11%and 3.70% for Cypriniformes, Siluriformes, Clupeiformes and Synbranchiformes, respectively. Five orders*viz*., Aulopiformes, Beloniformes, Osteoglossiformes, Pleuronectiformes and Tetraodontiformes were found in the percentage as 1.85% (for each) of the total number of fish species(Figure 3).However, the earlier studied (Hasan et al., 2014) [16]showed total of twelve fishes and shellfishes in the catches of set bag net from Ramnabad river. Later studied(Ali et al., 2014)[15]identified higher number of fish species than present finding, total 64 fish species under 12 orders and 32 families were recorded from four sampling stations of Ramnabad river of which Perciformes were most leading order constituting 34.38% followed by Siluriformes (21.88%), Cypriniformes (17.19%), Clupeiformes (9.38%),Pleuronectiformes (4.69%), Tetraodontiformes (3.13%), Osteoglossiformes (1.56%), Beloniformes (1.56%), Anguiliformes (1.56%), Pristiformes (1.56%), Rajiformes (1.56%) and Aulopiformes (1.56%). Higher number of species also found from from the Gharia beel (Chakraboty and Miraza, 2007)[3], but lower number was recorded from Chanda beel (Ehshan et al., 2007)[5].

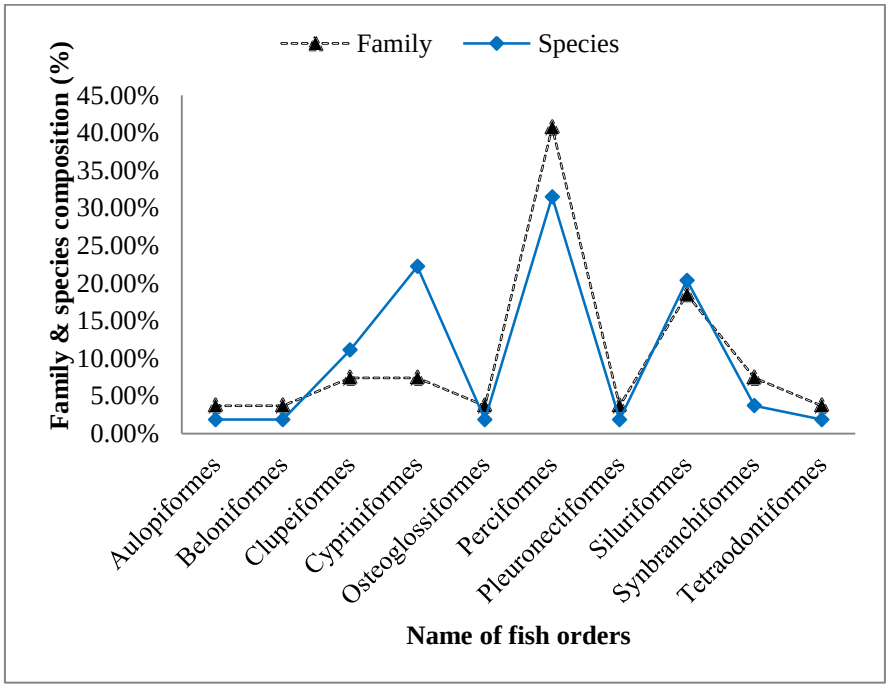


**Figure 3:** Family and fish species composition under different fish orders



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**Table 2: Systematic position of finfish species with their local name, common English name, individual encountered and IUCN red list status recorded from three sampling stations of Rabnabad channel during study period from February 2015 to September 2015**

| Order | Family | Scientific Name | Common English Name | Individual encountered | | | | **IUCN Red List Status |
|---|---|---|---|---|---|---|---|---|
| | | | | $S_1$ | $S_2$ | $S_3$ | Sub-total | |
| Aulopiformes | Synodontidae | *Harpadon nehereus* (Hamilton, 1822) | Bombay duck | 7 | 0 | 0 | 7 | NA |
| Beloniformes | Belonidae | *Xenentodon cancila* (Hamilton, 1822) | Freshwater garfish | 13 | 19 | 14 | 46 | NA |
| Clupeiformes | Clupeidae | *Tenualosa ilisha* (Hamilton, 1822) | Hilsa shad | 231 | 197 | 164 | 592 | NA |
| | | *Tenualosa toli* (Valenciennes, 1847) | Toli shad | 56 | 16 | 0 | 72 | NA |
| | | *Corica soborna* (Hamilton, 1822) | Ganges river sprat | 264 | 293 | 270 | 827 | NO |
| | | *Gudusia chapra* (Hamilton, 1822) | Indian river shad | 67 | 86 | 31 | 184 | NO |
| | Engraulidae | *Setipinna phasa* (Hamilton, 1822) | Gangetic hairfin anchovy | 40 | 0 | 33 | 73 | NO |
| | | *Thryssa purava* (Hamilton, 1822) | Oblique-jaw thryssa | 103 | 113 | 186 | 402 | NO |
| Cypriniformes | Cobitidae | *Lepidocephalichthys guntea* (Hamilton, 1822) | Guntea loach | 0 | 79 | 57 | 136 | NO |
| | | *Botia dayi* (Hora, 1932) | Hora loach | 41 | 31 | 23 | 95 | DD |
| | | *Botia lohachata* (Chaudhuri, 1912) | Reticulate loach | 7 | 4 | 0 | 11 | EN |
| | Cyprinidae | *Puntius sophore* (Hamilton, 1822) | Spot fin swamp barb | 47 | 61 | 71 | 179 | NO |
| | | *Puntius ticto* (Hamilton, 1822) | Ticto barb | 0 | 79 | 56 | 135 | VU |
| | | *Salmostoma bacaila* (Hamilton, 1822) | Large razorbelly minnow | 154 | 65 | 253 | 472 | NO |
| | | *Esomus danricus* (Hamilton, 1822) | Flying barb | 12 | 7 | 16 | 35 | NO |
| | | *Labeo rohita* (Hamilton, 1822) | Rohu | 3 | 0 | 4 | 7 | NA |
| | | *Gibelion catla* (Hamilton, 1822) | Catla | 5 | 0 | 7 | 12 | NO |
| | | *Devario devario* (Hamilton, 1822) | Sind danio | 62 | 121 | 99 | 282 | NO |



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | *Rohtee cotio* (Hamilton, 1822) | Cotio | 22 | 27 | 18 | 67 | EN |
| | | *Amblypharyngodon microlepis* (Bleeker, 1853) | Indian carplet | 156 | 259 | 293 | 708 | NO |
| Osteoglossiformes | Notopteridae | *Chitala chitala* (Hamilton, 1822) | Clown knife fish | 5 | 4 | 3 | 12 | EN |
| Perciformes | Ambassidae | *Chanda nama* (Hamilton, 1822) | Elongate glassy perchlet | 0 | 9 | 11 | 20 | VU |
| | Anabantidae | *Anabas testudineus* (Bloch, 1792) | Climbing perch | 13 | 7 | 14 | 34 | NO |
| | Channidae | *Channa punctatus* (Bloch, 1793) | Spotted snakehead | 0 | 18 | 25 | 43 | NO |
| | | *Channa marulius* (Hamilton, 1822) | Giant snakehead | 6 | 7 | 3 | 16 | EN |
| | | *Channa striatus* (Bloch, 1793) | Striped Snaked | 0 | 24 | 35 | 59 | NO |
| | Eleotridae | *Eleotris fusca* (Forster, 1801) | Dusky sleeper | 169 | 201 | 192 | 562 | NA |
| | Gobiidae | *Glossogobius giuris* (Hamilton, 1822) | Tank Goby | 144 | 163 | 206 | 513 | NO |
| | | *Pseudapocryptes elongatus* (Cuvier, 1816) | Lanceolate goby | 0 | 61 | 59 | 120 | NA |
| | | *Odontamblyopus rubicundus* (Hamilton, 1822) | Rubicusdus eelgoby | 0 | 0 | 97 | 97 | NO |
| | | *Taenioides cirratus* (Blyth, 1860) | Whiskered Eel Goby | 97 | 167 | 186 | 450 | NO |
| | Latidae | *Lates calcarifer* (Bloch, 1790) | Giant perch | 5 | 9 | 7 | 21 | NA |
| | Nandidae | *Nandus nandus* (Hamilton, 1822) | Mottled Nandus | 47 | 37 | 42 | 126 | VU |
| | Osphronemidae | *Trichogaster fasciata (*Bloch & Schneider, 1801) | Banded gourami | 33 | 55 | 30 | 118 | NO |
| | Polynemidae | *Polynemus paradiseus* (Linnaeus, 1758) | Paradise threadfin | 67 | 83 | 59 | 209 | NO |
| | Sciaenidae | *Otolithoides pama* (Hamilton, 1822) | Pama croaker | 7 | 0 | 0 | 7 | NA |
| | | *Nibea soldado* (Lacepède, 1802) | Silver jew | 91 | 101 | 107 | 299 | NA |
| | Sillaginidae | *Sillaginopsis panijus* (Hamilton, 1822) | Flathead sillago | 136 | 140 | 145 | 421 | NA |
| Pleuronectiformes | Cynoglossidae | *Cynoglossus cynoglossus* (Hamilton, 1822) | Bengal tongue sole | 17 | 8 | 7 | 32 | NO |
| | | *Mystus vittatus* (Bloch, 1794) | Striped River Catfish | 28 | 23 | 17 | 68 | NO |



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Siluriformes | Bagridae | *Sperata aor* (Hamilton, 1822) | Long-whiskered Catfish | 26 | 34 | 21 | 81 | VU |
| | | *Mystus tengara* (Hamilton, 1822) | Tengra catfish | 0 | 65 | 41 | 106 | NO |
| | | *Rita rita* (Hamilton, 1822) | Rita | 4 | 0 | 9 | 13 | CR |
| | Heteropneustidae | *Heteropneustes fossilis* (Bloch, 1794) | Stinging catfish | 11 | 17 | 9 | 37 | NO |
| | Pangasiidae | *Pangasius pangasius* (Hamilton, 1822) | Yellowtail catfish | 7 | 8 | 7 | 22 | CR |
| | Sisoridae | *Gagata gagata* (Hamilton, 1822) | Gangetic gagata | 21 | 29 | 46 | 96 | NO |
| | | *Wallago attu* (Bloch & Schneider, 1801) | Freshwater Shark | 26 | 35 | 32 | 93 | NO |
| | | *Bagarius bagarius* (Hamilton, 1822) | Goonch | 17 | 21 | 13 | 51 | EN |
| | Schilbeidae | *Silonia silondia* (Hamilton, 1822) | Silond catfish | 0 | 12 | 8 | 20 | EN |
| | | *Ailia coila* (Hamilton, 1822) | Gangetic ailia | 6 | 14 | 13 | 33 | VU |
| Synbranchiformes | Mastacembelidae | *Mastacembelus armatus* (Lacepède, 1800) | Zig-zag eel | 4 | 5 | 3 | 12 | EN |
| | | *Macrognathus aculeatus* (Bloch, 1786) | Lesser spiny eel | 57 | 93 | 28 | 178 | VU |
| | Synbranchidae | *Monopterus cuchia* (Hamilton, 1822) | Swamp eel | 3 | 2 | 4 | 9 | VU |
| Tetraodontiformes | Teraodontidae | *Tetraodon fluviatilis* (Hamilton, 1822) | Green puffer fish | 23 | 16 | 25 | 64 | NO |
| | | | Total | 2360 | 2925 | 3099 | 8384 | |

*LC= Least Concern, DD= Data Deficient, NO= Not threatened, CR= Critically Endangered, EN= Endangered, VU= Vulnerable, NA= Not Assessed*

*Biodiversity status*

To get a better description of fish diversity, a measurement of Shannon- Weiner index (H), Gibson's evenness (E), Simpson's dominance index (D), Simpson's index of diversity (1-D) and Margalef's index (d) of fishes of Rabnabad channel were undertaken (Table 3).

**Table 3: Different equation used for calculation of diversity indexes of available species recorded from three different sampling stations of Rabnabad channel**

| Variable | | $S_1$ | $S_2$ | $S_3$ |
|---|---|---|---|---|
| Taxa_ S | | 45 | 47 | 50 |
| Individuals | | 2360 | 2925 | 3099 |
| Shannon-Wiener Index (H) | $H = -\sum[(\frac{ni}{N}) \times ln(\frac{ni}{N})]$ | 3.22 | 3.32 | 3.30 |
| Gibson's evenness (E) | $E = eH/S$ | 0.56 | 0.59 | 0.54 |
| Simpson's dominance index (D) | $D = \sum[\frac{ni(ni-1)}{N(N-1)}]$ | 0.05 | 0.04 | 0.05 |
| Simpson's index of diversity (1-D) | $1 - D = 1 - \sum[\frac{ni(ni-1)}{N(N-1)}]$ | 0.95 | 0.96 | 0.95 |
| Margalef's index (d) | $d = S-1/lnN$ | 5.67 | 5.76 | 6.10 |

*Legends: N=Total number of organisms of all species found, ni=number of individuals of a particular species, i = an index number for each species present in a sample, S= the number of species of a single population and ln = the natural log of the number, ∑ =sum the values for each species.*

Shannon-Weiner index (H) affects both number of species and evenness of a community of population, diversity increases as both increases. When all species that made up a population community are equally abundant, diversity is shown in higher. From the study area, the H values found to be higher in $S_2$ (3.32) followed by $S_3$- 3.30 and lower in $S_2$- 3.22. The value of Evenness (E) varied between 1 and 0. The closer to 1 the more even the populations of fish that form the community. Gibson's evenness (E) was shown as 0.56, 0.59 and 0.54 for $S_1$, $S_2$ and $S_3$, respectively. The bigger the Simpson's dominance index (D) value usually ranges from 0 to 1, the smaller the biodiversity. The Simpson's index of diversity (1-D) value also ranges between 0 and 1, the greater the value, the greater the sample diversity. The value of D was found 0.05, 0.04 and 0.05 for $S_1$, $S_2$ and $S_3$, respectively. But the value of 1-D occurred 0.95, 0.96 and 0.95 for $S_1$, $S_2$ and $S_3$, respectively. The Margalef's index (d) was happen maximum in $S_3$ (6.10) followed by $S_2$- 5.76 and minimum in $S_1$- 5.67.

Among the three different sampling stations, $S_3$ was found to be the most diversified in terms of both number of species and individuals followed by $S_2$. The diversity indexes of present findings were much higher than the result of Aami river (Pallavi Shukla and Ajay Singh, 2013)[18]. But lower than the calculated value of diversity indices of Choto Jamuna river (Galib etal., 2013)[21].

*Conservation status*

A total of 54 species are threatened in Bangladesh of which 14 species are vulnerable, 28 species are endangered and 12 species are critically endangered (IUCN, 2000)[10].



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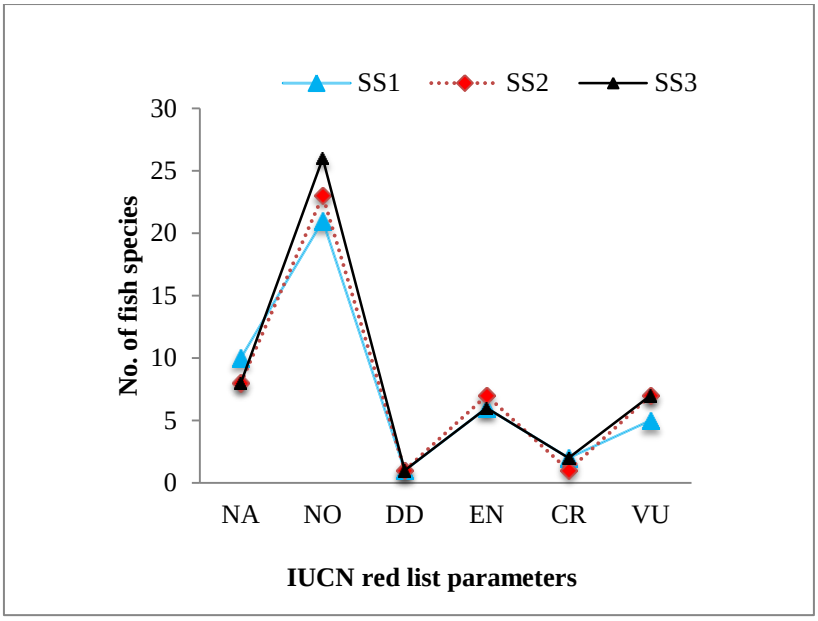


Figure 4: IUCN red list status of recorded fishes from three sampling stations of Rabnabad channel

But from the study area total 7 endangered, 2 critically endangered and 7 vulnerable species were detected from three sampling stations (figure 4).These are due to excess fishing pressure by non-selective, illegal and restricted fishing gears. One of the major causes of declining of fishes from the channel is the indiscriminate killing of small fishes in the early stage by various small size fishing gears like moia jal and badha jal under the group of push net and seine net respectively. Moia jal is mainly used to catch fry, fingerling and larvae of target species. Besides marked species other collected fry of several species are counted as trash fish which left in the catchment areas in unused form in the death condition. This gear is also responsible for declining benthic organisms, primary producer, alter food web, reducing bottom roughness, removing burrows and pits producing taxa and finally heavy siltation. Another destructive fishing gear is badha jal which placed in the shallow water of the channel during high tide and when the low tide reaches away from the lower border of the net, the fishes are caught. The catch composition of the netis ranging from small to large size species consequently density of both targeted and non-targeted species declined from the channel. A vast negative net for fish community is jagat ber jal under the group of seine are set in the profound water at the surface and extend down into the water column. Once the fish are encircled, the bottom of the net is pulled together to enclose the fish. The impacts of the net are found as like moia jal. This net cause damaged of breeding grounds, captured brood fish and reduced fish fries.

The majors group of net like cast net, lift net, traps and hook and line are not destructive and could be allowed to operate round the year to catch fish in the channel. But stationary nets (gill nets) especially current jal much accountable for turning down spawners from the Rabnabad channel. The findings were supported by (Rahmanet al., 1999)[20]. Besides, fishing gears other factors like agricultural runoff, shipment yards, discharge of oil from launch, steamer and mechanical trawlers, chemical wastages from agro-industrial sources fall through the drainage and polluted the water quality, consequently destroying the spawning, nursing and feeding grounds of many commercially important fish species of the channel. Some of these problems are also shown in other water body of Bangladesh (Sayeed et al., 2014[14], Galib et al., (2009)[7].So government as well as fisheries related organizations should take a conservation manner to guide the fishes in the channel from extinction as conservation of fish



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diversity is essential to maintain ecological/nutritional and socio-economic equilibrium (Lakra, 2010)[11].If the fishing effort decreased, then the density of fish biodiversity and the Shannon-Weiner diversity index will be increased.

## CONCLUSION

Fishing is one of the most widespread human impacts to the water body. The removal of fish for human consumption from the river has effects not only on the target species but also on associated communities. The study is a preliminary attempt to understand the fish fauna of different stations of Rabnabad channel. The ecosystem of Rabnabad channel still supports diverse types of fish species. But increased fishing pressure exerted from overfishing activities by the fishers community that operating current jal, jagat ber jal, badha jaland moia jal in the channel causes destruction of habitat, feeding, spawning and nursing grounds and also agricultural farming activities around the channel as factors that were probably responsible for lowing fisheries biodiversity gradually. This study could give out as baseline data in assisting the water bodies in management and conservation of aquatic resources especially fishes. Government and Fisheries research institution along with different agencies must take immediate action through public awareness and education to protect the ecosystem of these valuable fish species from extinction and to develop more feasible strategy as conservation measures.

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