

# Ichthyofauna Diversity in the Churni River, West Bengal: An In-Depth Analysis of Seasonal Variations

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**Abstract:** *The present study was carried out a qualitative and quantitative assessment of diversity of ichthyofauna in river Churni, West Bengal, India during pre- and post-monsoon seasons. The ichthyofauna species diversity indices such as total specimens (N), Shannon diversity index (H'), Index of Dominance (C), Berger-Parker Dominance Index, and Margalef's species richness index (S) and Gini coefficient (G) index were calculated. An increasing trend of total number of species (20 nos.), total numbers of organisms (1599 nos.), diversity index (2.90), Index of Dominance (0.94) and Margalef species richness (2.60) in post-monsoon when compared to pre-monsoon (18, nos., 1331 nos., 2.80, 0.93 and 2.40). While a decreasing trend of Berger-Parker Dominance Index (0.09) and Gini coefficient (0.28) in post-monsoon when compared to pre-monsoon (0.11 and 0.28) were obtained. It is concluded that the diversity of ichthyofauna was observed lower during pre- and post-monsoon period, which may be due to environmental pollution in the river Churni. Moreover, the in situ conservation methods may help to maintain aquatic diversity. It is suggested in future to evaluate the physico-chemical properties and the concentration of metal (loids) in the river water and sediment.*

**Keywords:** Ichthyofauna diversity, Fish diversity, Churni river, Water pollution, Biodiversity indices, West Bengal

## 1. Introduction

India is well-known for an important mega diversity country, claims the 9th position in the world related to freshwater diversity<sup>[1]</sup> having about 2500 fish species in total as per earlier study by Kar et al.<sup>[2]</sup>

West Bengal is called as a land of rivers because, large numbers of rivers comprise a network just like blood vessels which look like inhabiting a rich and diversified fish fauna characterized by many rare and endemic fish species. Several authors conducted studies on the diversity of freshwater fish fauna of India.<sup>[3-7]</sup>

As per the report of Thakur,<sup>[8]</sup> the river namely Mathabhanga-Churni is a tributary of the river Ganga. It is originated in Bangladesh territory by leaving the main channel of the Ganges about 16km underneath the point where the river Jalangi separated. This river bifurcates into two branches after inflowing Krishnaganj of Nadia district, West Bengal and the eastern branch is called as the river Ichamati and the western branch called the river Churni, which flows (43km) west and ultimately falls into the river Hooghly located at Chakdaha in the Nadia district.

To date, the aquatic diversity is under stress due to impacts induced by human, majorly included detrimental effects on fish and their habitats.<sup>[9-14]</sup> In any river, the environmental degradation is led to loss of its diversity. There has been definite declination in fish diversity found to be an indicator for hazardous impact in aquatic ecosystem. Many authors reported that the river Churni found with the problem of environmental degradation.<sup>[15-17]</sup> According to Das and Chakrabarty,<sup>[18]</sup> 63.6% of fish species appeared to have been eliminated from the polluted Churni River since 1983 in 20 years.

The objective of the present study was to examine the ichthyofauna diversity as per pre- and post-monsoon seasons in the river Churni, West Bengal.

## 2. Materials and Methods

### Selection of study area

The study site was selected in the bank of river Churni at Kalinarayanpur (Latitude = 23° 12'N and Longitude = 88° 34'E), West Bengal, India. The Google Earth image is depicted in Fig 1.



Figure 1: Google Earth image showing the study site

**Diversity assessment**

A total of 100m line transects were done randomly weekly once (3hrs. duration) in the study site during pre-monsoon and post-monsoon period (in the year 2021) and taken help from netting by fish catchers as per protocol of Bhakta and Bandyopadhyay.<sup>[19]</sup> Each species of fish was photographed and identified with the help of research articles and books.<sup>[20-22]</sup>

**Qualitative and quantitative assessment of insect and butterfly species**

Insect and butterfly diversity indices such as total specimens (N), Shannon diversity index (H'), Index of Dominance (C), Berger-Parker Dominance Index, and Margalef's species richness index (S), Gini coefficient index were calculated.<sup>[23-28]</sup> The formulae are as follows:

Shannon-Wiener diversity index (H') =  $-\sum P_i \ln P_i$   
 ..... (1)

where, P<sub>i</sub> is proportion of species i relative to the total number of species, and lnP<sub>i</sub> is natural logarithm of this proportion.

Index of Dominance (C) =  $\sum (n_i/N)^2$   
 ..... (2)

where, n<sub>i</sub> = importance value for each species (number of individuals), N = total number of importance value

Berger-Parker Dominance Index =  $N_{max} / N$   
 ..... (3)

where, N<sub>max</sub> is the number of Individuals of a species, and N is total population of birds.

Margalef's species richness =  $S-1 \div \ln N$   
 ..... (4)

where, S = number of species, ln N = natural logarithm of the total number of individuals

Where, n = number of values observed and i = rank of values in ascending order

Finally, Whitaker plot or rank-abundance curve was studied to know the abundance rank (X axis) and Y-axis relative abundance (Y axis). Further, it is used to visualize species richness and evenness simultaneously.<sup>[29]</sup> A Lorenz curve was studied to evaluate phenomena such as disproportionate distribution of species abundance in a community and to know the degree of inequality in abundance in a community.

The values of different biodiversity indices were calculated by using online tool viz. Biodiversity calculator developed by AL Young Studio ([https://www.alyoung.com/labs/biodiversity\\_calculator.html?rand](https://www.alyoung.com/labs/biodiversity_calculator.html?rand)).

**3. Results**

Table 1 describes the diversity of ichthyofauna in river Churni during pre-monsoon near the study site. The qualitative and quantitative assessment indicated that the variety of ichthyofauna were observed in the study site. There were about 18 varieties of species were recorded. Maximum species of total numbers of *Oreochromis mossambicus* (142 nos.) followed by *Labeo bata* (131 nos.) and *Anguilla bengalensis* (126 nos.) while minimum numbers of *Heteropneustes fossilis* (14 nos.) were obtained.

**Table 1:** Diversity of fish fauna in Churni river site during pre-monsoon

| Sl. No. | Common name    | Scientific name                    | Total no. of species |
|---------|----------------|------------------------------------|----------------------|
| 1.      | Rui            | <i>Labeo rohita</i>                | 103                  |
| 2.      | Tilapia        | <i>Oreochromis mossambicus</i>     | 142                  |
| 3.      | Ban            | <i>Anguilla bengalensis</i>        | 126                  |
| 4.      | Phesa          | <i>Setipinna phasa</i>             | 47                   |
| 5.      | Khoira         | <i>Gonialosa manmina</i>           | 41                   |
| 6.      | Lylantica      | <i>Oreochromis niloticus</i>       | 73                   |
| 7.      | Common carp    | <i>Cyprinus carpio</i>             | 29                   |
| 8.      | Mourala        | <i>Amblypharyngodon mola</i>       | 103                  |
| 9.      | Silver carp    | <i>Hypophthalmichthys molitrix</i> | 37                   |
| 10.     | Grass carp     | <i>Ctenopharyngodon idellus</i>    | 41                   |
| 11.     | Katla          | <i>Catla catla</i>                 | 107                  |
| 12.     | Mrigal         | <i>Cirrhinus mrigala</i>           | 102                  |
| 13.     | Bata           | <i>Labeo bata</i>                  | 131                  |
| 14.     | African pangus | <i>Pangasius sutchi</i>            | 47                   |
| 15.     | Olive barb     | <i>Puntius sarana sarana</i>       | 58                   |
| 16.     | Ticto barb     | <i>Puntius ticto</i>               | 51                   |
| 17.     | Singi          | <i>Heteropneustes fossilis</i>     | 14                   |
| 18.     | Koi            | <i>Anabas testudineus</i>          | 79                   |

Table 2 describes the diversity of ichthyofauna in river Churni during post-monsoon near the study site. The qualitative and quantitative assessment indicated that the variety of ichthyofauna were observed in the study site. There were about 20 varieties of species were recorded.

Maximum species of total numbers of *Labeo rohita* (155 nos.) followed by *Oreochromis mossambicus* (147 nos.) *Labeo bata* (137 nos.) and *Anguilla bengalensis* (126 nos.) while minimum numbers of *Sperata seenghala* (29 nos.) were obtained.

**Table 2:** Diversity of fish fauna in Churni river site during post-monsoon

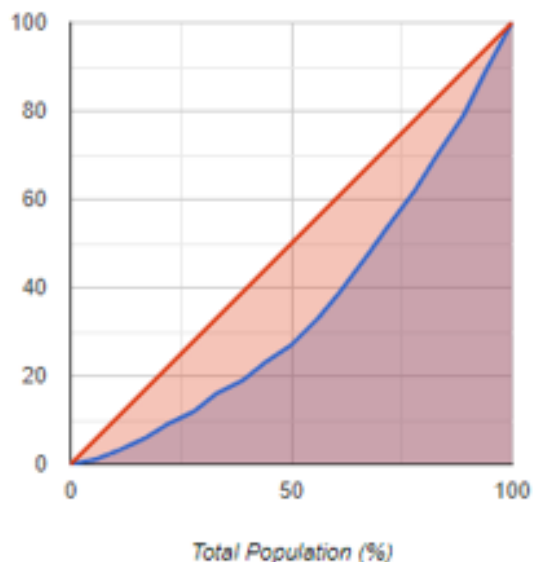
| Sl. No. | Common name         | Scientific name                    | Total no. of species |
|---------|---------------------|------------------------------------|----------------------|
| 1.      | Rui                 | <i>Labeo rohita</i>                | 155                  |
| 2.      | Tilapia             | <i>Oreochromis mossambicus</i>     | 147                  |
| 3.      | Ban                 | <i>Anguilla bengalensis</i>        | 131                  |
| 4.      | Phesa               | <i>Setipinna phasa</i>             | 51                   |
| 5.      | Khoira              | <i>Gonialosa manmina</i>           | 47                   |
| 6.      | Lylantica           | <i>Oreochromis niloticus</i>       | 79                   |
| 7.      | Common carp         | <i>Cyprinus carpio</i>             | 37                   |
| 8.      | Mourala             | <i>Amblypharyngodon mola</i>       | 109                  |
| 9.      | Silver carp         | <i>Hypophthalmichthys molitrix</i> | 46                   |
| 10.     | Grass carp          | <i>Ctenopharyngodon idellus</i>    | 47                   |
| 11.     | Katla               | <i>Catla catla</i>                 | 119                  |
| 12.     | Mrigal              | <i>Cirrhinus mrigala</i>           | 109                  |
| 13.     | Bata                | <i>Labeo bata</i>                  | 137                  |
| 14.     | African pangus      | <i>Pangasius sutchi</i>            | 56                   |
| 15.     | Olive barb          | <i>Puntius sarana sarana</i>       | 63                   |
| 16.     | Ticto barb          | <i>Puntius ticto</i>               | 69                   |
| 17.     | Singi               | <i>Heteropneustes fossilis</i>     | 28                   |
| 18.     | Koi                 | <i>Anabas testudineus</i>          | 89                   |
| 19.     | Pankal              | <i>Macrogathus pancalus</i>        | 51                   |
| 20.     | Giant river catfish | <i>Sperata seenghala</i>           | 29                   |

Table 3 describes different diversity indices for pre- and post-monsoon season at the site of river Churni. During post-monsoon, an increasing trend of total number of species (20 nos.), total numbers of organisms (1599 nos.), diversity index (2.90), Index of Dominance (0.94) and Margalef species richness (2.60) were obtained in comparison with pre-monsoon (18, nos., 1331 nos., 2.80, 0.93 and 2.40). While a decreasing trend of Berger-Parker Dominance Index (0.09) and Gini coefficient (0.28) were obtained in post-monsoon when compared to pre-monsoon (0.11 and 0.28).

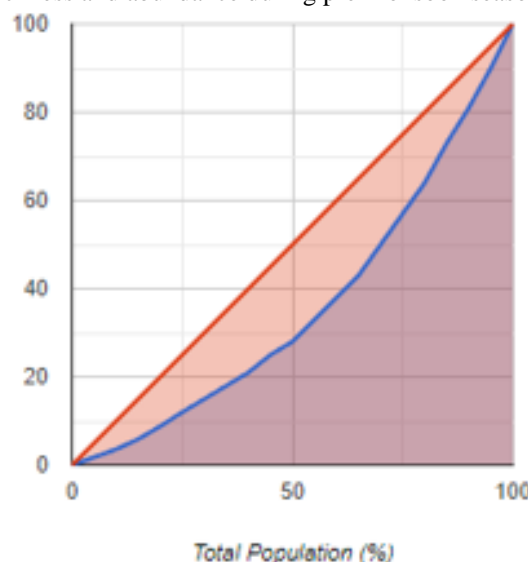
**Table 3:** Different diversity indices of the study site during pre- and post-monsoon

| Indices                        | Study site  |              |
|--------------------------------|-------------|--------------|
|                                | Pre-monsoon | Post-monsoon |
| Total No. of species           | 18          | 20           |
| Total No. of organisms         | 1331        | 1599         |
| Shannon-Wiener diversity index | 2.80        | 2.90         |
| Index of Dominance             | 0.93        | 0.94         |
| Berger-Parker Dominance Index  | 0.11        | 0.09         |
| Margalef species richness      | 2.40        | 2.60         |
| Gini coefficient               | 0.29        | 0.28         |

In Lorenz curve (Fig 1 and 2), it was noted the equal species abundance in which every species has the same population size. The Gini coefficient is the ratio of the area between the line of equality and Lorenz curve and the ranges observe between 0 and 1. In the present study, the values were found lower abundance as per Gini index (0.29 and 0.28) during pre- and post-monsoon seasons.



**Figure 1:** Lorenz graph for inequality in total species richness and abundance during pre-monsoon season



**Figure 2:** Lorenz graph for inequality in total species richness and abundance during post-monsoon season

#### 4. Discussion

The diversity study of Ichthyofauna of the River Churni has indicated that there are some variations in quality and quantity regarding fish species as per the pre- and post-monsoon seasons.

In an earlier study, Bakshi and Panigrahi<sup>[17]</sup> reported that about 15 species observed in pre-monsoon season while 17 species in post-monsoon period at upstream site of river Churni, which is supported the present study. But they also evaluated in midstream with the availability of fish species (22 and 21 nos.) during pre- and post-monsoon seasons.

As per the report of Thakur,<sup>[8]</sup> several industrial activities in the riverbank from Bangladesh and India are leading cause of river pollution. In the present study, maximum species of total numbers of *Oreochromis mossambicus* (142 nos.) followed by *Labeo bata* (131 nos.) and *Anguilla bengalensis* (126 nos.) while minimum numbers of *Heteropneustes fossilis* (14 nos.) were obtained during pre-monsoon season.



While maximum species of total numbers of *Labeo rohita* (155 nos.) followed by *Oreochromis mossambicus* (147 nos.) *Labeo bata* (137 nos.) and *Anguilla bengalensis* (126 nos.) while minimum numbers of *Sperata seenghala* (29 nos.) were obtained during post-monsoon. Regarding exotic fish species (*Oreochromis mossambicus*), a similar result was observed, which is confirmed by the previous works.<sup>[19,30]</sup>

## 5. Conclusion

It is concluded that the diversity of ichthyofauna was observed lower during pre- and post-monsoon period, which may be due to environmental pollution in the river Churni. Moreover, the *in situ* conservation methods may help to maintain aquatic diversity. It is suggested in future to evaluate the physico-chemical properties and the concentration of metal(oids) in the river water and sediment.

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## Conflict of interest

Authors declare no conflict of interest in the study and preparation of manuscript.

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