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FISH DIVERSITY IN RELATION TO HABITAT OF RAPTI RIVER, CHITWAN

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Abstract: The Rapti River originates in the Mahabharat Range in Central Nepal and flows east to west through the inner Terai region, passing through the Chitwan Valley. It harbors to diverse wildlife, different fish species and other aquatic animals. The study aimed to explore baseline information on the diversity and abundance of fish species and their relationship with environmental variables. A study was carried out to understand the diversity of fish in Rapti River at three different stations. A total of 25 species of fishes belonging to 6 orders, 12 families and 18 genera were recorded. Among the orders, Cypriniformes had the highest number of species (52%) followed by Siluriformes (24%), Perciformes (12%) while Tetraodontiformes, Synbranchiformes, Beloniformes represented each about by 4%. Fish conservation in Rapti River was very effective because only license holder fisherman can catch the fish in river. Local fisherman believed that traditional medicinal benefits of fish species like *Puntius ticto* supports to increased milk production during breast feeding and some fish species like *Glyptothorax telchitta, Puntius ticto* and *Garua bachcha* were declining day by day due to various anthropogenic activities like pollution, regular fishing, illegal fishing and so on.

Keywords: Anthropogenic activities, Chitwan, Fish conservation, Fish diversity, Nepal, Rapti River.

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INTRODUCTION

Nepal is one of the richest countries, blessed with an abundance of water resources with so many rivers and rivulets. Koshi, Karnali and Gandaki are the three main river systems. The size, origin, and flow characteristics of Nepal's rivers are used to classify them as large, medium, or small (Adhikari *et al.,* 2013). With more than 6,000 rivers dispersed throughout the nation, Nepal is renowned for its high diversity of freshwater fish species, a quality that is attributed to the country's distinct geographical structure (Limbu and Prasad, 2019).

The term 'Rapti' can refer to a number of different geographical areas, such as the Rapti River, which can be either the East or West Rapti River. The Rapti River originates in the Mahabharat Range

(lower Himalayas) in Central Nepal. It flows east to west through the inner Terai region, passing through the Chitwan Valley. Its tributaries include Lothther and Manahari on the right, and Samari, Karra, Kukhreni, Reu, and Panchand on the left. A wide variety of fish and other aquatic species are sustained by the Rapti River, which is essential to the aquatic environment. Although there have been a lot of human-caused impacts on the Rapti River, mostly from sand mining, agricultural runoff containing pesticides, and unauthorized fishing (Bhatta and Shrestha, 1973; Dubey and Arya, 2022).

Sah (2018) recorded a total of 33 fish species recognized in the Narayani River; the majority of them are migratory. The majority of these species can be found in the middle of the water column, with fewer in rock crevices and on the stream bottom. Fish distribution in the river is categorized, with the most diversity in the mid-water column and the least in rock crevices and streambed areas. Sah (2023) reported that Trisuli River has 23 fish species reported from various places. Nepal currently has 252 different species of fish (Shrestha, 2019).

Numerous ichthyologists from India, Nepal, Bangladesh and around the world have recorded several peculiar fish species via their researches including Prakash and Verma (2015), Ashok (2017), Shrestha (2019) and Chakraborty *et al.* (2021a).

Oli *et al.* (2013) analysis of physicochemical parameters in Rampur Ghol and indicated the considerable seasonal changes in water quality, yet the water is still appropriate for fish. Rampur Ghol has a diverse fish population, with 22 species representing 13 families and five orders. However, the study found a significant drop in both fish species and abundance compared to previous data. According to Jha (2018), Chitwan district is endowed with varied aquatic resources, which harbor diverse fish species in central Nepal. A total of 86 fish species from 18 families and 46 genera were recorded in the Narayani and Rapti rivers by Dhakal (2018). Anthropogenic activities, pollution and unethical agriculture influence the fish distribution in a particular area (Verma, 2018; Chakraborty *et al.*, 2021b; Prakash and Verma, 2022; Singh *et al.*, 2023). Distribution and sustainable development of fisheries depend upon many factors (Wichert and Rapport, 1998; Prakash, 2021; Hemprabha and Arya, 2024).

The present study was aimed to explore baseline information on the diversity and abundance of fish species and their relationship with environmental variables. Besides, physico-chemical parameters such as water temperature, pH, DO etc. were also analyzed during field visit.

MATERIALS AND METHODS

Sampling sites

The three sampling sites at Rapti River were identified for an initial survey, i.e. Lamaghat (Station I), Sundighat (Station II) and Daraibote Taal (Station III). Fishing was allowed only to licensed fishermen and restricted to other people. These three different sampling locations were classified by characteristics such as water current, confluence spots, and human intervention, the riverbed, which is made up of pebbles, sand, and cobbles. The survey was conducted between January and December 2024.

Station I (Lamaghat): Undisturbed area with large rocks, little sand, high water current, and grasses.

Station II (Sundighat): Disturbed area with human activities like fishing and cattle grazing.

Station III (Daraibote Taal): Undeveloped area with large stones, gravel, sand, and the presence of aquatic animals like crocodiles and bird crocodiles, birds were found.

Collection of fish and identification

The different samples of fishes were collected from every sampling station. Fishes were collected using various methods; including cast nets with a 6 mm × 6 mm mesh size, bamboo fish traps, and mosquito nets, during the hours of 7 am to 4 pm at different stations with the help of local fishermen. Habitat and their local name, and morphological details were noted for taxonomic confirmation at the time of collection with the help of local fishermen. The fishes were

photographed before being preserved in 10% formalin solution with their heads positioned upside down to protect their caudal fins. The specimens were then taken to the Zoology laboratory of Birendra Multiple Campus, Nepal for identification. Shrestha (2019) taxonomic references were used for identification, up to the species level.

Fig. 1: Study area and sampling sites in Rapti River, Chitwan, Nepal.

Environmental variables

The environmental factors measured during each field visit were: water temperature, air temperature, pH, and water velocity. A digital thermometer was used to measure the water temperature by placing it in the water at a depth of 0.3m, and air temperature was measured with a digital thermometer. The pH was measured by using a pH meter and DO was calculated with a Winkler titrimetric method. The float method, which involves a stopwatch and measuring tape, was used to measure water velocity.

Fish identification

Fishes were identified as:

1. Fin rays of each fin like dorsal, pelvic, ventral, anal, and caudal were counted by the help of forceps.
2. Numbers of barbels were counted with the forceps with a pointed tip.
3. Number of scales:

a) along the lateral line.

b) from the base of the dorsal fin to downwards anteriorly in the same oblique line to the ventral surface.

The data collected in such a way from the Rapti River were entered into the Microsoft Excel spreadsheet and analyzed using descriptive statistics.

RESULTS

Author reported a sum of 25 fish species from different sites of the Rapti river, which were identified as:

1. ***Puntius ticto*** **(Tite Pothi, Sidra)**
   Diagnostic character: D9 (2/7); P12; V8; A8 (2/6); C16
   Total length: 6cm

2. ***Paracanthocobitis botia* / *Nemacheilus botia* (Baghe, Pate Gadela, Goira)**
Diagnostic character: D12 (2/10); P10; V7; A7 (2/5); C17
Total length: 6.5cm

3. ***Mystus tengara* (Tenger)**
Diagnostic character: D8 (1/7); P10 (1/9); V5; A9 (1/8); C18
Total length: 12cm

4. ***Neogobius melanostomus* (Round Goby)**
Diagnostic character: D6 (1/5); P10 (1/9); V11; A11; C18
Total length: 12cm

5. ***Mastacembelus armatus* (Baam, Garchi)**
Total length: 14cm\

6. ***Xenentodon cancila* (Kauwa, Kabali, Chuche baam)**
Total length: 15cm

7. ***Oreochromis niloticus* (Nile Tilapia)**
Diagnostic character: D8; P12; V8; A5; C14
Total length: 5cm

8. ***Pseudolaguvia ribeiroi* (Tinkantiya)**
Diagnostic character: D1/6; P1/8; V6; A3/7
Total length: 3.5cm

9. ***Nemacheilus rupecula*/ *Schistura rupecula* (Bhotee, Gadelo)**
Diagnostic character: D11; P10; V7; A7; C18
Total length: 4.5cm

10. ***Nemacheilus beavani*/ *Schistura beavani* (Dharkee Gadero)**
Diagnostic character: D5 (1/4); P6; V6; A5; C10
Total length: 4cm

11. ***Garra gotyla* (Budu)**
Diagnostic character: D8 (1/7); P11; V8; A6 (1/5); C17
Total length: 8cm

13. ***Glyptothorax trilineatus* (Telcapre)**
Diagnostic character: D7 (1/6); P7(1/6); V7; A9 (1/8); C19
Total length: 7cm

14. ***Channa gachua* (Bhoti)**
Diagnostic character: D29; P16; V6; A20; C12
Total length: 6cm

15. ***Glyptothorax kashmirensis***
Diagnostic character: D1/5; P1/8: V6; A1/8; C22
Total length: 8cm

16. ***Eutropiichthys murius* (Jalkapoor)**
Diagnostic character: D1/7; P1/8; V6; A3/36; C17
Total length: 28cm

17. ***Sperata seenghala* (Tenger, Sujaha)**
Diagnostic character: D8 (1/7); P4 (1/3); V6; A10 (1/9); C14
Total length: 27cm

18. ***Osteobrama cotio cotio* (Gurda)**
Diagnostic character: D9 (1/8); P9 (1/8); V10; A28; C18
Total length: 9cm

19. ***Labeo pangusia* (Gadani)**
Diagnostic character: D10 (1/9); P14; V9; A7 (1/6); C18
Total length: 23cm

20. ***Barilius bendelisis* (Motiya)**
Diagnostic character: D8 (1/7); P13; V9; A10; C18
Total length: 13cm

21. ***Cabdio morar* (Karangi, Chakale)**
Diagnostic character: D8 (1/7); P11; V8; A12; C20
Total length: 12cm

22. ***Barilius modestus* (Chiple Faketa)**
Diagnostic character: D9 (1/8); P14; V9; A12 (1/11); C18
Total length: 14cm

23. ***Barilius shacra* (Fakete)**
Diagnostic character: D8 (1/7); P13; V8; A9 (2/7); C13
Total length: 8cm

24. ***Leiodon cutcutia* (Pokcha, Galphalani)**
Total length: 5 cm

25. ***Garra annandalei* (Lohari)**
Diagnostic character: D11 (3/8); P15; V8; A7 (2/6); C17
Total length: 16.5 cm

Note: Details of different symbols used are:
D: Dorsal fin
P: Pectoral fin
V: Ventral fin
A: Anal fin
C: Caudal fin
L. l: Lateral line
L.tr: Transverse rows of scales above and below the lateral line. In this case an oblique stroke (/) separates the rows of scale above and below the lateral line.

Collection and frequency of fish

Different species of fishes collected during the exploration are listed (table 1-3) as under:

Table 1 : Collection of fish at station I.

S. No.	Local Name	Scientific Name	Frequency
1.	Datari	*Sperata seenghala*	2
2.	Chepuwa	*Cabdio morar*	16
3.	Buduna	*Garra gotyla*	3
4.	Motiya	*Barilius bendelisis*	1
5.	Bam	*Mastacembelus armatus*	12
6.	Sidra	*Puntius ticto*	3
7.	Nile tilapia	*Oreochromis niloticus*	3
8.	Jalkapoor	*Eutropiichthys murius*	1
9.	Faketa	*Barilius barila*	6
10.	Bhoti	*Channa gachua*	1
11.	--------	*Glyptothorax kashmirensis*	2
12.	Chuche bam	*Xenentodon cancila*	1

Table 2 : Collection of fish at station II.

S. No.	Local Name	Scientific Name	Frequency
1.	Faketa	*Barilius barila*	27
2.	Gadani	*Labeo pangusia*	6
3.	Chuna	*Osteobrama cotio*	3
4.	Round goby	*Neogobius melanostomes*	1
5.	Gurda	*Osteobrama cotio cotio*	3
6.	Goira	*Nemacheilus botia*	4
7.	Tengra	*Mystus tengara*	2
8.	Chuche bam	*Xenentodon cancila*	1
9.	Telcapre	*Glyptothorax trilineatus*	1

Table 3 : Collection of fish at station III.

S. No.	Local Name	Scientific Name	Frequency
1.	Bhotee, Gadelo	*Nemacheilus rupecula*	2
2.	Dharkee gadero	*Nemacheilus beavani*	5
3.	Chiple faketa	*Barilius modestus*	1
4.	Faketa	*Barilius shacra*	2
5.	Pokcha, Galphalani	*Leiodon cutcutia*	1
6.	Lohari	*Garra annandalei*	1
7.	Baam	*Mastacembelus armatus*	1
8.	Faketa	*Barilius barila*	5

Table 4 : Classification of collected species of fish.

S. No.	Order (6)	Family (12)	Genera (18)	Species (25)	Local name
1.	Cypriniformes	Cyprinidae	*Barilius*	*B. barila*	Faketa
2.	,,	,,	,,	*B. bendelisis*	Motiya
3.	,,	,,	,,	*B. shacra*	Fakete
4.	,,	,,	,,	*B. modestus*	Chiple faketa
5.	,,	,,	*Puntius*	*P. ticto*	Sidra
6.	,,	,,	*Labeo*	*L. pangusia*	Gadani
7.	,,	,,	*Cabdio*	*C. morar*	Karangi, Chakale
8.	,,	,,	*Garra*	*G. gotyla*	Buduna
9.	,,	,,	,,	*G. annandalei*	Lohari
10.	,,	,,	*Osteobrama*	*O. cotio*	Gurda
11.	,,	Nemacheilidae	*Nemacheilus*	*N. beavani*	Dharkee gadero
12.	,,	,,	,,	*N. rupecula*	Gadela
13.	,,	,,	,,	*N. botia*	Goira
14.	Tetraodontiformes	Tetraodontidae	*Leiodon*	*L. cutcutia*	Pokcha
15.	Siluriformes	Sisoridae	*Glyptothorax*	*G. trilineatus*	Telcapre
16.	,,	,,	,,	*G. kashmirensis*	
17.	,,	Erethistidae	*Pseudolaguvia*	*P. riberoi*	Tinkantiya
18.	,,	Schilbeidae	*Eutropiichthys*	*E. murius*	Jalkapoor
19.	,,	Bagridae	*Sperata*	*S. seenghala*	Tenger, Sujaha
20.	,,	,,	*Mystus*	*M. tengara*	Tenger
21.	Perciformes	Channidae	*Channa*	*C. gachua*	Bhoti
22.	,,	Cichlidae	*Oreochromis*	*O. niloticus*	Nile tilapia
23.	,,	Gobiidae	*Neogobius*	*N. melanostomus*	Round goby
24.	Synbranchiformes	Mastacembelidae	*Mastacembelus*	*M. armatus*	Baam
25.	Beloniformes	Belonidae	*Xenentodon*	*X. cancila*	Chuche baam, Kabali

Order wise-fish composition

Fishes surveyed belong to 6 different orders (fig. 3) like Cypriniformes (52%), Tetraodontiformes (4%), Siluriformes (24%), Perciformes (12%), Synbranchiformes (4%) and Beloniformes (4%).

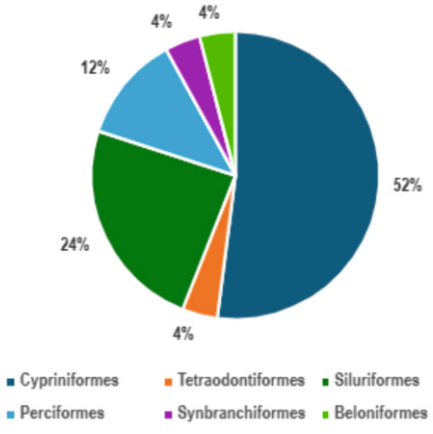

Fig. 3: Order-wise fish composition.

Family-wise fish composition

Studied fishes belong to 12 different families (fig. 4) like Cyprinidae (42.3%), Nemacheilidae (11.5%), Tetraodontidae (3.8%), Sisoridae (8%), Erethistidae (3.8%), Schilbeidae (3.8%), Bagridae (7.7%), Channidae (3.8%), Cichlidae 3.8%), Gobiidae (3.8%), Mastacembelidae (3.8%), Belonidae (3.8%).

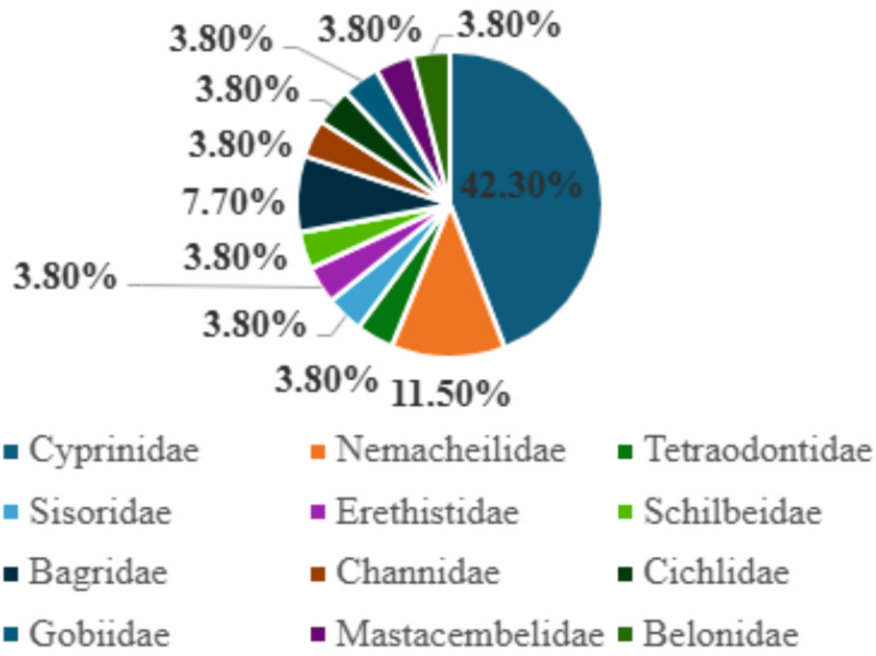

Fig. 4: Family-wise fish composition.

DISCUSSION

In the present study, altogether 25 species of fish (table 4) were recorded. When all species of fish were classified, it was found that they belong to 6 orders, 12 families and 18 genera. Among the orders, Cypriniformes had the highest number of species 52%, followed by Siluriformes (24%), Perciformes (12%), while Synbranchiformes, Tetraodontiformes, and Beloniformes represented each by about 4%. Similarly, Cyprinidae had the highest number of species 42.3%, among the families, followed by Nemacheilidae, Tetraodontidae, Sisoridae, Erethistidae, Schilbeidae, Bagridae, Channidae, Cichlidae, Gobiidae, Mastacembelidae, and Belonidae. Station I showed a record of 12 species in which *Cabdio morar* and *Mastacembelus armatus* were with higher abundance while *Barilius bendelisis*, *Eutropiichthys murius*, *Channa gachua* and *Xenentodon cancila* had lower abundance. Similarly, station II recorded 9 species of fish, out of which *Barilius barila* has the highest proportion while at station III *Nemacheilus rupecula*, *Nemacheilus beavani*, *Barilius modestus*, *Barilius shacra*, *Leiodon cutcutia*, *Garra annandalei* and *Mastacembelus armatus* were found. All of those species were recorded throughout the study period in field.

Out of the total recorded species, there were some fish species which were common to all the sites such as *Barilius barila*, *Xenentodon cancila* and *Mastacembelus armatus*. All the parameters were within the range for supporting healthy fish communities in the river. Aquatic life and fish diversity are, however, threatened by mining, forestry, and development in several river segments.

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