Environment and Agriculture: Biodiversity, Agriculture and Pollution in South Asia, 2001, pp. 78-83.
Eds: P.K. Jha, S.R. Baral, S.B. Karmacharya, H.D. Lekhak, P. Lacoul and C.B. Baniya
Publisher: Ecological Society (ECOS), P.O. Box 6132, Kathmandu, Nepal.

FISH DIVERSITY AND FISHERY RESOURCES OF THE TINAU RIVER, WESTERN NEPAL

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ABSTRACT

Present investigation reveals the existing fish fauna and their distribution pattern in the Tinau River, Western Nepal. A total of 35 species belonging to 25 genera, 12 families and 5 orders are recorded. Among collected fish species, Cyprinidae family was dominant constituting 81.73% of the total, followed by Cobitidae constituting 11.24% of the total collection. Physico-chemical and biological parameters of water were analysed to determine distribution, abundance and frequency of ichthyofauna. Chemical nature of water was found to be suitable with well-oxygenated and slightly alkaline pH range. Existing dam in the Tinau River has negative effect to migratory fishes, e.g., *Bagarius bagarius, Labeo angra* and *Tor tor* of which former two species have totally disappeared from upstream of the dam.

Key words: Fish fauna, Tinau River, physico-chemical and biological parameters, socio-economic status.

INTRODUCTION

The inland water resources of Nepal totalling 745,000 ha consist of river systems, lakes, reservoirs, village ponds, wetlands and irrigated rice fields. Nepal has more than 6000 rivers and streams with three main river systems, viz., the Gandaki, the Koshi, and the Karnali. Besides these, Mahakali, Kankai, Kamala, Mechi, Rapti, Babai and Tinau are equally important rivers. A large number of studies have been performed in the main river systems regarding fish diversity and other ecological aspects. However, much remains to be done on the fish ecology of the hill stream and with the water quality.

There are 185 fish species in Nepal belonging to 79 genera, 31 families and 11 orders (Shrestha 1995). Altogether 34 species (18%) are threatened (vulnerable, endangered and rare), 90 species (49%) have the status of commonly/occasionally recorded and 61 species (33%) have the status of insufficiently known.

Limited information is available on the fish fauna of the Tinau River. Shrestha (1981) reported 8 fish species from this river and its tributaries. This study has been an attempt to determine the existing ichthyofauna and their distribution pattern, and water quality of the Tinau River.

STUDY AREA

The Tinau River, originating from the Mahabharat range of Palpa district about 20 km east of Tansen, was selected for the present study.

It is separated from all the three major river systems of Nepal, and runs about 95 km between an altitude of 100-800 m. However, present study area includes about 51 km from Mariphant to Bethari. For the present investigation, five main sites were selected, viz., Mariphant

(Damkada, 684 m), Charchare (574 m), dovan (250 m), Butwal (188 m) and Bethari (107). Mariphant was the uppermost station with less interference of human beings. A dam has been built at Dovan station to generate hydroelectric power.

METHODOLOGY

The field work was conducted during November 1994 to October 1995, ten days each month in the field. The primary of basic source of data is based on the fish collected from river, direct field observations, and information sampling. Questionnaires were administered to collect the information regarding changing pattern of the river and fish distribution, general environment of the river like lowering of water level, and land erosion, siltation, flood level, etc.

The morphometric characteristics and measurements of all sample species were noted down in situ. All the samples were preserved in 4 - 8% formaldehyde and a longitudinal incision was made along the abdomen for larger specimens, and brought to the laboratory of Central Department of Zoology, Tribhuvan University, for identification and further investigation. These collected fish samples were identified after Shrivastava (1968), Shrestha (1981) and Jayaram (1981).

Analysis of physical, chemical and biological parameters of the Tinau River water were carried out after Needham and Needham (1962), APHA (1976), Adoni (1985), and Trivedy and Goel (1986). Co-efficient of correlation between some important physicochemical parameters with composition of fish species were also calculated by using Karl-Pearson's method (1988).

RESULTS AND DISCUSSION

Physicochemical and Biological Parameters

Water colour of this river was clear throughout the year except monsoon (July) influencing the transparency and turbidity of the river water. Table 1 describes the physicochemical nature of the Tinau River.

Table 1. Physicochemical parameters of the Tinau River at different stations.

Parameters	Months	Max/Min value
Water velocity	July	2.3 m/s (max)
	October	0.2 m/s (min)
Temperature	June	32.5 ^{0}C (max)
	January	16.5 ^{0}C (min)
Transparency	January	79 cm (max)
	July	3 cm (min)
Turbidity	July	291.63 mg/l (max)
	January	8.16 mg/l (min)
pH	September/October	8.6 (max)
	October	7.8 (min)
Dissolved Oxygen	May/June/July	8.92 mg/l (max)
	May/ February	5.68 mg/l (min)
Total alkalinity	January	54.05 mg/l (max)
	May	12.01 mg/l (min)
Total Hardness	April	204 mg/l (max)
	May	54 mg/l (min)
Free Carbon Dioxide	February	13.99 mg/l (max)
	May/April	3.99 mg/l (min)

Note: m/s indicates meter per second; ^{0}C indicates degree Celsius; and mg/l indicates milligram per litre.

The water velocity showed positive correlation co-efficient value (r = 0.224) with dissolved oxygen (er. = 0.185) which is regulated merely by the slope gradient of the river bed. Water velocity is highest at station III because of maximum slope gradient in the present investigation (Table 1). This supports the view of Jhingran (1975) according to which stream velocity is merely the function of slope gradient of the river bed. The water temperature in the Tinau River ranged between 16.5 ^{o}C to 32.5 ^{o}C which is favourable for different types of aquatic organisms including fishes. Surface water temperature showed negative correlation co-efficient value (r = 0.783) with DO with probable error (er. = 0.117). Similar relation was found in between surface water temperature and altitude (r = 0.448 and er. = 0.241) which explains the increase of surface water temperature with decrease of altitude. Generally, the currents in lotic environment tend to keep pH uniform over considerable distances. In the Tinau River the pH value fluctuated narrowly (fluctuating range is 0.8) with an average value of 8.3. This range showed positive correlation co-efficient value (r = 0.382; er. = 0.166) with fish species.

According to APHA (1976), the dissolved oxygen concentration above 5 mg/l is suitable for the support of diverse biota. The dissolved oxygen value of Tinau River was never below 5.68 mg/l throughout the year, hence, it is good for fish habitat. DO of the river water showed positive correlation (r = 0.527) with the composition of fish fauna with probable error 0.14. During the present investigation, the total alkalinity of rover water ranged in between 12.01 mg/l to 54.05 mg/l which had no negative effect on aquatic organisms. During this study the total hardness ranged in between 54 mg/l to 204 mg/l (sum of Ca^{++} and Mg^{++}) which was favourable for riverine fishes. The free CO_2 was recorded between 3.99 mg/l and 13.99 mg/l. Free CO_2 in water helps in the formation of bicarbonates and carbonates and keeps fluctuation of pH under check. Free CO_2 in the Tinau River water showed negative correlation (r = -0.486) with fish species composition (er. = 0.148) which explains the negative effect of free carbon dioxide on the composition of fish species.

Very few records of planktons were observed as the investigation was carried out in fresh running water. Phytoplanktons recorded during this period include *Spirogyra*, *Lyngbya*, *Tabellaria* and *Microcystis*. Similarly, zooplanktons include *Cyclops*, *Monostyla* and *Daphnia*. Among the phytoplanktons *Spirogyra* was abundant at all the stations during the study period.

The Tinau River provides a habitat for fresh water fishes of diverse type, viz., snow trout, catfishes, stone loaches, sucker heads, mahaseers, eels etc. Thirty-five different fish species were recorded from the Tinau River during the investigation representing 25 genera, belonging to 12 families and 5 orders (Table 2).

Only eight species of fishes were recorded from station I among which the dominant species were *Barilius bendelisis, B. vagra* and *Puntius sophore.* At station II, only six fish species were recorded among which the dominant species were *Barilius bendelisis, B.vagra* and *Garra gotyla.* Maximum number (21) of fish species were recorded from the station III, among which *Barilius barila, B. bendelisis, Garra gotyla* and *Noemacheilus beavani* were dominant species. Station IV comprised of 12 fish species with *Barilius bendelisis, Garra gotyla* and *Puntius sophore*. Similarly, station V consisted of 13 different fish species among which the dominant species were *Puntius conchonius* and *P. sophore* (Table 2). During the investigation period about 25% of total catch composition was consisted by *Barilius bendelisis*, 18% by *Puntius sophore*, and 11% by *Garra gotyla* and rest 32 fish species constituted about 46%. Cyprinidae is most common family representing 18 fish species and constituting 51.42% of fish species. Similarly, Cyprinidae alone constituted 11.24 and others constituted about 7.03% of the total catch composition.

Shrestha(1981) has reported eight fish species from the Tinau river belonging to the families Cyprinidae, Cobitidae and Amblycipitidae; among which *Barilius bola, tor putitora* and *Amblyceps mangois* were not observed during the present investigation. *Bagarius bagarius* was abundant in this river before the construction of dam but this species no longer existed in the upper regions of the dam, i.e., station I, II and III. Local people also informed about the existence of *Acrossocheilus hexagonolepis* and *Labeo angra* in this river but could not be observed during the present study.

Subfamily Schizothoracini of Cyprinidae includes two genera, *Schizothorax* and *Schyzothoraichthys* which according to Shrestha (1995) are commonly found distributed at an altitude ranging from 784 m to 3323 m, but were reported from quite lower altitude (251 m) at station III in the Tinau River (i.e., lower limit). This might be due to flooded condition of the river, the record of which was made only once in July from such an altitude.

Preferential fish Habitat

The habitat preference of some of the important fish species in the Tinau River was based on sampling and information from local fishermen. Large game cum food fishes like Sahar (*Tor tor*) prefer stony rapids and pools and have ability to migrate from down-up stream. Small fishes such as *Schizothorax plagiostomus* and *Glyptothorax pectinopterus* have suction disc on their ventral side for clinging to stones and rocks and are found in rapids of upper riches. Small fishes like *Noemacheilus beavani, N. botia* and *N. rupicola* have restricted food habit in sandy bottoms hiding under stones. Catfishes (*Heteropneustes fossilis*) and snake headed fish (*Channa gachua*) partially bury themselves in sandy or muddy which also have tendency to overland through wet vegetation during dry season. Fish like *Noemacheilus rupicola* mimic with the dead log and dead woody material in water. Generally fish in the Tinau River migrate upstream in early monsoon (May-June) and down stream in September-October.

Table 2. Distribution of ichthyofauna at different stations in the Tinau River.

Family	Species	Local name	St.I	St.II	St.III	St.IV	St.V
Notopteridae	*Notopterous notopterous*	Golhi	-	-	-	-	+
Cyprinidae	*Barilius barila*	Fageta	-	-	+	+	-
	B. bendelisis	Fageta	+	+	+	+	-
	B. vagra	Fageta	+	+	+	+	-
	Cirrhinus reba	Raiya	-	-	-	-	+
	Danio devario	-	-	-	-	+	-
	D. rerio	-	-	-	+	+	-
	Esomus dendricus	Darai	-	-	-	-	+
	Garra annandeli	Buduna	-	-	+	+	-
	G. gotyla	Buduna	+	+	+	+	-
	Oxygaster bacaila	Chalwa	-	-	+	-	-
	Puntius chilinoids	-	-	-	+	-	-
	P. conchonius	Sidre	+	-	-	+	+
	P. sophore	Sidre	+	-	-	+	+
	Tor tor	Katle	-	-	+	-	-
	Psilorhynchus pseudecheneis	Tite	-	-	+	-	-
	P. sucatio	-	-	-	+	-	-
	Schizothorax plagiostomus	Asala	-	-	+	-	-
	Schizothoraichthyes esocinus	Asala	-	-	+	-	-
Cobidtidae	*Botia lohachata*	Baghe	-	+	+	+	-
	Lepidocephalichthys guntea	-	-	-	-	-	+
	Noemacheilus beavani	Gadela	+	+	+	-	-
	N. botia	Gadela	-	-	+	+	-
	N. rupicola	Gadela	-	-	+	-	-
Bagridae	*Mystus bleekeri*	Tengra	-	-	-	-	+
Sisoridae	*Glyptothorax pectinopterus*	Kabhre	-	+	+	-	-
Schilbeidae	*Pseudeutropius atherinoides*	Patasi	-	-	-	-	+
Saccobranchidae	*Heteropneustes fossilis*	Singhi	+	-	-	-	-
Claridae	*Clarius batricus*	Mungri	-	-	-	-	+
Ophiocephalidae	*Channa gachua*	Hile, Bhoti	+	-	+	+	-
Nandidae	*Nandus nandus*	-	-	-	-	-	+
Gobiidae	*Glossogobius giuris*	-	-	-	+	-	+
Mastacembelidae	*Macrognathus aculeatus*	Gainchi	-	-	-	-	+
	Mastacembelus armatus	Bam	-	-	+	-	-
	M. pancalus	Gainchi	-	-	-	-	+

Where, 'St.' = Station; - = absence; and + = present.

Socio-economic Status

Although survey revealed that about 12,240 families are engaged in aquaculture activities and about 36,700 people have been estimated to be actively involved in fishery profession in Nepal (Pradhan and Pantha 1995), an extensive study on the actual number of fishermen and their socio-economic condition is needed to evaluate the actual production from capture fishery.

About 83% of fishermen of this river are totally illiterate, 10% have an education upto 5th standard and 7% with an

education upto 8th standard. About 40% of fishermen know about the family planning but only 20% of them are taking benefit from it and the rest believe that the children are blessings of god. Only 27% of fishermen earn their livelihood by fishery profession and 73% consider that many of their household problems are fulfilled by fishing. About 57% of fishermen are living in small huts made of bamboo (*Dendrocalmus strictus*) and Khar (*Imperata cylindrical*), 17% have brick walls and tile roofs and 26% have their houses made up of stone walls and have roofs of Khar and zink plates (karkatpata). Nearly 86% males and 14% females were engaged in fishing, but during off seasons men worked as labour too, while women were engaged in their household affaires.

Effect of dam on fishery

Hydro-dam of the Tinau River is located at Dovan, about 4 km north of Butwal in hilly region. The powerhouse is located at 1 km south of the dam site. The effect of dam in the Tinau River is more pronounced and has affected the abundance and distribution of fish species in the river by obstructing the movement of seasonal as well as local migratory fishes. According to the local people, before the establishment of the dam, shoals of Gounch (*Bagarius bagarius*) and Thedi (*Labeo angra*) used to visit the areas above dam, but now they are completely disappeared from this area.

Construction of dam has considerably reduced the surface area of fishing water to downstream. Many current loving fish species could not cross the physical barrier of the dam, as a result, their upstream migration have been checked and many good sized Gounch (*Bagarius bagarius*), Thedi (*Labeo angra*) and Jalkapoor (*Pseudeutropius*) have ceased to visit the upstream. Similarly, the number of migratory fish like Tor reduced considerably in the downstream while the fishes, e.g., Sidre (*Puntius*), Fageta (*Barilius*), Gadela (*Noemacheilus*) and Buduna (*Garra*) totally inhabiting in low water were not affected and have got a good hydro-biological condition. They have undergone a rapid increase due to the absence of their predatory fishes like *Tor*. As a result, the abundance of large sized migratory fishes have been gradually replaced by small fishes.

In the Tinau River only five threatened fish species were recorded during the study period, viz., *Puntius chilinoides, Tor tor, Danio rerio, Schizothorax plagiostomus* and *Psilorhynchus pseudecheneis*. It is recommended that legal protection be accorded to ten fish species in Nepal out of which four species, viz., *Tor tor* (endangered), *Danio rerio* (Velnerable), *Schizothorax plagiostomus* (Vulnerable) and *Psilorrhynchus pseudecheneis* (Vulnerable) were recorded from the Tinau River.

ACKNOWLEDGEMENT

We express our gratitude to late Prof. Y.K. Malla, former head, Central Department of Zoology, T.U., for providing laboratory facilities and valueable suggestions during the study, and to Prof. T.C. Majupuria for encouragement. We wish to express thanks to our friends C. Pokharel, R.Shrestha, R. Jha, S.R. Adhikari, J. Ghimire, R. Koirala, G. Khadka, and S. Shrestha for their help and kind cooperation during the research work.

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