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Taxonomic investigation and fish diversity study on some hill stream fishes available in Roshi khola, Panauti of Nepal

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Abstract

The Roshi-khola flows in mid hill region of Kavrepalanchok district of Bagmati zone of Nepal. The present investigation was carried out to understand baseline information of hill-stream fishes and fishing implements of Roshi-khola during January to June 2016. The sampling station was visited three times during the March, April and May. Various fishing gears such as home made net, mosquito net, thunche, etc. were used for fish collection. Hill stream fishes comprising two orders, three families and five genera were collected from an altitude of 2000m. Altogether five species two from Cyprinidae, two from Cobitidae and one from Siluridae were collected and they were as *Schizothorachthys labiatus*, *Schizothorax plagiosomus*, *Schistura beavani*, *Schistura rupecula* and *Glyptosternum maculatum*. It was found that the local community and government are not enough caring for the conservation of hill stream fishes in the Roshi-khola so, conservation and management principles of hill stream fishes need to be encouraged.

Keywords: Roshi-khola, Hill-stream fishes, *Schizothorax*, Fishing gears

1. Introduction

Nepal is a small land linked country with an area of 1, 47,181sq km. It lies between India and China, stands between the latitude of 20^o21' to 30^o27' north and its longitude is between 80^o4' to 88^o12' east. It extends 885 km along the east-west with an average width of 193 km along the north side. Within this limited area exists a remarkable altitudinal variation, varying from the plain in the south with a hot tropical climate to the mountain region of temperate climate and a very cold alpine in the Himalayan region [1]. Nepal has several sources of water, which includes the glaciers and the monsoon rain. The inland resources of Nepal total 818,500 (3% of Nepal's land area), of which irrigated paddy field covers the greatest area 398,000ha (49%). Marginal swamp cover 12,500ha (1.4%), river 395,000 ha (48%), lakes 5,000ha (0.60%), reservoir 1,500 (0.20%) and village ponds 6,500ha (0.80%) and marginal/swamps/ghols cover (1.4%) [2].

The fish diversity of Nepal had been poorly studied by the Nepalese ichthyologist relative to other fauna. Over the few decades, study of fish diversity in Nepal is in increasing trend because of the increase in ichthyologic activity. Nepalese ichthyologist encompassed 232 fish species including 11 order, 37 families and 98 genera [3]. Shrestha [4] has recorded 182 indigenous fish species from Nepal. Rajbangsi [5] prepared a checklist from the published literature and reported 187 species. Shrestha (2008) recorded 232 fish species from Nepal including 15 exotic fish species. Gautam *et al.* [6] enumerated 42 fish species belonging to 6 orders, 18 families and 34 genera. Shrestha *et al.* [7] have recorded 30 fish species from the Tamor River. Shrestha *et al.* [7] have recorded 53 fish species belonging to 20 families, while Sound and Shrestha [8] introduced 23 fish species belonging to 3 orders, 4 families and 18 genera. Roshi khola is one of the important water resources for important hill stream fishes of Kavrepalanchok. Very little work has been done in Fish Diversity of the Roshi khola. Being a small river and nature of its course from midhill region, it has divergent fish species. Therefore, the present study entitled "Taxonomic investigation and fish diversity study on some hill stream fishes available in roshi khola, panauti of Nepal" has been undertaken to collect the baseline informations of the fishes of Roshi khola. Moreover, it is also believed that the work will certainly provide necessary informations for further studies, research work and future management plan in this river.

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Fig 1: Roshi Khola of Kavrepalanchowk District, Nepal

Materials and Methods

The present investigation was started from the year at January 2016 to June 2016, series of collection of fishes were made from the Roshi khola. The field study was carried out for six months starting from January 2016 to July 2016 covering 3 different seasons: Sishir (Magh, Falgun), Bashanata (Chaitra, Baisakh), Grishma (Jestha, Ashad). Each and every sampling station was visited 3 times in different seasons during the study period. Roshi khola takes its origin from the Fulchoki and it is the branches of Sunkoshi River. At an elevation of about 32km in south east corner of Kavrepalanchok district. Thus, fish collection was made with the help of local fishermen using various nets.

The ecological variation of size and color of the fishes were noted down in the field. Local names of fishes were also noted down in the field with the assistance of local fishermen. Fishes were caught, from river and muddy water and preserved in 8 percent formalin solution. Observations were also made in the field to know the status of fish species at the Roshi khola. Different types of fishes were collected and identified in situ and brought to Zoology Laboratory of Tri-Chandra Multiple Campus, Ghantaghar for confirmation. During visits to the various fish markets and fishing sites, informations were gathered from the fishermen on the maximum size weight, months of maximum and minimum catch. Observations were also focus in the various kinds of

fishing techniques and fishing gears. The methods were photographed and catch composition were recorded.

The data were collected directly by field observations, interviews, and questionnaire and secondarily through literatures to analyze the present and the past conditions of the fish and fisheries resources of Roshi khola. The informations so collected also enabled to determine the various conventional and nonconventional fishing practices being adopted by the local fishermen along with their socio-economic conditions. The primary data were collected directly by field observations and interviews with different class groups like fishermen and local people, while the secondary informations viz were collected from different reports, research papers, dissertations, magazines and journals etc.

3. Results

During the present study, a total of five species under two orders, three families and four genera were recorded. The most common species distributed in the Roshi khola was *Schizothoracichthys plagiostomus*, second common species was *Schizothorax labiatus*. Similarly, the rare species of the river was *Schistura rupecula*, *Schistura beavani* and *Glyptosternum maculatum*. *Schizothorax plagiostomus* was found at all field visits throughout the time period (Table. 1).

Table 1: List of fishes collected from Roshi Khola

S. N.	Scientific Name	Common Name	Local Name	Order	Family
1	<i>Schizothoracichthys labiatus</i>	Snow Trout	Sun Asla	Cypriniformes	Cyprinidae
2	<i>Schizothorax plagiostomus</i>	Kunar Snow rout	Asla	Cypriniformes	Cyprinidae
3	<i>Schistura beavani</i>	Ring Loach	Dharke Gadela	Cypriniformes	Cobitidae
4	<i>Schistura rupecula</i>	Loach	Gadela	Cypriniformes	Cobitidae
5	<i>Glyptosternum maculatum</i>	Torrent Cat Fish	Til Kabre	Siluriformes	Siluridae

Fishes collected from Roshi khola with their ecological behaviour

a. *Schizothoracichthys labiatus* (McClelland, 1839)

Schizothoracichthys labiatus is commonly known as "Asla" in Nepal. It is beautifully colored silvery brown fish with trilobed labial fold. Its dorsal surface is darker and sides and belly silvery. Its body is covered with small scales. The males are more brightly colored, especially during spawning. Body is elongated and narrow. Head is large. Snout is pointed, studded with pores. Mouth is sub terminal and arch shaped protractile. Upper jaw is longer than lower. Lips are thick. Barbels are 2 pairs and end in a trident point. Dorsal fin is

slightly in advanced than the ventrals. Dorsal spines are strong. The ventral fins are pinkish-yellow in color and the subsequent pair of fins including the single anal fin is reddish. Anal fin consists of seven rays. Caudal fin is forked. Lateral line is complete. The basic food consists of algal slime, larvae, insects and worms. Its flesh is very tasty. The female lays several thousands of eggs during spawning seasons (June-August). In Nepal it is found in upper reaches of Koshi, Gandaki, Karnali and Mahakali feeder streams. Fin Formula: D 11(3/8); P 18; V 12; A 7(2/5); C 19; Ll 100-110; Ltr 30-35/1/26-27; B: 2 prs

Order : Cypriniformes
 Family : Cyprinidae
 Sub-Family : Schizothoracinae
 Genus : *Schizothoraichthys*
 Species : *labiatus* (Mc Clelland)



Fig 2: *Schizothoraichthys labiatus* (Mc Clelland)

b. *Schizothorax plagiostomus* (Heckel)

Schizothorax plagiostomus is one of the most dominant species of Roshi Khola and is locally known as Sun Asla and is also known as the Snow Trout. It is a heavily spotted silvery golden snow trout with blunt snout. Body is elongated but more cylindrical. The color of the body is silvery with golden yellow tint on sides. The scales are minute. Snout is covered with horny tubercles, but their size and number is well marked in males. Mouth is inferior with a suctorial disc in chin formed by edge of the lower lip. Barbels are 2 pairs, one pair of rostral and another pair of maxillary, which are short. The abdomen is rounded. The paired fins often tinged with red. The dorsal fin originating more advanced to ventral. The dorsal fin is more towards anterior side and its last undivided fin ray is serrated internally. Caudal fin forked. Lateral line is complete. This spotted snow trout graze over algal bed and lick mud. It feeds mainly in early morning and evening. It is mostly snared and hooked by fishermen. It occurs in all snow fed feeder streams and rivers 600m to 2000m. This species generally become sexually mature in 2 years and female produces about 30,000 to 50,000 eggs. The pulpy meat of this fish is considered to have excellent taste. In the context of Nepal the dried or smoked fish is offered as sagun (as an auspicious food gift at the birthday and other ceremonies). Besides Roshi River (Panauti), this fish is also found in Khimti Rivers and their feeder stream, Trisuli, Gandaki, Koshi, and Karnali rivers. Fin Formula: D 10 (3/7); P 16-17; V 10; A 7 (2/5); C19- 20; L1 105, Ltr 23/23; B. 2 prs.

Order : Cypriniformes
 Family : Cyprinidae
 Sub-Family : Schizothoracinae
 Genus : *Schizothorax*
 Species : *plagiostomus* (Heckel)



Fig 3: *Schizothorax plagiostomus* (Heckel)

c. *Schistura beavani* (Gunthar, 1868)

Schistura beavani (Ring Loach) is a typical hill stream fish belonging to the family Cypriniformes, which is locally known as Dharke Gadela. Body is spindle shaped yellowish in color with 9-10 vertical bands on the body. The body consists of small minute scales. The mouth is semi-circular with fleshy lips. Barbels are three pairs, two pairs of rostral and one pairs of maxillary. Dorsal and anal fins shot with black dots.. Dorsal fin is originating opposite to the ventral. Caudal fin is slightly forked. A weavy dark band is present at the base of caudal fin. Lateral line is complete. It is found in the hill streams of Nepal an elevation range of 300m to 700m. It feeds on zooplanktons and earthworms. It breeds in May to June in small brook and creeks. Besides Roshi Khola (Panauti) this fish is also found in Bagmati, Sunkoshi, Melamchi, Arun, Trisuli, Mechi, Gandaki, Karnali and Mahakali rivers of Nepal. Fin Formula: D 10 (2/8); P 11; V 7; A 7(2/5); C 19; B: 3 prs.

Order : Cypriniformes
 Family : Cobitidae
 Sub-Family : Nemacheilinae
 Genus : *Schistura*
 Species : *beavani*
 (Gunthar, 1868)



Fig 4: *Schistura beavani* (Gunthar, 1868)

d. *Schistura rupecula* (Mc Clelland, 1839)

This is a typical representative of the loach family of the Himalayan water, noted for the small proportioned elongated and cylindrical body. The body is smooth with the minute scales, set in the skin. The color of the body is yellowish-brown with darker 14-16 bands, thus making the fish hard to distinguish from the river bottom. Generally the bands are broader than inter space. It has broad snout, Mouth is with fleshy lips. Eyes are situated dorsally and in the middle of the head. Barbels are 3 pairs, two pairs of rostral barbels, of which outer pair longer and one pair of maxillary barbels. Ventral fin is originating slightly in advance of dorsal. Caudal fin is slightly forked. Lateral line is complete. It feeds on small larvae, found at the bottom and is itself often the prey of predatory fishes. It favours a sandy bottom where there is a possibility of hiding under various stones. If it penetrates still waters, for instance a pond with good inlet and outlet, it can multiply there very quickly indeed. The breeding season starts from spring (February) until May and June. It sheds ripe eggs at periodic intervals. Stone loach used to be very popular for its delicious white flesh. It has no sporting significance, but occasionally serves as bait fish for predators. Altitudinal range of this species is 1,000 to 1,500m. Besides Koshi, this fish is also found in Narayani, Gandaki, Trishuli, Bheri and Karnali rivers. This stone loach lives in Nepalese and Tibetan

rivers in mountainous and semi-mountainous, gently sloping areas. Fin Formula: D 9-11(2-3/7-8); P 10; V 8; A 7(2/5); C 18 B:3 prs.

Order : Cypriniformes
 Family : Cobitidae
 Sub-Family : Nemacheilinae
 Genus : *Schistura*
 Species : *rupecula*
 (Mc Clelland, 1839)



Fig 5: *Schistura beavani* (Gunthar, 1868)

e. *Glyptosternum maculatum* (Regan)

Glyptosternum maculatum is commonly known as Torrent Catfish in Nepal belonging to family Siluriformes, which is locally known as Til Kabre. It is characterized by yellowish body color with depressed head. Mouth is inferior with villiform teeth in bands on jaws. Upper jaw is longer. Eyes are small and covered externally with small membrane. Barbels are four pairs. Adhesive disc is spindle shaped without any central pits. The paired fins are dotted with black. The dorsal fin is originating in advance to ventral and more anterior. Dorsal fin short and adipose fin is long. Adipose dorsal fin is sharp, long and low. The caudal fin is not forked and consists of black line. Its altitude range is 80 to 1,800m. This fish found in all intermittent feeder streams of Koshi, Bagmati, Trishuli, Rapti, Narayani, Karnali and Mahakali rivers. Fin Formula: D 1/6/0; P 13(1/12); V 6; A6 (1/5); C 15; B: 4 prs.

Order : Siluriformes
 Family : Sisoridae
 Genus : *Glyptosternum*
 Species : *maculatum* (Regan)



Fig 6: *Glyptosternum maculatum* (Regan)

4. Discussion

Ichthyodiversity refers to a variety of fish species; depending on context and scale, it could refer to alleles or genotypes within piscian population, to species of life forms within a fish community, and to species of life forms across

aquaregimes [10]. Biodiversity is also essential for stabilization of ecosystems, protection of overall environmental quality, for understanding intrinsic worth of all species on the earth [11]. Positive correlations between biomass production and species abundance have been recorded in various earlier studies [12]. The species diversity of an ecosystem is often related to the amount of living and nonliving organic matter present in it. Further, species diversity is a property at the population level while the functional diversity concept is more strongly related to ecosystem stability and stress, physical and chemical factors for determining population dynamics in the lentic ecosystem. Also, the various organisms including the plankton play a significant role in the dynamics of the ecosystem [13].

Fish constitutes almost half of the total number of vertebrates in the world. They live in almost all conceivable aquatic habitats. They exhibit enormous diversity of size, shape and biology, and in the habitats they occupy. Kar and Barbhuiya [14] estimated 21,723 extant species of fish under 4,044 genera, 445 families and 50 Orders in the world, compared to 21,450 extant tetrapods. Of these, 8,411 are freshwater species and 11,650 are marine. Roshi khola is one of the important water resources for important hill stream fishes of Kavrepalanchok. Very little work has been done in Fish Diversity of the Roshi khola. Being a small river and nature of its course from midhill region, it has divergent fish species. In this study, a total of five species under two orders, three families and four genera were recorded. The most common species distributed in the Roshi khola was *Schizothorax plagiostomus*, second common species was *Schizothorax labiatus*. Similarly, the rare species of the river was *Schistura rupecula*, *Schistura beavani* and *Glyptosternum maculatum*. *Schizothorax plagiostomus* was found at all field visits throughout the time period. The occurrence of fish species and their relative abundance is related with the number of factors viz. flow rate, nature of substratum, water temperature, water depth, availability of food, physico-chemical properties and stream length [16]. The present attempt admirably focused on the relationship between fish diversity and their relative abundance with respect to altitudinal variation. Suarez *et al.* [17] also observed that altitude is the main determining factor. The fish diversity as well as species richness increased with decrease in altitude. The stream headwaters contained few species than to those occurring downstream [18]. Sarkar *et al.* [19] also reported that the fish diversity increase in the lower stretches of stream due to the significant contribution of number of rivulets leading to increase in the total discharge. Fish species richness generally increased with increasing stream order and was higher in the adventitious streams than in the headwater streams [20].

5. Conclusion

The present investigation has revealed that there was a rapid degradation in the riverine environment of Roshi khola due to both natural and man-made causes leading to the sharp declination in fish population and their diversity. The main problems of this river were over exploitation, illegal fishing practices, construction of roads along the length of the river, land-slides, soil erosion, unusual flooding, sand and stone mining. It was found that the local community and government are not enough caring for the conservation of hill stream fishes in the Roshi-khola so, conservation and management principles of hill stream fishes were highly encouraged.

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