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Study of the fresh water fish diversity of Koshi river of Nepal

Shah Pinkey

Abstract
Fish survey were undertaken during August 2015 to January 2016 to predict the diversity of the fishes in Koshi Barrage. An attempt has been made to survey the existing fish diversity in six months of duration in two consecutive seasons (rainy and winter). Fishes caught alive or in fresh condition were preserved in 9-10% formalin solution. The fishes were collected, fixed and labeled giving serial numbers, the name of exact locality from where they have been collected; date of the collection and the common local name on each jar. The fishes were identified and finally species diversity was calculated, which is not yet focussed at this site. Knowledge of highest diversity in a particular season can be a most useful tool for the aquaculture for both quantity and quality harvesting of the fishes. With this point of view, the research has been conducted. Species diversity was found to be higher in winter (1.47) than in rainy season (1.18).

Keywords: Diversity, seasons, Koshi barrage

1. Introduction
Nepal covers an area of 147,181 square kilometres, that resides more than 6000 rivers and streams with three main river systems, viz., the Koshi, the Gandaki and the Karnali. The indigenous and exotic fishes of Nepal in total were found to be 186 species (Shrestha, J., 1995; Subba and Ghosh, 1996) [7, 9, 6]. Out of these there were fifty-nine coldwater indigenous and two exotic fish species in Nepal as investigated by Shrestha. The latest data reveals about 200 fish species, of which 191 are indigenous and 9 exotic.

1.1. Fish and fish diversity in Nepal
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. Of the 39,900 species of vertebrates in the world, Nelson (1984) 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. Other researchers, have arrived at different estimates, most of which range between 17,000 and 30,000 for the numbers of currently recognized fish species. The eventual number of living fish species may be close to 28,000 in the world. Day (1889) described 1418 species of fish under 342 genera from the British India. The fish fauna of the major tropical regions, Southern Asia, Africa, South and Central America are generally different with respect to genera; but, some families have members in two or all of the continents. In Southern Asia the predominant fish groups are the carps (Cyprinidae) and the cat fishes (Siluroidea) (Berra, 1981).
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. There are 185 fish species in Nepal belonging to 79 genera, 31 families and 11orders (Shrestha, 1995) [7, 9].The indigenous and exotic fish of Nepal total 186 species (Shrestha, J., 1995; Subba and Ghosh, 1996) [7, 9, 6].They are distributed from the lowland plains (Terai), through the hills to the Himalayan mountains up to an altitude of approximately 4000 m. Nepal is rich in water resources and fish diversity. The main sources of water of Nepalare rivers originating from Himalayas and their tributaries. In addition to rivers, there are several lakes, ponds, reservoirs, etc. which provide shelter and feeding habitats to fresh water

fishes. The initial taxonomic work of fishes of Nepal goes back towards eighteenth century when Hamilton (1822) [1], Hickel (1843), Gumther (1861, 1868) [11] and Day (1869) [11] made expeditions to survey fish of India and its adjoining countries. They addressed the fishes of Nepal for the first time. Since then, the inception of taxonomic works on fish of Nepal took place so far the literature are concern. Still a through survey of fishes of Himalayan waters of Nepal is incomplete. Among a good numbers of contributors to taxonomical works on fishes of Nepal, the works of Shrestha (1981), Talmar and Jhingran (1991) [4], Tereshima (1984) [9, 10] and Subba (1995, 1996) [8, 6] deserve special mention. The authors have made an attempt to collect and identify the fishes of eastern Terai of Nepal.

The Nepal Himalayas are well known for their running and standing waters supporting about 200 species of fish are described from the Himalayan drainage system of Nepal (Shrestha1995) [7, 9]. High diversity fishes in the rivers of Nepal calls for concerted efforts to preserve them for posterity. The lotic water mass of the Himalayan region comprises many torrential rivers and streams, which provide a wide variety of ecological niches for important fresh water fishes. However, the effects of land use on fresh water systems are growing. In the Nepalese rivers, the ecological studies of these water bodies have started only recently. The rivers of Himalayan region differ from the other rivers in carrying much larger sediment loads and having more frequent floods.

2. Materials and Methods

Koshi is the biggest river of Nepal. It is also known as saptakoshi river. Koshi flows from eastern Nepal. Different branches of koshi are originated from different mountains with different names and they are flowing towards southeast, southwest and direct south. After reaching near Triveni, Arun and Sunkoshi and later on Tamor join each other and flow downward to the south with the name Saptakoshi. The water, east from Goshainkunda of central Nepal and to the west of Kanchangunjha of eastern Nepal collects to this river covering a large area of high mountains and hills. Out of its main seven branches, Arun and Bhotekoshi are originated from Tibet. Hence, Arun River enters Nepal from Kimathanka pass or boarder and the Bhotekoshi River enters Nepal from Tatopani pass. Latter on the Saptakoshi River enters towards India, Bihar from Bhimnagar.

Therefore, the water-shared area for Koshi River is very big. It covers 60420 square kilometer in three countries. Out of this area, Nepal bears 27883, India 11410 and Tibet bears 21127 square kilometer. Therefore, it is an international river. After reaching it in Ganga River, it flows up Bangladesh and falls down in Indian Ocean. Koshi falls in Ganga river from Kurshila of India, Bihar. The length of this river is 729 lometer from Tibet to India Bihar. It is 254 kilometer long from Koshi Barrage to Kursila in India and 68 kilometer from Triveni to Koshi Barrage in Nepal. The capacity of producing hydro-electricity is 22500-mw in this river. Varahakshetra, Chatara, Mainamain, Bishnupaduka, Manakamana, Ramdhuni and Pindeswara are some of the famous religious centers of Kausiki region. Some important religious sites are there in Bihar India also at the bank of Kausiki River (Khatiwada, 2014) [2]. The field study was carried out in the koshi barrage area that encloses three districts namely saptari, sunsari and udayapur.

All the fishes were collected from the koshi barrage, the part of which lies in sunsari and saptari district, of Nepal and also from the landing sites and market area close to it. The fishes were collected for observation and identification during the period of November 2015 to January 2016 by using different types of 'Nets and Gears' commonly used in fisheries and through the help of fisherman. The field was visited twice a week for six months. Photographs of the fishes were taken on the spot, as the colour of the fishes may change after fixation in the formalin. Fishes were collected with the help of local fisherman using cast nets, scoopnet, hooks, Dhadiya etc. Fishes caught alive or in fresh condition were injected with 40% formalin through their mouth and vent and finally preserved in 10% formalin. The fishes collected and fixed, were then labeled giving serial numbers, the name of exact locality from where they were collected; date of the collection and the local name on each jar. and finally brought in AUCST (Andhra University College of Science and Technology), Department of Zoology, in India for further identification and investigation. The fishes were identified using a website www.fishbase, articles, journals of Nepal and Talwar and Jhingran, 1991 [4] and finally species diversity was calculated by using Shanon Wiener function (Shanon-Wiener 1963, cited in Krebs 1988 and Yadav *et al.* 1987) [3].

3. Results and Discussion

The present study reveals species diversity, 1.47and relative diversity, 0.83 in winter season. The species diversity is, 1.18 and relative diversity, 0.76 in the rainy season. In the period of six months in two consectuive seasons, species diversity and relative diversity; both of them is found to be maximum in wintet season than in rainy season.

Table1: for mathematical calculation

S. No.	Name of the fishes	Rainy season				Winter season					
		Aug	Sep.	fi	filogfi	Oct.	Nov	Dec.	Jan.	fi	FIlogfi
1	Labeo rohita	260	300	300	743.13	260	160	170	800	800	2322.47
2	Parambassis ranga	15	-	15	17.64	-	10	14	5	14	16.04
3	Mystus cavasious	200	400	400	1040.82	300	250	225	100	300	743.13
4	Mastacembelus armatus	100	90	100	200	20	-	80	-	80	152.24
5	Clupisoma montana	500	-	500	1349.485	-	300	180	200	300	743.13
6	Catla catla	100	40	100	200	60	80	-	27	80	152.24
7	Labeo bata	300	-	300	743.13	200	270	300	400	400	1040.82
8	Salmophasia bacaila	300	-	300	743.13	200	125	200	250	250	599.48
9	Macrognathus pancalus	50	-	50	84.94	20	-	35	30	35	54.04
10	Botia lohachata	50	30	50	84.94	15	40	-	-	40	64.08
11	Puntius sophore	30	20	30	44.31	-	130	-	30	130	44.31
12	Macrognathus aral	120	100	120	249.50	80	120	-	76	120	249.50
13	Cirrhinus mrigala	255	220	255	613.667	190	260	-	195	260	627.89
14	Channa punctatus	30	25	30	44.31	35	39	-	34	39	62.05
15	Trichogaster fasciata	24	20	24	33.12	18	10	15	20	20	26.02
16	Badis badis	20	40	40	64.88	35	22	-	10	35	54.04
17	Heteropneustes fossilis	25	20	25	34.94	40	45	77	150	150	326.41
18	Parambassis lala	14	15	15	17.64	16	14	-	15	16	19.26
19	Leiodon cutcutia	-	6	6	4.66	-	7	-	-	7	5.91
20	Gagata cenia	26	25	26	36.78	-	19	-	20	20	26.02
21	Mystus vittatus	22	-	22	29.53	30	25	-	35	35	54.04
22	Chaca chaca	-	-	-	-	10	-	-	-	-	-
23	Sperata aor	25	-	25	34.94	16	20	-	10	20	26.02
24	Chagunius chagunio	-	-	-	-	-	120	-	80	120	249.50
25	Raiamas guttatus	-	-	-	-	-	120	-	-	120	249.50
26	Tor tor	-	25	25	34.94	-	32	30	18	32	48.16
27	Eutropichthys vacha	55	-	55	95.71	45	60	-	-	60	106.68
28	Mystus tengara	180	170	180	405.94	160	200	-	100	200	460.20
29	Xenentodon cancilla	21	22	22	29.53	-	20	-	6	20	26.02
30	Ompok bimaculatus	-	-	-	-	13	15	-	14	15	17.64
31	Labeo fimbriatus	4	5	5	3.49	6	-	9	2	9	8.58
32	Monopterus cuchia	-	-	-	-	10	12	-	-	12	12.95
33	Channa orientalis	50	40	50	84.94	53	45	-	40	53	91.38
34	Glossogobius giuris	-	-	-	-	-	-	-	6	6	4.66
35	Chanda nama	-	-	-	-	10	9	11	6	11	11.45
36	Nangra assamensis	30	25	30	44.31	-	-	-	-	-	-
37	Canthophrys gongota	30	25	3O	44.31	-	-	-	-	-	-
38	Ctenopharyngodon idella	-	-			-	9	19	6	19	24.29
39	Clarias batrachus	-	-			-	-	75	60	75	140.62
40	Clupisoma garuwa	-	-			-	14	19	12	19	24.29
41	Barbonymous gonionotus	-	-			-	50	98	150	150	326.41
42	Cyprinus carpio	-	-			-	25	39	30	39	62.05
43	Hypothalmichthys nobilis	-	-			-	87	96	90	96	190.29
44	Notopterus notopterus	-	-			-	130	142	145	145	313.39
45	Puntius terio	-	-			-	17	19	19	19	24.29
46	Anabus testudinous	-	-			-	17	19	15	19	24.29
47	Glyptothorax telchitta	-	-			-	-	9	6	9	8.58
48	Labeo calbasu	-	-			-	4	-	8	8	7.22
49	Chela cachieus	-	-			-	-	-	6	6	4.66
50	Nandus nandus	-	-			-	-	-	10	10	10
51	Nandus meni	-	-			-	13	-	15	15	17.64
52	Channa gachuwa	-	-			-	19	11	12	19	24.29
53	Cabdio maror	-	-			-	130	120	115	130	274.81
54	Channa striatus	-	-			-	-	5	-	5	3.49
55	Barilius barna	-	-			-		8	7	8	7.22
56	Hypothalmichthys molitrix	-	-			-	35	37	30	37	58.02
57	Wallago attu	-	-			-	-	-	23	23	31.31
58	Puntius conchonius	-	-			-	11	12	15	15	17.64
59	Lepidocephalichthys guntea	-	-			-	-	17	20	20	26.02
				n =3100	Σ filogfi= 7158.662					n = 4 695	Σ filogfi= 10316.68

Species diversity calculation for rainy season,

$$H = \frac{n\log n - \sum fi \log fi}{n}$$

$$= \frac{3100\log 3100 - 7158.662}{3100}$$

$$= \frac{10823.22 - 7158.662}{3100}$$ Where,

$$= 1.18$$

H= index of species diversity
n = total individuals
fi = number of individual species.

To calculate Jackob's coefficient,

$$J = \frac{H}{H\ max}$$

$$= \frac{H}{LogK}$$

$$= \frac{1.18}{Log\ 36}$$

$$= \frac{1.18}{1.55}$$

= 0.76 Where,
J = relative diversity
H = observed diversity
H max = proportion of maximum possible diversity, H max = Log K
K= number of species present

Species diversity calculation for winter season

$$H = \frac{n\log n - \sum fi \log fi}{n}$$

$$= \frac{4695\log 4695 - 10316.68}{4695}$$

$$= \frac{17238.32 - 10316.68}{4695}$$

= 1.47Where,
H= index of species diversity
n = total individuals
fi = number of individual species.

To calculate Jackob's coefficient,

$$J = \frac{H}{H\ max}$$

$$= \frac{H}{LogK}$$

$$= \frac{1.47}{Log\ 59}$$

= 0.83
Where,
J = relative diversity
H = observed diversity
H max = proportion of maximum possible diversity, H max = Log K
K= number of species present

5. Conclusion and recommendation

Fish diversity is supposed to be maximum in winter season. So, it is appropriate to harvest both quantitatively and qualitatively in winter season. Further scientific research is better to be focussed in this season by the future researchers.

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