



The Study of Ichthyofaunal Diversity of Chenani Hydroelectric Reservoir, Udhampur (J&K) INDIA

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Abstract

The present work was carried out in Chenani hydroelectric reservoir to investigate its monthly variations in the physico-chemical parameters and its fish fauna during the study period of September 2011 to August 2012. Eight species of fishes which belongs to a single family i.e Cyprinidae (*Schizothorax richardsonii*, *Tor pituitora*, *Cirrhinus mrigala mrigala*, *Garra gotyla gotyla*, *Labeo boga*, *Labeo bata*, *Labeo rohita* and *Labeo dero*) were found in Chenani hydroelectric reservoir. The relative species diversity, species richness, dominance and evenness indexes were calculated. The value of Simpson index ranged between $H' = 0.34$ (March) to 1.48 (Nov.). The value of Shannon-Weiner index was higher ($I = 1.81$) in March and lower ($I = 0.96$) in Sept. Species richness in term of Margalef's index and Menhinick's index varied between minimum valued $R_1 = 0.71$ (Sept.) to a maximum value $R_1 = 2.07$ (Aug.) and a minimum valued $R_2 = 0.49$ (Sept.) to a maximum value $R_2 = 1.48$ (Aug.) respectively. The minimum evenness value was observed in Nov. and maximum in Oct. the values being $E = 0$ and $E = 0.96$ respectively.

Keywords: Ichthyofaunal, Chenani hydroelectric reservoir, physico-chemical parameters, fish fauna, shannon-weiner index

Introduction

From the ancient time man has been using fresh water fish both for food and game purposes. From past 4-5 decades population explosion has posed a great threat on fish population. Fish diversity has been declined to greater extent due to destruction of habitat both by natural and anthropogenic factors. Studies in wide variety of ecosystems and organisms suggest that species richness tends to vary strongly with ecosystem production and habitat heterogeneity¹. Studies of spatial and temporal patterns of diversity, distribution and composition of freshwater fishes are useful to examine different factors that influence the structure of the fish community². Fish species are also an important indicator of ecological health and the abundance and health of fish will show the health of water bodies³. Fish is used as a significant source of protein for millions of people around the world. Human population explosion has placed a significant demand on fish as a food source. It is estimated that approximately 25 percent of all protein consumed by people comes from fish sources of both marine and fresh water ecosystem. Fish research has become an increasingly important study area, as fish population is declining throughout the world. The decline of fish has an adverse impact on aquatic ecosystems as well as a significant impact on human population as it is one of the primary food sources. Anthropogenic activities such as modification of the environment, culture, harvesting and effects of modernization have contributed to the pollution of water bodies which serve as habitat for fishes⁴. Further overfishing in the past 4-5 decades has significantly reduced fish populations across the world. The purpose of present work is to find out

various fish fauna inhabiting the Chenani hydroelectric reservoir. The data so obtained will helps the environmentalist and policy makers to determine what course of action to be taken for proper management and protection of fish fauna.

Material and Methods

Chenani hydroelectric reservoir is situated at 32°57' 45.49' N to 75°10' 46.93'E having dimension of 750×150×22 feet with a capacity of 15 mw (figure 1). Water is poured into the reservoir by an artificial canal of 9 km from river Tawi. Water samples were collected once every month from this reservoir during September 2011 to August 2012 and estimated for physico-chemical parameters like water temperature, air temperature, transparency, pH, dissolved oxygen, free carbon dioxide, carbonates, bicarbonates, calcium, magnesium, chloride, sulphates, nitrates and phosphates by standard methods of APHA⁵.

The fish fauna shall be collected using cast net, with the help of local fisherman on monthly basis. Specimens so collected will be identified using various morphometric and meristic characters i.e. general body shape, structure of fins and parameters like total length, standard length, length of caudal fin, dorsal fin, pelvic and pectoral fin; body depth, head length, eye diameter, pre-dorsal and post-dorsal distance. Fishes will be identified and classified as per the classification scheme given⁶⁻⁹. The diversity of fishes were calculated by Simpson Index¹⁰ and Shannon-Weiner¹¹. Species Richness was calculated in terms of Margalef's index and Menhinick's¹² index and evenness indices by Pielou's index¹³.

Results and Discussion

Analysis of Physico-chemical parameters: The values of water quality parameters are given in the table 1. Water temperature is an important parameter for any aquatic ecosystem by its value of influence on aquatic life directly or indirectly. In the present study water temperature was gradually decreased from Sept. 2011 to January 2012 and increasing from February 2012 to June 2012. The value of water temperature ranged between 9.7°C (Dec.) to 24°C (June) Maximum value of both air and water temperature in the month of June may be attributed to the increased photoperiod and longer day length whereas minima acquired in December may be due to shorter photoperiod and shorter day length. Further atmospheric temperature of an area also depends upon its altitudinal and longitudinal location¹⁴⁻¹⁶. Water colour of this river was clear throughout the year except monsoon (August) influencing the transparency and turbidity of the river water. pH of water remain alkaline throughout the year and ranged between 8.2 (Nov.) to 8.6 (June). The alkaline nature of pH may be the result of various biological activities as also studied¹⁷. High pH in summer was because of utilization of bicarbonate and carbonate buffer system¹⁸. Dissolved oxygen showed an increase with the decline in water temperature and its values ranged between 4.82 mg/l (Sept.) to 9.58 mg/l (Jan.). Free carbon dioxide bear inverse relationship with dissolved oxygen and its value increased in summer season while decreased in winter. The value of FCO₂ ranged between 1.23 mg/l (Feb.) to 6.21 mg/l (Sept.). Bicarbonates were present in the permissible limit and ranged between 80.0 mg/l (Sept.) to 149.8 mg/l (Feb.). During the study period, the values of chloride fluctuated between 4.09 mg/l (Feb.) to 22.99 mg/l (Sept.). The higher concentration recorded during summer may be due to animal, agricultural and sewage runoff during rain and higher evaporation rate¹⁹. The value of sulphates, phosphates and nitrates do not Varied in uniform manner. Further their

concentrations increases during monsoon season because of animal and agricultural runoff.

Analysis of Fish Fauna: The result of the present study revealed the occurrence of 8 fresh water fish species belonging to 5 genera and a single family Cyprinidae (*Gara gotyla gotyla*, *Schizothorax richardsonii*, *Cirrhinus mrigala mrigala*, *Tor putitora*, *Labeo boga*, *Labeo rohita*, *Labeo bata* and *Labeo dero*) as shown in figure 3- 10. Dominance of cyprinids particularly *Tor putitora* and *Schizothorax richardsonii* was clearly expressed in glacierfed and snow-fed rivers Tawi of upper reaches. Dominance of cyprinidae family was reported in reservoirs²⁰. Average number of fish species per catch is shown in the table 2. Among the recorded fish species, *Gara gotyla gotyla* had the high abundance in number of fish species per catch. All the four species of *Labeo* genera were very common during the present study. The golden Mahseer (*Tor putitora*) is an important game and food fish distributed well along the cold water Himalayan rivers. The native name *Mahseer* refers to its large scales and heads. *Tor putitora* is a migratory fish and it attains a maximum weight up to 25kg in 4-5 year. A12 kg golden Mahseer had been recorded during the present study. The adult fish is a column feeder and is omnivorous. Being a migratory fish, *Tor putitora* migrate to lower elevation in summer months and took reverse journey in winter months. Another migratory species *Schizothorax richardsonii* migrate from lower elevation to higher elevation in summer months and return to lower elevation in winter months. According to IUCN Red List of Threatened Species, *Tor putitora* is listed among endangered fish species. The ecological status of golden Mahseer has been reported as endangered²¹⁻²³. Moreover the population of *Schizothorax richardsonii* has seen a continuous decline due to overfishing and it is considered as Vulnerable species. During the present study *Cirrhinus mrigala mrigala* was very rarely found may be due to intolerable low water temperature.

Table-1

Monthly variations in the Physico-Chemical parameters of Chenani hydroelectric Reservoir during Sept. 2011 to Aug. 2012

Parameters	Unit	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
Air temp.	°C	28	31	30.6	16.5	17	16.5	28	29	33	37	34	33
Water temp.	°C	23	22	21.5	9.7	10	9.9	11.5	14	19	24	23	23
Transparency	cm	425	80	415	206	240	180	190	195	211	218	118	45
pH of water		8.6	8.3	8.2	8.2	8.2	8.6	8.5	8.3	8.5	8.6	8.5	8.3
FCO ₂	mg/l	6.21	5.68	4.23	2.17	2.09	1.23	2.60	4.72	4.85	3.27	4.29	5.90
DO	mg/l	4.82	5.88	8.16	9.54	9.58	9.39	9.24	8.84	8.64	7.11	6.11	5.81
Carbonates	mg/l	-	-	-	-	-	-	-	-	-	-	-	-
bicarbonates	mg/l	88	102	94.6	103.8	130.8	149.8	122.2	145.2	133.4	131.4	127.4	129.8
Chloride	mg/l	22.99	7.49	10.79	4.99	7.89	4.09	8.099	7.89	8.29	8.29	7.59	7.89
Calcium	mg/l	75.6	46.20	59.01	73.50	68.67	26.57	27.08	71.19	78.54	80.64	86.10	88.2
Magnesium	mg/l	73.6	66.77	72.66	102.13	48.8	66.07	65.56	46.30	42.51	44.20	21.87	20.36
Phosphate	mg/l	0.108	0.144	0.139	0.110	0.126	0.10	0.14	0.216	0.121	0.142	0.211	0.319
Sulphate	mg/l	0.036	0.020	0.011	0.080	0.121	0.09	0.019	0.027	0.021	0.033	0.053	0.063
Nitrate	mg/l	0.139	0.231	0.151	0.116	0.123	0.109	0.125	0.127	0.164	0.161	0.217	0.283

Table-2
Monthly variations in the average number of fishes per catch from the study area

S. No	Name of species Family – Cyprinidae	Average no. of fishes per catch/ month											
		Sep	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug
1	<i>Gara gotyla gotyla</i> (Gray)	3.5	2.5	2.5	1.5	2	2.5	3	2.5	3	3.5	2	2
2	<i>Schizothorax richardsoni</i> (Gray)	0.5	0.5	1	1.5	2.5	3	3	2.5	3	3.5	3	3
3	<i>Tor putitora</i> (Hamilton-Buchanan)	1	1.5	1	0.5	0.5	1	0.5	0.5	1	0.5	3	3
4	<i>Labeo boga</i> (Hamilton-Buchanan)	2.5	1.5	2	2	2	1.5	1.5	1.5	1.5	2	2	2
5	<i>Cirrhinus mrigala mrigala</i> (Hamilton Buchanan)	-	-	-	-	0.5	1	1	1	0.5	-	1	1
6	<i>Labeo rohita</i> (Hamilton-Buchanan)	-	-	-	-	1	1.5	1.5	2	2	2	1.5	1
7	<i>Labeo bata</i> (Hamilton-Buchanan)	-	-	-	1	1	1.5	1.5	1	1.5	1.5	1.5	2
8	<i>Labeo dero</i> (Hamilton-Buchanan)	-	-	-	1	1	1	1.5	1	2	1	1.5	1.5

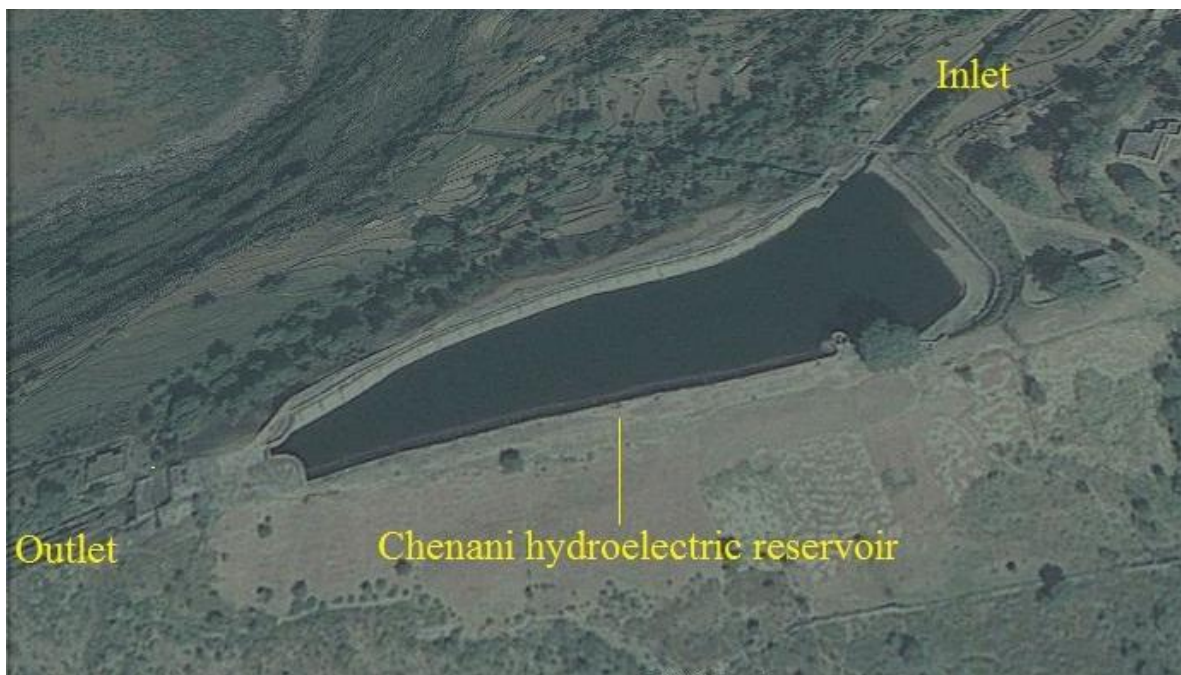


Figure-1
Aerial view of the study site showing Chenani hydroelectric reservoir, its inlet and outlet

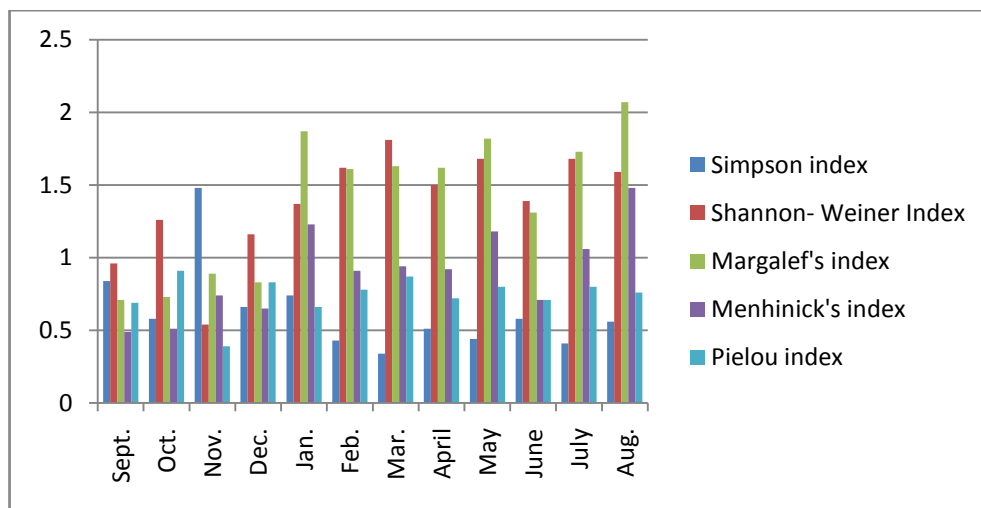


Figure-2
Monthly variations in the fish diversity, richness and evenness index's of Chenani hydroelectric reservoir



Figure-3
Labeo bata



Figure-7
Labeo boga



Figure-4
Gara gotyla



Figure-8
Cirrhinus mrigala mrigala



Figure-5
Schizothorax richardsoni



Figure-9
Tor pituitora



Figure-6
Labeo rohita



Figure-10
Labeo dero

The values of Species Diversity Index, Species Richness index and Evenness in Chenani hydroelectric reservoir is given in figure 2. Species diversity was calculated by Simpson and Shannon-Weiner index. The value of Simpson index ranged between $H' = 0.34$ (March) to 1.48 (Nov.). The value of Shannon-Weiner index was higher ($I = 1.81$) in March and lower ($I = 0.96$) in Sept. Species richness in term of Maraglef's index and Menhinick's index were calculated which varied between minimum valued $R_1 = 0.71$ (Sept.) to a maximum value $R_1 = 2.07$ (Aug.) and a minimum valued $R_2 = 0.49$ (Sept.) to a maximum value $R_2 = 1.48$ (August) respectively. The minimum evenness value was observed in Nov. and maximum in Oct. the values being $E = 0$ and $E = 0.96$ respectively. From the analysis it is found that species diversity and richness were maximum in March 2012 and August 2012 respectively.

Conclusion

The present study revealed that the physico-chemical parameters of Chenani hydroelectric reservoir are in the permissible limit. Presence of Eight Fish species in the reservoir showed its productive status but in spite of that it is not used for commercial fish production. Being a good source of protein and due to over increasing demands of human population, application of both indigenous and exotic fish species culture in Chenani hydroelectric reservoir will fulfil some food requirement of people of Udhampur.

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