

FISH DIVERSITY AND THEIR LIMNOLOGICAL STATUS OF GANGA RIVER SYSTEM IN FOOTHILLS OF GARHWAL HIMALAYA, UTTARAKHAND, INDIA

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ABSTRACT

Uttarakhand, a newly created hill state of India, is enriched with aquatic ecosystem of various disciplines like rivers, streams, lakes and reservoirs. The important rivers are Alaknanda, Bhagirathi, Bhilangana, Mandakini, Koshi, Ganga and Yamuna. The rivers are snow fed and spring fed. There are large number of snow fed rivers and streams such as Alaknanda, Bhagirathi, Mandakini and Ganga. Besides the snow fed rivers, there are so many spring fed rivers such as Henwal, HemGanga, Song, Suswa, Ganga and hundreds of rivulets. They all contain a very rich and colourful fish fauna. River Hemwal, Hem Ganga, Song and Suswa are tributaries of river Ganga. In the present study some spring fed and snow fed rivers such as Henwal, HemGanga, Ganga, Song, Suswa, Alaknanda, Bhagirathi and Bhilangana were investigated. During the course of study a total of 53 species belonging to 11 families were reported out of these 52 species were reported in Ganga 38 in Henwal, 36 in HemGanga, 48 in Song, 44 in river Suswa 32 in Alaknanda, 32 in Bhagirathi and 29 in river Bhilangana. Besides the collection of fishes the physico-chemical parameters such as temperature, velocity, turbidity, conductivity, total dissolved solids, pH, alkalinity, free CO₂, DO, BOD, chlorides, calcium and magnesium were also analyzed. Some endangered and rare fish fauna are also reported in the present investigation.

Key Words : Limnology, Pollution, Endangered, Physico-chemical, Fish-diversity

INTRODUCTION

Purans refers to the area of Uttarakhand as Kedarkhand. The ancient name of Uttarakhand was Panchaladesh, which means that the pandavas of Mahabharata period lived here. First of all listed the fish fauna of river Ganga and its tributaries, before this work no other work was published. Later on^{1,2} published their work on Ichthyofauna of Ganga river system. The report on the fish diversity of Ganga river system in foothills of Garhwal Himalayas is scanty and limited to Dehradun district only.

Physico - geographical features

Recently, Uttarakhand came into existence as a 27th state of India on November 9, 2000. It is located between latitude 28° 40' – 31° 29' N and longitude 77° 35' – 81° 5' E. It covers

about 53,483 Km² area and is inhabited by 8.5 million (according to 2001 Counting) people. It encompasses thirteen districts i.e. Uttarkashi, Chamoli, Rudraprayag, Tehri Garhwal, Dehradun, Pauri Garhwal, Pithoragarh, Champawat, Almora, Bageshwar, Nainital, Udham Singh Nagar and Haridwar. Uttarakhand is enriched with aquatic ecosystem of various disciplines like rivers, streams, lakes and rivulets, which have very rich flora and fauna (**Fig.1**).

AIMS AND OBJECTIVES

In the present study an attempt has been made to describe the fishes of river Ganga and its tributaries at foothills of Garhwal Himalayas including the analysis of physico-chemical parameters and its impact on fish fauna. A total of 53 species of fishes belonging to 11 families were reported during the course of study.

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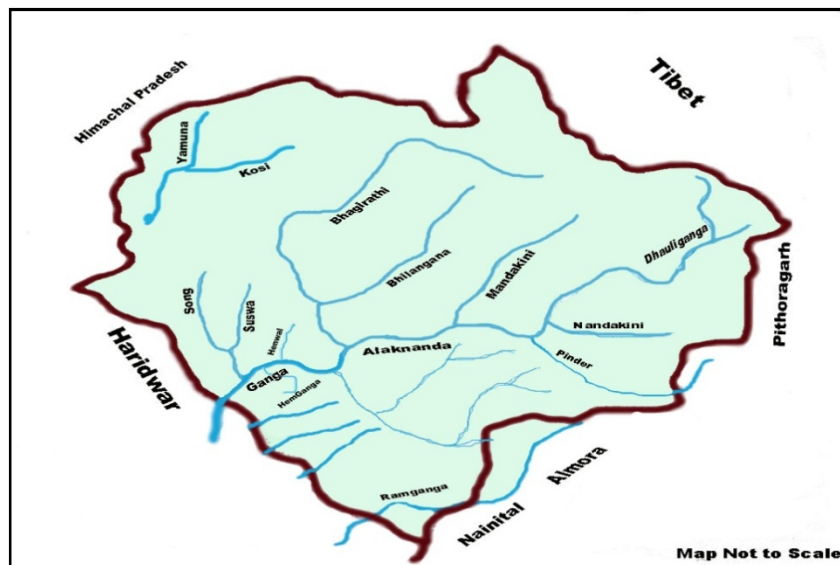


Fig. 1 : Map of Ganga river system at foothills of Garhwal Himalayas

MATERIAL AND METHODS

Analysis of various physico-chemical parameters like temperature, velocity, turbidity, conductivity, T.D.S., pH, alkalinity, free CO₂, DO, BOD, chlorides, calcium and magnesium have done by standard methods. Systematic study of fish fauna in various rivers of Ganga river system in foothills of Garhwal Hamalayas have also done.

RESULTS AND DISCUSSION

The data showing various physico-chemical parameters are shown in **Table 1**, while a systematic list of fish fauna of various rivers of Ganga river system is shown in **Table 2**. In the present study the temperature ranges between 9.8⁰C- 26.80⁰ C. The maximum velocity was found as 3.3m/s and minimum was 0.1m/s. Temperature was found quite suitable for the survival and growth of fish fauna.³ Found similar trend of fluctuating temperature. Turbidity of various rivers of Ganga river system fluctuated between 0.00 JTU to 525 JTU. It was observed during course of study that turbidity increases in monsoon season as compared to winter and summer, the reason being the mixing of sand and silt to river waters in rainy season, which results in choking conditions of fish gills and ultimately cause their death. Conductivity ranges between 48.5 µmhos/cm to 367.0 µmhos/cm. The T.D.S. fluctuated between 58.5 mg/l to 997.5 mg/l. The

pH of Ganga rivers system remains alkaline and ranges from 6.58 to 8.37. pH remains alkaline in almost all rivers of Ganga river system, which is a good indicator for survival of fish. The alkalinity fluctuated between 30.0 mg/l to 331.38mg/l. Maximum free CO₂ was observed as 4.75mg/l and minimum as 0.20 mg/l. According to incomplete utilization in photosynthesis and respiratory activities results in the presence of free CO₂. A negative relationship between DO and free CO₂ was found during course of study. Similar type of relationship was found.^{4,5} The value of DO ranges between 6.13 mg/l to 12.5mg/l. The BOD was recorded maximum as 3.85 mg/l and minimum as 0.8 mg/l. DO and BOD shows negative relationship as also reported. Chlorides in river of Ganga system fluctuated between 1.72mg/l to 28.50 mg/l. Calcium concentration ranges between 25mg/l to 125mg/l. The magnesium was observed maximum as 17.30mg/l and minimum as 5.6 mg/l. During the present study 53 species of fishes belonging to 11 families were reported belongs to phylum vertebrata (**Table 2**), Out of these *Tor tor*, *Tor putitora*, *Raimas bola* were found as endangered fishes while *Barilius vagra* and *Garra gotyla gotyla* were found as vulnerable fish species, out of all other fishes *Barilius bendelisis*, *Chagunius chagunio*,

Table 1 : Physico chemical analysis of rivers in Uttarakhand, India

Parameters	Rivers of Uttarakhand							
	Henwal	HemGanga	Song	Suswa	Ganga	Alaknanda	Bhagirathi	Bhilangana
Temperature (° C)	16.5 - 24.0	10.0 – 21.0	9.8 – 20.37	19.0 – 22.5	20.90-26.80	11.0-21.5	8.0-18.0	14.0-21.5
Velocity (m/s)	0.5 – 1.1	0.4 – 3.3	0.73 – 1.99	0.1 – 1.00	0.57 – 1.17	0.22-1.80	0.50-2.5	0.31-1.90
Turbidity (JTU)	0.0 – 60.0	0.0 – 85.0	0.0 – 525	0.0 – 65.0	0.0 – 40.0	0.0-25.0	12.0-180	0.0-32.0
Conductivity (µmhos/cm)	80.0 – 175.0	65.0 – 155.0	99.3 – 367.0	60.0 – 290.0	75.3 – 265.6	48.5-175.8	55.0-205.6	52.0-265.2
T.D.S. (mg/l)	96.5 – 186.0	83.2 – 130.2	58.5 – 997.5	155.0 – 210.0	126.3 – 216.5	75.0-190.5	85.0-125	85.0-155.0
pH	7.2 – 8.1	7.1 – 7.9	7.61 – 8.14	7.9 – 8.35	6.58 – 8.37	6.9-7.3	7.12-8.20	6.8-7.2
Alkalinity (mg/l)	210.0–320.0	145.0-265.0	35.2-69.11	131.6-175.0	276.8-331.38	85-125	30.0-108.0	48-150
Free CO ₂ (mg/l)	1.8 – 2.7	1.2 – 2.3	0.75 – 4.75	1.17 – 1.65	2.71 – 3.85	0.95-1.65	0.2-4.3	0.33-1.65
DO (mg/l)	7.0 – 10.5	7.5 – 11.0	7.6 – 12.5	8.5 – 9.25	6.13 – 8.34	6.75-9.75	6.8-11.20	6.25-9.50
BOD (mg/l)	1.0- 2.2	0.8 – 1.90	1.80 – 3.85	1.80 – 3.70	1.37 – 2.19	0.9-1.9	0.8-2.6	0.75-2.1
Chlorides (mg/l)	12.0 – 20.0	10.0 – 18.0	1.72 – 11.58	16.33 – 19.28	14.97 – 24.67	17.5-28.5	12.0-18.0	15.0-25.0
Calcium (mg/l)	66.0 - 80.0	55.0 – 120.0	45.0 – 110.0	35.0 – 77.54	77.85 – 89.73	25.0-95.0	65.0-125.0	45.0-110.0
Magnesium (mg/l)	8.1 – 9.20	7.3 – 14.90	9.2 – 15.60	11.2 – 17.30	10.8 - 15.30	5.6-12.4	7.5-15.0	6.5-16.5

Table 2 : Systematic list of fish fauna of various rivers of Ganga river system in foothills of Garhwal Himalayas, India

Phylum-Vertebrata, Subphylum -Craniata, Super class-Gnathostomata, Series-Pisces, Class-Teleostomi, Subclass-Aetinoptergii, Order-Cyprinoidae, Suborder-Cyprinoidae

Name of species	Rivers							
	Henwal	HemGanga	Song	Suswa	Ganga	Alaknanda	Bhagirathi	Bhilangana
Family : Cyprinidae								
<i>Barilius barna</i> (Ham.)	P	P	P	P	P	P	P	P
<i>Barilius bendelisis</i> (Ham.)	P	P	P	P	P	P	P	P
<i>**Barilius vagra</i> (Ham.)	P	P	P	P	A	P	P	P
<i>*Raimas bola</i> (Ham.)	P	P	P	P	P	P	P	P
<i>Danio devario</i> (Ham.)	P	P	P	P	P	P	P	A
<i>Chagunius chagunio</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Cirrhinus mrigala</i> (Ham.)	A	A	P	P	P	P	P	A
<i>**Garra gotyla gotyla</i> (Gray)	A	A	P	P	P	P	P	P
<i>Schizothorax plagiostomus</i> (Heckel)	P	P	P	P	P	P	P	P
<i>Schizothoraichthys richardsonii</i> (Gray)	P	P	P	P	P	P	P	P
<i>Schizothorax curvifrons</i> (Heckel)	P	P	P	P	P	P	P	P
<i>Schizothorax sinuatus</i> (Heckel)	P	P	P	P	P	P	P	P
<i>Schizothoraichthys niger</i> (Heckel)	A	P	P	A	P	P	P	P
<i>Schizothoraichthys progastus</i> (McClelland)	P	P	P	P	P	P	P	P
<i>Labeo rohita</i> (Ham.)	A	P	P	P	P	P	P	P
<i>Labeo calbasu</i> (Ham.)	A	A	P	P	P	P	P	P
<i>Labeo dero</i> (Ham.)	P	A	P	P	P	P	P	P
<i>Labeo dyocheilus</i> (Mc Clelland)	P	A	P	P	P	P	P	P
<i>Oxygaster bacaila</i> (Ham.)	A	A	P	P	P	A	A	A
<i>Puntius conchoni</i> (Ham.)	P	P	A	A	P	A	A	A
<i>Puntius chola</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Puntius sarana</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Puntius sophore</i> (Ham.)	A	A	P	P	P	A	A	A
<i>Puntius ticto</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Puntius phutunio</i> (Ham.)	A	A	P	P	P	A	A	A

<i>*Tor putitora</i> (Ham.)	P	P	P	P	P	P	P	P
<i>*Tor tor</i> (Ham.)	P	P	P	P	P	P	P	P
<i>Rasbora daniconius</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Esomus danricus</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Crossocheilus latius latius</i> (Ham)	P	P	P	P	P	P	P	P
Family : Cobitidae								
<i>Botia dario</i> (Ham.)	P	P	P	A	P	P	P	P
<i>Leptocephalus guntea</i> (Ham.)	P	P	P	P	P	P	A	A
<i>Noemacheilus botia</i> (Ham.)	P	P	P	P	P	A	A	A
<i>Noemacheilus rupicola</i> (Mc Clelland)	P	P	P	P	P	P	P	P
<i>Noemacheilus savona</i> (Ham.)	P	P	P	P	P	P	P	P
<i>Noemacheilus bevani</i> (Gunther)	P	P	P	P	P	P	P	P
Family : Bagridae								
<i>Mystus vittatus</i> (Bloch)	A	A	P	A	P	A	A	A
<i>Mystus bleekeri</i> (Day)	A	A	P	P	P	A	A	A
<i>Mystus seenghala</i> (Sykes)	A	A	P	P	P	A	A	A
<i>Mystus tengara</i> (Ham.)	A	A	P	P	P	A	A	A
Family : Claridae								
<i>Clarias batrachus</i> (Linn.)	P	A	P	P	P	A	A	A
Family : Belonidae								
<i>Xenentodon cancila</i> (Ham.)	A	A	P	P	P	A	A	A
Family : Mastacembelidae								
<i>Mastacembelus armatus</i> (Lacepede)	P	P	P	P	P	A	P	P
<i>Mastacembelus punctalus</i> (Ham.)	P	P	P	P	P	P	P	P
Family : Channidae								
<i>Channa punctatus</i> (Bloch)	P	P	P	P	P	A	A	A
<i>Channa gachua</i> (Ham.)	P	P	P	P	P	A	A	A
Family : Anabantidae								
<i>Colisa fasciatus</i> (Bloch & Schn.)	P	P	P	P	P	P	P	P
Family : Nandidae								

<i>Nandus nandus</i> (Ham.)	A	A	A	A	P	A	A	A
Family : Schilbeidae								
<i>Clupisoma garua</i> (Ham.)	P	A	A	A	P	P	P	P
Family : Sisoride								
<i>Glyptothorax pectinopterus</i> (Mc Clelland)	P	P	P	P	P	P	P	P
<i>Glyptothorax cavia</i> (Ham.)	P	P	A	A	P	P	P	P
<i>Glyptothorax brevipinnis</i> (Hora.)	P	P	A	A	P	P	P	P
<i>Bagarius bagarius</i> (Ham.)	A	A	P	A	P	P	P	A

* Endangered, **Vulnerable, P=Present, A=Absent

Garra lamta, Labeo boga, Labeo dero, Labeo dyocheilus, Puntius chola, Puntius sarana, Puntius sophore, Puntius phutunio, Rasbora daniconius, Esomus danricus, Crossocheilus latius latius, Leploephalus guntea, Noemacheilus botia, Noemacheilus savona, Noemacheilus bevani, Mystus vittatus, Xenentodon cancila, Mastacembelus armatus, Channa gachua, Glyptothorax pectinopterus were found at low risk.

An overall fish survey in the area has revealed a rapid decline in fish diversity. The main reason for decline of fishes is due to over fishing by various destructive fishing methods especially during breeding season. The pollution of the river by flash flood, landslides and soil erosion etc. have also been responsible for the depletion of fish fauna.^{6,7}

CONCLUSION

It may be concluded from the above study that fishes of various rivers of Ganga river system at foothills of Garhwal Himalaya totally depends upon physico-chemical parameters. Although all the parameters are found favorable for fish survival but certain parameters such as turbidity which increases in monsoon season results in increased number of fish mortality due to choking of gills besides this the major problem is illegal fishing which results in declining of fish population in Ganga river system.

Hence there is an urgent need of action plan for conservation of fish habitat, fishery development etc., besides this safety measures should be taken to control illegal fishing by

total ban on fishing especially in breeding season.

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