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Diversity of fishes in Uttrakhand (Devprayag to Haridwar)

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Abstract

Current investigation is carried out during December 2018 and November 2020 to measure the diversity and composition of freshwater fishes in river Ganga-Uttrakhand (Devprayag to Haridwar). Fisheries Resource of Uttarakhand comprise of fast flowing rivers and their tributaries, high and low altitude natural lakes, manmade reservoirs, ponds and diggies. Out of total stream length of 2686kms, 725 km is suitable for food and game fishes.In the present study, we analysed fish diversity of river Ganga at different locations between Haridwar to Deprival. By this study we explained the consequence of human interference, pollution on fish diversity. During the course of study a total of 19 species belonging to 11 families were reported from this region. Prior to reaching Rishikesh it is coupled by another tributary Nayar, which is a documented breeding ground for most important game fish of Ganga, refereed as Masheer (Tor sp.). Cypriniformes and Cyprinidae were the most species rich order and family of this region. Some threatened are rare fish fauna are also reported in the present investigation.

Keywords: fresh water, diversity, human interference, breeding grounds

Introduction

The Ganga River originates at Gomukh and flows down to Ganga sagar travelling a distance of 2525 kms. During its course through eleven states, the river receives numerous tributaries (with characteristic quality, pollution load and biota) including Bhilangana, Alakhnanda, RamGanga, Kali, Ymuna, Gomti, Ghagra, Gandhak and Kosi. The study was conducted in Uttrakhand (Devprayag to Haridwar) (1). Uttrakhand came into existence as 27th state of India on November 9th 2000. It is located between latitude 28^{0}40' – 31^o 29' N and longitude 77^o 35'–81^o 5'E. It covers about 53483 km^2 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 (2). Uttrakhand is enriched with acquatic ecosystem of various disciplines like rivers streams, lakes and rivulets, which have very rich flora and fauna. The climate of region is mainly tropical with a well-defined rainy season between June and October, a very mild winter between December and February and a relatively dry pre monsoon summer between March and May. At present, 32,500 fish species are listed 3,553 species of native fishes are currently recognized and of these 877 occur with in India. At present, 2555 species of finfish have been recorded in the database developed by NBFGR Lucknow of which 877 from freshwater, 133 brackish water and 1,563 are from marine environment, excluding 291 exotic species with information on their taxonomic positions and other biological information (Jena and Sarkar, 2012, NBFGR database 2013) (3). A current study of Sarkar *et al*, (2012) reports that Gangetic system alone accounting 143 species of fishes which contributes about 20% of fresh water fishes of the total fishes reported in India. Therefore the taxonomic collection apart, not much work has been done on the study of freshwater fishes in the Northern India mainly in Upper Ganga Region (4). Given the high levels of faunal diversity and endemicity observed so far, there is an urgent need to understand the fish diversity and distribution of this region. Accordingly with the help of this paper we not only explained fish diversity and division of this region (Devprayag to Haridwar) but also explain the effect of human activities in this region. As per the recent spurt of human activities in this region exploiting its water resources for hydroelectric purposes (5). Not only are the rivers directly affected by the developmental activities, but they are also affected by other threats like introduction of exotic species, over fishing and the disposal of industrial and domestic waste from the new industries and settlements. Before the rich species diversity in this region of the subcontinent is vanished forever, the documentation of the species found here are well as their distribution is vital; this together with the identification of the threats will help in formulating the needed conversation measures (6). As an initial step in this direction, the main purpose of this study was to collect data on species richness and distributions that could serve as baseline information to monitor the potential upper Ganga region shows that this region is very high in diversity as well as endemicity.

Material and Method

Study Area

Uttarakhand formerly known as Uttaranchal is a state in

the northern part of India. It is often referred to as the "Devabhumi" due to many Hindu temples and pilgrimage centres found throughout the state (7). Uttarakhand is known for the natural environment of the Himalayas, the Bhabar and the Terai regions. It borders the Tibet Autonomous Region of China to the north; the Sudurpashchim Pradesh of Nepal to the east; the Indian states of Uttar Pradesh to the south and Himachal Pradesh to the west and north-west. The state is divided into two divisions, Garhwal and Kumaon with a total of 13 districts.

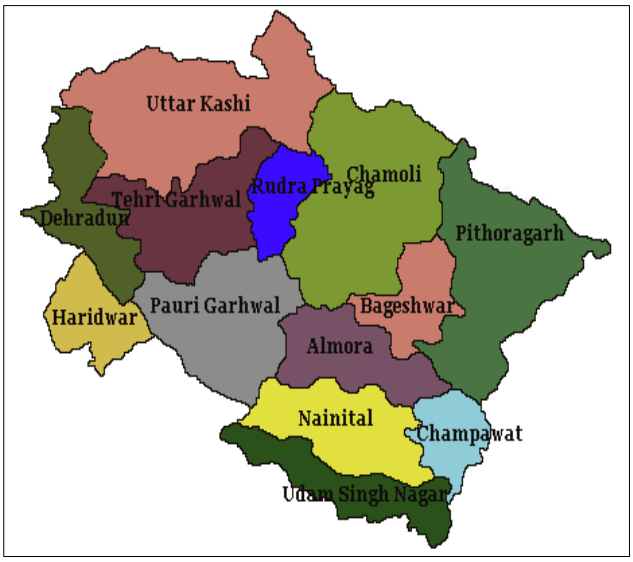

Fig 1: Uttrakhand

Devprayag (Latitude: 30º08'49.4"N; Longitude: 78º35', Elevation: 474m above mean sea level) to Haridwar (Latitude: 29º57'20.1"N; Longitude: 78º10'56.3"E; Elevation: 290 m above mean sea level) in Tehri Garhwal District in the state of Uttrrakhand, India and Devprayag is the confluence point of rivers Bhagirathi and Alakhnanda, and the river Ganga downstream descent at Rishikesh and travels up to Haridwar in plains. Before reaching Rishikesh, it is joined by another tributary Nayar (8). The river stretch consists of rapid, riffles and pools. The substrate consists of mature boulders, cobbles and pebbles. Sand is also present at few places in this zone. The river water in this stretch appears clear and clean, and has high transparency with moderate depth. The current velocity range between 0.1-3.0 m/s (Kishore, 1998). The water temperature is also moderate and varies between15-23^{0}C. The flows are substantially fluctuating and the river meanders into few channels at Haridwar d/s of Rishikesh (9).

Fig 2: Map Showing Study Area i.e. Devprayag to Haridwar

Sampling

The study was carried out from December 18 and November 20. For the collection of fishes, cast net of 1-2 m diameter with mesh size of 0.05 cm knot to knot with heavy sinkers, which allow rapid settling of the net at the bottom is used. At the each study site, at a time 10-15 throws were casted at different sites of the river between mid-morning and late afternoon on a fixed day every month (10). Representative specimens of different fish species were preserved in 10% formaldehyde solution and identified in the laboratory using standard references.

Observation and Result

Table 1: Taxa of fish fauna observed in the sub-stretch Devprayag to Haridwar

Taxa	No. of Fishes In Year (2005)	No. of Fishes In Year (2019)
Cyprinidae		
Barilius barila	A	P
B. bendelisis	P	P
B. bola	P	P
B. vagra	P	A
Crossocheilus latius latius	P	P
Danio devario	P	A
D. rerio	P	A
Esomus danricus	P	A
Garra gotyla gotyla	P	P
Labeo angara	A	P
L. calbasu	A	P
L. dero	P	P
L. dyocheilus	P	P
L. gonius	P	A
Puntius sarana sarana	P	A
P. sophore	P	A
P. ticto	P	P
Raiamas bola	A	A
Rasbora daniconius	P	A
Salmostoma bacaila	P	A

Schizothoracthys progastus	A	P
Schizothorax plagiostomus	P	P
S. sinuatus	P	P
Tor putitora	P	P
Tor tor	P	P
Sisoridae		
Bagarius bagarius	P	A
Glyptothorax lineatus	A	P
G. pectinopterus	P	A
Osphronemidae		
Colisa fasciatus	P	A
Balitoridae		
Nemacheilus beavani	P	A
N. botio	P	A
N. montanus	P	A
N. savona	P	A
Cobitidae		
Botio dario	P	A
Belonidae		
Xenantodon cancila	P	A
Channidae		
Channa gauchua	P	A
Mastacembelidae		
Mastacembelus armatus	P	A
Bagridae		
Mystus tengara	P	A
Rita rita	P	A
Clariidae		
Clarias batrachus	A	P
Schilbeidae		
Clupisoma garua	P	A
Mugilidae		
Rhinomugil corsula	A	P
Total	35	19

Devprayag is the meeting point of the rivers Bhagirathi and Alakhnanda, and the river Ganga downstream descends at Rishikesh and traverses up to the Haridwar in plains. Prior to reaching Rishikesh, it is coupled by another tributary Nayar, which is recognized breeding ground for the most important game fish of Ganga, referred as Mahseer (Tor sp.) (11). Cypriniformes and Cyprinid were the most species rich order and family of this region. The Upper mountain section i.e. up to Devprayag, 39 fish species were reported in Bhagirathi from Gangotri to Devprayag and 42 species in the Alakhnanda from Mana to Devprayag (Singh *et al*., 1987). Recently, Nautical *et al*., (2007) reported brown trout (Salmo trutta morph fario Linnaeus, 1758) in a left side tributary (Kherag Gad) of the Bhagirathi river downstream of Bhaironghati. Twenty species were reported in the Alakhnanda River and its tributaries near Up and Down Streams of the proposed barrage and power house site of Vishnugad Pipalkoti Hydro-Electric Project (12). On the other hand, Khanna and Badola (1994) recorded 30 fish species around Rishikesh-Haridwar section in the foot hill section of mountain zone. In the foothill section, Negi andf Malik (2005) recorded 35 species at Rishikesh and Natiyal *et al*. (2010) recorded 20 species between Kaudiyala and Rishikesh. The most typical fish in the region were Cyprinidae, snow trauts (Schizothorax sp, Schizothoraichthys sp. Torchelynoides sp) Balitoridae (Schistura sp.) and Sisoridae (Pseudecheneis sp., Glyptothorax sp.). Vital fishes reported in sub stretch consist of minor carps (e.g. Barilius sp, Puntius sp.) major carps (Labeo sp.), Mahseer (Tor sp.) and catfishes (Bagarius bagarius, Rita rita) (refer Table).

The river stretch consists of rapid, riffles and pools. The substrate consists of mature boulders, cobbles and pebbles. Sand is also present at few places in this zone. The river water in this stretch appears clear and clean, and has high transparency with moderate depth (13). The current velocity range between 0.1-3.0 m/s (Kishore, 1998). The water temperature is also moderate and varies between15-23^{0}C. The flows are substantially fluctuating and the river meanders into few channels at Haridwar d/s of Rishikesh (14).

Conclusion

Fishery resources are accessible in the form of rivers and their tributaries, reservoirs, wetlands, lakes, ponds and tanks exhibiting a rich genetic diversity. However, owing to ever growing demand of water in this region, these bio resources are experiencing grave threats to mutually diversity and ecosystem firmness (15). Along with a number of fishes are vanishing due to several anthropogenic factors. Throughout the last few decades, the fish biodiversity of the country are declining swiftly due to anthropogenic environmental degradation like urbanization, damming, abstraction of water for irrigation, power generation and pollution, which have subjected our natural water bodies in general and rivers, in particular to severe stress with disturbing effects on fresh water fish diversity(16).

Along with that this has modified the continuums of the Ganga in the examined stretch. The continuum of the fauna depends on their dispersal ability to essential for population dynamics, and since aquatic organisms can disperse only if there are no barriers, their dispersal was hindered, inhibited and impaired. This may have lead to turn down in the

resemblance in the UGP, where no major river from different bio geographic zone is joining the Ganga (17). There is a serious lacuna about the natural range of each species (however small in size) as there have been no dedicated research program for Ganga with economic implications for the country, specially irrigation and the variety of livelihood it provides to poverty ridden area of North India. For illustration, it is well known that the snow trouts *S.richardsonii* and *S. plagiostomus* reside form little below Badrinath to Haridwar and *Tor putitora* reside in the foothill (even Bijnor) but migrate even beyond Srinagar, Alakhnanda and Tehri (not now because of Tehri Dam). If these fishes are not found in impounded areas then it is obvious that the continuum does not exists but then the fish needs the food web and each constituent has an ecological function in the ecosystem(18). Hence there is emphasis on the knowledge of the various components of Biodiversity and their distribution to know the health of the ecosystem. Changes in division indicate the disturbance in the environment.

For a Better Future

Human activities and stressors that impend freshwater and marine fishes are likely to become more widespread, intense and damaging unless they are curbed through prevention, improved management (e.g. fisheries) and rebuilding or adaptation programmes. In the freshwater realm, decades of research and practical experience provide plenty guidance on methods for integrated catchment management (Collares-Pereira and Cowx, 2004) (19), restoration of aquatic habitats (Roni *et al*., 2008), dam management and removal (Olden, 2016), provision of environmental flows (Arthington, 2012) and restoration of riparian and floodplain processes (Naiman *et al*., 2010; Kingsford, 2015). Fished populations can be transformed by applying appropriate guidelines (e.g. catch-and-release), no-take zones in critical areas for breeding and recruitment, and even managed relocation and reestablishments (Cooke and Schramm, 2007). Recovery programmes range from individual species to the fauna of entire river basins. Abundant studies integrate basic knowledge of fish biology and focused threat assessment into individual species' recovery plans (20). Management of the vendace and whitefish (Coregonus lavaretus), the UK's rarest freshwater fishes, has involved protection and improvement of their habitats and the creation of refuge populations (Winfield *et al*., 2012, 2013). A remarkable effort at basin scale is the recuperation of fish communities throughout Australia's Murray–Darling Basin, where native fishes are subject to severe impacts by many stressors (Koehn and Lintermans, 2012). The exposure of freshwater systems and their fishes to many dissimilar coincident or sequential stressors strengthens ecological impacts and vastly complicates restoration and conservation planning, especially where spatially diffuse stressor syndromes span multiple jurisdictions and legislation, management agencies, or nationalities (Closs *et al*., 2016). The society of freshwater fishes under scenarios of climate change may be the greatest conservation challenge in regions where aquatic ecosystems are already exposed to multiple interacting stressors. The underlying science builds on two spheres of research – conservation physiology and conservation biogeography (Olden *et al*., 2010; Heino *et al*., 2016). Even without data-intensive research, simple and easily coded vulnerability analyses can be used to determine conservation priorities (Moyle *et al*., 2015). In the marine realm overfishing, compounded by under-assessment, under-management, and international trade for valuable meat, fins and live animals for the aquarium trade (21).

For a better tomorrow we must remain a strong monitoring on the varying environment. Sustainable fishery is not about fishing for monetary purposes only it has also a great concern to save the fish habitat or aquatic environment including fishes and other aquatic organisms to keep the ecosystem continual as far as possible (22). These freshwater resources are also our life supporting system that cannot be subjugated any more for economic purposes only. Supreme sustainable yield should be changed accordingly to the changing environment and it must sufficient with fish population of a particular species. Any divergence would lead to further erosion of biodiversity and would be detrimental for fisheries and environment as a whole. Right information at right time can save this biodiversity. So to change the trends of biodiversity in optimistic direction the role of right information input and information technology as a tool is quite predictable (23). There are a number of different initiatives in progress at present, all resembling the need to inventory, records and monitor freshwater fish diversity from different points of view. A collective effort to conclude the priorities and to concentrate the available resources on these is surely an essential prerequisite for a better future.

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