



Biodiversity of Freshwater Fishes in Uttar Pradesh: Regenerating Status and Reinforcing Conservation Efforts for Sustainable Management

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Introduction

In recent years, it was realized that the fish and freshwaters are one of the most vulnerable resources in nature that have been heavily impacted by human usage and regulation. Uttar Pradesh, one of the largest states in India, has vast potential of aquatic bioresources and offers considerable scope of inland fisheries development and aquaculture. The fishery resources in Uttar Pradesh region are available in the form of rivers and their tributaries, reservoirs, wetlands, lakes, ponds and tanks exhibited a rich genetic diversity. The drainage pattern is dominated and controlled by river Ganga system recognized as the master stream of the state. Its total length is about 2,525 kms of which 1450 kms is in U.P. and Uttaranchal. The most important tributaries are Yamuna on the right side and Ram Ganga, Gomti and Ghagra on the left side. Yamuna is 1376 Sq. km long basin, covering an area of 320 lakh sq. km of which 61750 Sq. Km. lies in U.P. The important tributaries of Yamuna are Chambal, Sind, Betwa, Dhasan, Baghin and Ken. These rivers contribute 79 billion cubic m of water every year into the main stream. The Gomti has its length of 940 Km and contributes 7.39 billion cu m of water per year to main river Ganga. The Ghaghra contributes the largest amount of water per annum to the entire Ganga basin, (94.4 billion cu m.). Its total area is 1, 27,950 sq km of which 49,750 sq km lies in Uttar Pradesh. The other important tributaries are Saryu, Rapti and Gandak. Although, studies on the fish fauna of the rivers of Uttar Pradesh have been made by several authors and

information was mostly reported on the systematic, biogeographical and ecological aspects but these information are still inadequate to address the critical issues for their sustainable management.

Current status and trend

The current assessment of the rivers of Uttar Pradesh reveals about a total biodiversity 124 species 74 genera and 28 families. This diversity has contributed of about 14.11% of the India's freshwater fish diversity (Fig. 1). Over all, the diversity among families was recorded to be widely distributed and common to all rivers; for eg. Cyprinidae, Bagridae, Siluridae, Mastacembelidae and Schilbeidae. The river Gerua had a highest number of species (87) and genera (52) followed by Gomti (68 species) Betwa (63 species), Ghagara (62 species) and Ken river (42 species etc. Based on the non parametric method of species richness estimation the expected species richness for all the tributaries were calculated which showed highest species richness in Betwa river (5.89) followed by Gomti (4.87) and Ghagara rivers (4.32). Evaluation of the commercial value appears that out of the total biodiversity collected, 35 species were considered as potential aquarium fishes (*Rasbora daniconius*, *Danio davario*, *Puntius ticto*, *Amblyphrigodon mola*, *Osteobrama cotio cotio*, *Chanda nama* etc), 54 species were potential food fishes (*Catla catla*, *Labeo rohita*, *Cirrihinus mrigala*, *Channa marulius*, *Notopterus notopterus* etc) and nine species were listed under potential sport fishes (*Tor tor*, *Aorichthys seenghala*, *Mystus*



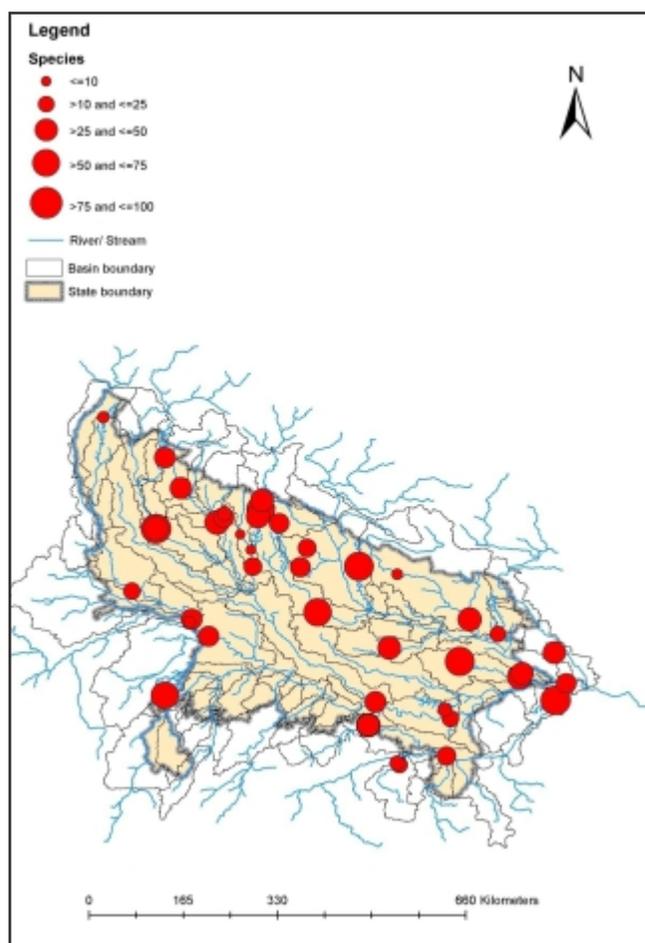


Fig 1. Fish species richness in the rivers of Uttar Pradesh

tengara, Walago attu etc). Assessment of the threat status as per IUCN red list of threatened species showed that one species as endangered (EN), two species as vulnerable, nine species under near threatened, 75 species as least concern and data on 11 species were not available to categorize them under any threat category. Some of the important fishes recorded from the rivers of Uttar Pradesh are depicted in Fig. 2

Detecting biodiversity change

The present study is an extensive assessment which brings together the studies of fish diversity in Northern India, which have been studied quite extensively with regards to its freshwater fish diversity and is known to have rich fish diversity comprising threatened, migratory and commercially important fishes. Comparable results

from the past studies showed that the declining fish diversity status represents an increasing trend. For example, river Gomti showed a total species diversity of 68 species which is higher than the earlier reported 56 species by Sarkar *et al.* (2010). Correspondingly, river Betwa contributes about 76% of the species diversity in Northern India itself whereas; the total fish diversity was reported of about 63 species covering entire stretch in Uttar Pradesh and Madhya Pradesh. Moreover, the reported 87 species from river Gerua of the Katerniaghat Wildlife Sanctuary was found similar as compared to earlier report by Sarkar *et al.* (2008). The diversity index was also recorded higher in this river as compare to others which showed the existence of a balance between total species and total individual of every species. Moreover, Sarkar *et al.* (2008) reported a significant increase in species richness, presence of many threatened species, and distinct stocks in the water bodies of the wildlife-protected areas than the fished areas of a lotic water body. The rich fish diversity in a small stretch of this river as compare to other large rivers studied here confirms that protected freshwater area is important for conservation of the regional fish biodiversity, especially for local and endangered fish species. The literature indicates that fish densities are generally higher in protected areas and demographic structure differs significantly in the relative abundance of larger individuals, both of which in turn result in greater biomass.

Invasive alien species

Total of six exotic fish species viz. *Oreochromis mossambicus*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Ctenopharyngodaon idellus*, *Oreochromis mossambicus*, *Clarias gariepinus* and *Pterygoplichthys disjunctivus*, (a newly reported exotic in India) distributed was recorded in this state. Although a total of ten exotic species were reported from River Ganga in a recent study by Sarkar *et al.* (2011). In this study, the endangered (*Chagunius chagunio*, *Chitala chitala* and *Tor tor*) and migratory species (*Bagarius bagarius*, *Ompok pabda*, *Walago attu* and *Aorichthys aor*) and the increasing appearance of





Figure 2: Species Diversity of sea anemone in Andaman and Nicobar Islands in comparison with India



Pangasius pangasius



Silonia silonia



Chitala chitala



Ompok pabda



Rhinomugil corsula



Labeo bogut



Nandus nandus



Bagarias bagarias

exotic species in the fishery is a warranting situation of biological invasion threatening ecological integrity. Moreover, in the main stream of River Ganga the repopulating trend of *C. carpio* in degrading water of the river (Sarkar *et al.* 2011) has come up to conserve rich fish genetic resources before it faces a major alteration.

New distribution and shifts

A number of cold water genera like species which were never reported in river Gomti were available at the middle to lower stretches. For instance, the range extensions of several fish species including *Amblyceps mangois*, *Erethistes hara*, *Glyptothorax cavia*, and *Schistura rupecula* were recorded from the middle stretches of river Gomti. In another interesting discovery, an eel-loach *Pangio pangia* Hamilton, described in 1822

from East India in the River Ganges, has never been reported subsequently, reported for the first time in river Gomti in Uttar Pradesh. The current record revealed the possibilities due to climate change since other current studies showed perceptible shifts in many of the freshwater fishes in River Ganga (Vass *et al.*, 2009; Sarkar *et al.*, 2011).

Threats

The freshwater resources of North India are currently experiencing an alarming decline in fish biodiversity due to various anthropogenic activities. Destructive fishing methods, entry of exotic species, use of poison, habitat alteration and water diversion, poor vegetation cover in the river banks, siltation, water abstraction, and low water velocity have been affected the overall fish diversity to large extent. Evidently, this will prove



hazardous to the abundance and distribution of fish fauna of the Uttar Pradesh. Water pollution has become a great threat to the aquatic fish fauna almost in all the major rivers in North India. River Betwa is highly impacted with fragmentation due to lack of water, damming, and multiple water use while River Gomti and Ghagara facing serious threats due to habitat alteration and water diversion, poor vegetation. Thus towards restoring of the critical habitats of the fishes in these rivers research efforts should immediately be translated into social and political actions as early as possible.

Conservation Measures

For the protection of aquatic resources, flora and fauna of the rivers and tributaries, there is need to remove various stresses on the aquatic resources. Some of the suggested measures are:

1. Assessment of aquatic resources, prioritization of conservation sites through GIS and ground validation.
2. Updated inventory of the fish fauna, evaluation and germplasm registration.
3. Impact assessment of exotic species and disease management.
4. Identification of priority habitats, establishment of more Protected Areas.
5. *Ex-situ* conservation and Live Gene Bank.
6. Conservation aquaculture for food and ornamental fishes.
7. Development of a state specific aquaculture

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and fisheries enhancement model.

8. Diversification of aqua farming.
9. Research efforts on the biodiversity, conservation biology, captive breeding.
10. Ranching and stock enhancement of indigenous fish yearlings.
11. Public awareness campaign including people's participation and HRD.
12. Climate change and implications in freshwater fisheries.
13. Legislative framework for fish biodiversity

Conclusion

The rich freshwater fish diversity recorded under this project can be utilized for decision making in conservation and management in a scientific manners. Also, there is an immediate need of more conservation programme in order to retain this natural freshwater heritage in Uttar Pradesh region.

Acknowledgements

We are extremely grateful to the Uttar Pradesh Biodiversity Board, Lucknow for financial support to carry out the present investigation. We also express our gratitude and thank to Director, National Bureau of fish Genetic resources, Lucknow for providing all facilities. Project investigator wish to thank to all the research scholar's involved in the project, for assisting in field exploration and other necessary support.