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Present Status of Fish Diversity of Davipatan Division of Uttar Pradesh, India

Prakash Sadguru

Department of Zoology, M.L.K.P.G. College, Balrampur (U.P.), India

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Abstract: Davipatan division of eastern Uttar Pradesh (U.P.) has vast potential of fish faunal biodiversity and offers immense scope of inland fisheries development. To assess the fish diversity of the Davipatan division of U.P., a preliminary survey of all four districts viz. Gonda, Bahraich, Balrampur and Shravasti were undertaken during September, 2020 to August, 2021 and data have been collected with the help of local fisherman and fish market survey. During study period, 58 fish species belonging to 36 genera, 21 families and 9 orders have been identified. The order Cypriniformes was found as dominated order with 21 species (36.20%) followed by Siluriformes 16 species (27.58%), Perciformes 7 species (12.06%), Ophiocephaliformes 5 species (8.62%), Synbranchiformes 3 species (5.17%), Clupeiformes 2 species (3.44%), Osteoglossiformes 2 species (3.44%), Beloniformes 1 species (1.72%) and Tetraodontiformes 1 species (1.72%). The present investigation showed that all the four districts of Davipatan division possesses rich fish biodiversity but proper conservation measures are required to maintain sustainability and richness of the fish species diversity of that tarai region of eastern U.P. Out of the total number of 58 species recorded during the study, 30 species may be listed as potential species of ornamental value. According to IUCN, 44 were enlisted as Least Concern (LC), 5 species as near endangered (NE), 5 species as near threatened (NT), 3 listed as Endangered (EN) and 1 species was listed as Vulnerable (VU).

Keywords: Fish diversity, Davipatan division, Conservation status, Endangered species, Vulnerable species, IUCN

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Introduction

Fish is one of the most important components of food for human beings, because it provides protein, lipids, vitamins, essential amino acids, fatty acids (ω 3 polyunsaturated, eicosapentaenoic and docosahexaenoic fatty acids) and minerals for the growth and development of body as well as maintenance of human health by preventing several nutritional deficiency diseases (Verma, 2019; Prakash, 2020a). The fishes are used not only as food, medicine but also as bio-indicators, research models, active links between ecosystems,

entertainment and to mitigate vector borne diseases (Verma, 2021). Fish diversity within the fresh water ecosystem has a great importance in terms of the livelihood and the economic importance of the people living around it.

Fisheries sector in India rank third in the world in total fish production and contributes around 1.07 % of the country's Gross Domestic Products (GDP) and 5.34% of the agricultural GDP. With third position in fisheries, the country has high potentials in this sector for rural

development, nutritional security and employment generation. Uttar Pradesh, one of the largest states in India, has vast potential of aquatic bio-resources and offers considerable scope of inland fisheries development. State contributes approximately 14.68% of the total national fish diversity and resources are available in the form of 28,500 km of rivers and canals, 1.38 lakh ha of reservoirs, 1.33 lakh ha of lakes and 1.61 lakh ha of ponds (Lakra, 2010). Therefore, there lies the scope for utilization of these vast resources for fishery development. In spite of vast freshwater resources, fishery has been assigned a least priority among long chain of stake holders of U.P.

The fish diversity is subjected to the changes in land and water resulting into substantial losses of fishes and remaining species may be at a risk. Fish species inhabiting the fresh water bodies have to live under harsher and more variable conditions and they may put to extra ordinary stress because of human interventions. Natural water has more stable conditions under which the fish evolve, hence enlisting biodiversity and its distribution over time and space becomes important. Until one knows the diversity and variations over time and space, it is difficult to plan conservation and the development projects related to water resources (Prakash, 2020b). Thus, there is an urgent need for proper investigation and documentation of the fish diversity in order to develop a fresh water diversity information system.

During the last few decades, the fish biodiversity of the state is declining rapidly due to habitat destruction, defragmentation, irrational fishing practices, introduction of exotic species environmental aberrations like reduction in water volume, increased sedimentation, water abstraction, and water pollution over the years (Ashok, 2018). This diversity is declining and even few species have been lost from the freshwater ecosystem of India and some are belonging under endemic, endangered and threatened category (Sanjay and Prakash, 2020; Arya, 2021). The

climate change plays a major role in composition and diversity of aquatic ecosystem (Prakash and Srivastava, 2019; Mandal and Singh, 2020; Prakash, 2021).

A huge number of studies have been made by different researchers on fish diversity of various fresh water bodies in India including U.P. such as Bhat (2003), Bagra and Das (2010), Jayaram (2010), Lakra (2010), Kumar (2012), Islam *et al.* (2013), Shukla and Singh (2013), Verma *et al.* (2015), Gowda *et al.* (2015), Prakash (2016, 2020a, b), Verma (2017, 2020); Prakash and Singh (2020), Prakash and Yadav (2020), Prakash *et al.* (2020) and Sanjay and Prakash (2020) but detail information about fish diversity of Davipatan division of U.P. is yet not available.

The presence of many lentic and lotic fresh water bodies in form of ponds, lakes, wetlands, reservoirs, streams, river etc. in Gonda, Bahraich, Balrampur and Shravasti districts of Devipatan division of Tarai region of eastern Uttar Pradesh offer immense scope and potential for inland fishery development. Before utilizing these fresh water bodies in fish culture practices, it is of utmost importance to have the knowledge of existence of fish fauna because paucity of such knowledge is a serious constraint in exploitation of these fresh water bodies. Therefore, the aim of the present investigation was to explore the status of piscine diversity, composition of major fishery groups, yield and management issues along with suggested measures for inland freshwater fishery enhancement and to provide current data as well as a better knowledge of the fish diversity.

Materials and Methods

Fishes were collected from tanks, ponds, lakes, river (Rapti, Swan), irrigation canals, wetlands, reservoirs of Gonda, Bahraich, Balrampur and Shravasti districts of Davipatan division by local fisherman using hand-nets, gill nets, cast nets, drag nets, scoop net including hooks and lines mainly during the time of fishing. River Rapti is the main river traversing in this area and plays a

vital role in the topography and causes serious flood havoc in the monsoon season. Investigations regarding fish capture and collection were conducted twice in a month for the period of one year from September, 2020 to August 2021.

The collected small sized fishes were directly placed in a wide mouth jar having 10% formalin solution. But larger specimens were preserved with incision on belly in the plastic containers. Fresh or preserved samples were identified up to species level. Identification of fish specimens was done by examining its shape, colour, pattern of scales, fins, mouth pattern and other morphological characters with the help of standard taxonomic keys for fishes (Datta Munshi and Srivastava, 1988; Day, 1989; Menon, 1992; Srivastava, 2002; Jayaram, 2010).

Results and Discussion

During the present study period, a total of 58 fish species belonging 36 genera, 21 families and 9 orders were recorded. All the fish recorded with their economic importance and IUCN conservation status are given in the Table1. After morphometric and meristic analysis of all fish specimens, the author found that the order Cypriniformes (21 species) contributed maximum as compared to Siluriformes (16 species), Perciformes (7 species), Ophiocephaliformes (5 species), Synbranchiformes (3 species), Clupeiformes (2 species), Osteoglossiformes (2 species), Beloniformes (1 species) and Tetraodontiformes (1 species). Out of total 58 fish species recorded during the study, 30 species had potential for the ornamental fish market (Table 1).

In the present investigation, the dominant order was Cypriniformes (minnows and carps) comprising 36.20% of all the number of fish species recorded. Next to Cypriniformes, other dominant orders were Siluriformes, Perciformes, Ophiocephaliformes, Synbranchiformes, Clupeiformes, Osteoglossiformes, Beloniformes and Tetraodontiformes representing 27.58%, 12.06%, 8.62%, 5.17%, 3.44%, 3.44%, 1.72% and 1.72%,

respectively (Fig. 1). Fish species composition when grouped into families reveal that Cyprinidae constituting major share 36.20% followed by family Bagridae 10.34%; Channidae 8.62%; each Siluridae and Mastacembeleidae share 5.17%; each Notopteridae, Clariidae and Ambassidae 3.44% and each of remaining 12 families comprises 1.72% (Fig. 2).

In this present investigation, total of five exotic fish species (invasive alien species) viz, *Gudusia chapra*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella* and *Clarias griepinus* were reported in this area. Author also noticed the occurrence of endangered *Notopterus chital*, *Mastacembelus aculeatus* and *Tetraodon cutcutia* and migratory fish species (*Bagarius bagarius*, *Ompok pabda* and *Wallago attu*). The increasing appearance of exotic species in the fishery is a warranting situation of biological invasion threatening ecological integrity (Sarkar *et al.*, 2015). Recently 92 fish species belong to 58 genera and 24 families were recorded by NBFGR, Lucknow from river Ganga in U.P. and also the presence of 83 fish species in Lucknow district of U.P. (Verma *et al.*, 2015) and 46 species belonging to 30 genera and 19 families in Rapti river flowing through Shrivasti and Balrampur districts of U.P. (Sanjay and Prakash, 2020).

On the basis of rate of decline, population size, area of geographic distribution and degree of population, distribution fragmentation etc. IUCN (International Union for Conservation of Nature) Red List (2020) classified the species into nine groups including EN (Endangered), VU (Vulnerable), NT (Near Threatened), LC (Least Concern) and NE (Not evaluated). As per latest version of IUCN Red List, out of 58 identified species, 3 species comes under EN (endangered), 1 species under UV (vulnerable), 5 under NT (Near Threatened), 44 under LC (Least Concern) and 3 species are NE (Not Evaluated) so far. According to conservation assessment of National Bureau of Fish Genetic Resources, a total of 20 freshwater fishes are categorized as threatened of which 9

Table1: Fish diversity of Davipatan Division of Uttar Pradesh

Order	Family	Scientific name	Local/ Common name	Economic Importance	Availability in the area	IUCN Status
Clupeiformes	Clupeidae (Herrings)	<i>Gudusia chapra</i>	Suhia	Food	Rare	LC
	Engraulidae (Forage fish)	<i>Setipinna phasa</i>	Phasia / Phansi	Food	Rare	LC
Osteoglossiformes	Notopteridae (Feather back/ Knife fishes)	<i>Notopterus notopterus</i>	Patra/	Food, Orn	Common	LC
		<i>Notopterus chitala</i>	Chitala	Food, Orn	Moderate	EN
Cypriniformes	Cyprinidae	<i>Labeo rohita</i>	Rohu	Food	Common	LC
		<i>Labeo bata</i>	Bata	Food	Common	LC
		<i>Labeo gonius</i>	Kuria/ Gonius	Food	Rare	LC
		<i>Labeo calbasu</i>	Karaunchh	Food	Rare	LC
		<i>Labeo dero</i>	Kalabans / Gargi	Food	Common	LC
		<i>Catla catla</i>	Bhakur	Food	Moderate	LC
		<i>Cirrhinus mrigala</i>	Naini/ Mrigal	Food	Common	LC
		<i>Cirrhinus reba</i>	Reba / Raia	Food	Common	LC
		<i>Hypophthalmichthys molitrix</i>	Silver carp	Food	Rare	NT
		<i>Ctenopharyngodon idella</i>	Grass carp	Food	Rare	NE
		<i>Cyprinus carpio</i>	Common carp	Food	Rare	VU
		<i>Amblypharyngodon mola</i>	Mola carplet /Dhawai	Food, Orn	Very rare	LC
		<i>Puntius sarana</i>	Sarana	Food, Orn	Common	LC
		<i>Puntius ticto</i>	Two spot barb	Food, Orn	Rare	LC
		<i>Puntius chola</i>	Barb/ Olive barb	Food, Orn	Moderate	LC
		<i>Puntius sophore</i>	Pool barb	Food, Orn	Rare	LC
		<i>Rasbora daniconius</i>	Slender rasbora	Food, Orn	Rare	LC
		<i>Oxygaster gora</i>	Dariai challo	Food, Orn	Rare	LC
		<i>Danio devario</i>	Patukari	Food, Orn	Rare	LC
		<i>Esomus danricus</i>	Dendua	Food, Orn	Very Rare	LC
		<i>Barilius bola</i>	Bhola	Food, Game	Very Rare	LC
Siluriformes	Bagridae	<i>Mystus seenghala</i>	Tengara	Food, Orn	Rare	LC
		<i>Mystus cavasious</i>	Tengara / Dariai tengare	Food, Orn	Common	LC
		<i>Mystus vittatus</i>	Tengara	Food, Orn	Common	LC
		<i>Mystus tengara</i>	Tengara	Food, Orn	Common	LC
		<i>Mystus aor</i>	Tengara	Food, Orn	Moderate	LC
		<i>Rita rita</i>	Rita	Food, Orn	Moderate	LC

	Siluridae	<i>Wallago attu</i>	Pardni	Food	Common	LC
		<i>Ompak pabda</i>	Pabdah catfish	Food, Orn	Common	NT
		<i>Ompak bimaculatus</i>	Butter catfish	Food, Orn	Rare	NT
	Schilbeidae	<i>Pangasius pangasius</i>	Panguscatfish	Food	Rare	LC
		<i>Ailia coila</i>	Gangetic ailia	Food	Very Rare	NT
	Sisoridae	<i>Bagarius bagarius</i>	Gonch	-	Very Rare	NT
	Clariidae	<i>Clarias batrachus</i>	Mangur	Food	Moderate	LC
		<i>Clarias gariepinus</i>	African catfish	Food	Common	LC
	Saccobranchidae	<i>Heteropneustes fossilis</i>	Singhi	Food	Moderate	LC
	Chacidae	<i>Chaca chaca</i>	Angler catfish / Chakawa	-	Very Rare	LC
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Kauwa	Food, Orn	Moderate	LC
Ophiocephaliformes	Channidae	<i>Channa punctatus</i>	Girai	Food	Common	NE
		<i>Channa marulius</i>	Saura	Food	Moderate	LC
		<i>Channa striatus</i>	Saura	Food	Common	LC
		<i>Channa gachua</i>	Chanaga	Food	Rare	LC
		<i>Channa stewartii</i>	Sauri	Food	Rarer	LC
Perciformes	Gobiidae	<i>Glossogobius giuris</i>	Balia	Food, Orn	Rare	LC
	Badidae	<i>Badis badis</i>	Blue Perch	Food, Orn	Rare	LC
	Anabantidae	<i>Anabas testudineus</i>	Kawai	Food, Orn	Moderate	LC
	Nandidae	<i>Nandus nandus</i>	Dhebri	Food, Orn	Rare	LC
	Osphronemidae	<i>Colisa fasciatus</i>	Rainbow gourami	Orn	Moderate	NE
	Ambassidae	<i>Chanda nama</i>	Chanda	Orn	Moderate	NE
		<i>Chanda ranga</i>	Chanri	Orn	Very Rare	NE
Synbranchiformes	Mastacembeleidae (Spiny eels)	<i>Mastacembelus armatus</i>	Bam / Zig-zag eel	Food, Orn	Rare	LC
		<i>Mastacembelus pancalus</i>	Bam	Food, Orn	Very Rare	LC
		<i>Mastacembelus aculeatus</i>	Bam	Food, Orn	Very Rare	EN
Tetraodontiformes	Tetraodontidae (Puffer fish)	<i>Tetraodon cutcutia</i>	Kutkutia	-	Very Rare	EN

*LC=Least Concern, NT=Near Threatened, VU= Vulnerable, EN=Endangered, NE=Not Evaluated; Orn=Ornamental

under endangered and 11 vulnerable. The Government of Uttar Pradesh has declared endangered *Notopterus chitala* (*Chitala chitala*) as a state fish and planned to conserve it (Lakra, 2010). So, considerable attention should be paid to conserve fish species comes under EN and NT.

Due to lack of sufficient information on

population dynamics of fish species of Davipatan division of U.P., it is not possible to quantify the rate of decline in its diversity but this study would be useful as baseline data for any future assessment and conservation plan for fisheries. However, more awareness and motivation required on the value of indigenous is

Fig. 1: Diagrammatic representation of per cent contribution in each order.

Fig. 2: Diagrammatic representation of the per cent contribution in each Family.

fish diversity and conservation of aquatic resources to ensure the sharing of benefits of its utilization in an equitable manner so that the aquatic ecosystem gets adequate time to recover its natural community structure (Lakhra, 2010).

During the survey it was observed that majority of the fish species of this tarai region of eastern U.P. which were once abundant has

depleted from the natural water bodies. The environmental stress like degradation and loss of habitats, construction of barrages and dams in the upper segment of river Ghagra, unsustainable fishing practices, unauthorized collection of fishes at an unprecedented rate and invasion of exotic fishes are the main factors for depletion of these fish resources from their natural habitats. The

environmental threats could be man-made and natural or in combination and sustainable utilization of natural resources are issues receiving global attention after signing the convention on biological diversity (Verma *et al.*, 2015). Although not much published literature is available on the threat status of fish species of U.P., yet it is fact that population of some species is constantly going down and there is an urgent need to protect the same for posterity. Thus, for the protection of aquatic natural fishery resources, there is need to reduce the various stresses caused by anthropogenic activities on the aquatic ecosystem.

For the protection of vast freshwater fish resources available in this tarai region of eastern U.P., there is need to remove various natural as well as anthropogenic stresses on the fresh water bodies. Some of the suggested measures are: (i) Assessment of aquatic resources and fish potentials in this natural fresh waterbodies, (ii) Updated inventory of the fish fauna, evaluation and germplasm registration, (iii) Assess the impact of exotic species on abundance of indigenous fish species, (iv) Survey the fish parasites and their management, (v) Identification of priority habitats, establishment of more protected area, (vi) Conservation of food and ornamental fish species, (vii) Research efforts on the biodiversity, conservation biology, captive breeding, (viii) Stocking of fingerlings of indigenous fishes in the natural lotic and lentic water bodies, (ix) Public awareness campaign including people's participation and HRD, and (x) Legislative framework like introduction of in situ conservation programme including fish sanctuaries and habitat management for protect the fish biodiversity.

Conclusion

Davipatan division of U.P. has vast freshwater lotic and lentic water bodies that are utilized as freshwater capture and culture fisheries resources. The present fish diversity in the lotic water bodies (river, irrigation canals, streams etc)

originate mainly from natural reproduction or escape from the various lentic water bodies of the districts during rainy seasons.

In the present study the rich freshwater fish diversity recorded that can be utilized for decision making in conservation and management in a scientific manners. A proper management policy also needs to be conceptualized and implemented at the earliest for sustenance and optimum utilization of the natural fishery resources of Davipatan division of U. P. Also, there is an immediate need of more conservation programme in order to retain this natural freshwater heritage in tarai region of U.P. The availability of indigenous ornamental fishes in natural water bodies is also perceived to be declining rapidly which needs to be conserving at the earliest.

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