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RESEARCH ARTICLE

A CRITICAL EVALUATION OF LITERATURE ON FRESHWATER FISHES RESEARCH IN INDIA

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ABSTRACT

Fishes constitute an economically significant group of aquatic animals due to their importance in providing food to riverine communities and urban centers. As a food, fishes provide a wide range of nutritional gains, including fish meat, fish protein, manure, shagreen, isinglass, glue and other products. The term "fish" is usually a convenient description for a group of poikilothermic (cold blooded) aqutic vertibrates under the chordate phylum that breathe with gills (Nelson, 2006). Actinopterygians, the bony or ray finned fishes, are without a doubt the majority of fishes found in freshwaters.

Fishes devided into 3 classes-

- Agnatha-Jawless fish such as hagfish and lampreys.
- Chrondrichthyes-Fish whose skeleton is made of cartilage such as sharks, rays and skates.
- Osteichthyes-Fish whose skeleton is composed mostly of bone such as bass, perch, catfish.

Fish biodiversity can be defined as variety of fish species. Fish biodiversity encompasses freshwater ecosystems, including lakes, ponds, reservoirs, rivers, streams, groundwater and wet lands as well as marine ecosystems including oceans and estuaries. Fish biodiversity includes all unique species, their habitats and interaction between them. Due to the life history traits fishes are suitable as early warning signals of anthropogenic stress on natural ecosystem dynamics, or conversely, as indicators of ecosystem recovery and of resilience. Their presence in large number and variety in lentic bodies is a good indication that water is virgin and suitable for human consumption and utility.

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INTRODUCTION

Bhatt 2000 deals Book Reviews In India 2500 fish species have been reported, of which 930 (40%) are freshwater inhabitant. Sakhare 2001 investigated the occurrence of 23 fish species belonging to 7 orders in Jawalgaon reservoir in Solapur district of Maharashtra. The fishes belonging to order Cypriniformes were dominant with 11 species followed by order Siluriformes with 4 species, while orders like Osteoglssiformes, Perciformes and Channiformes were represented by 2 species and the rest of the orders by single species. Biradar, R. S. 2002 studied frequency distribution of fish species at various sampling sites. On the basis of occurrence of the species in all sampling sites they were categorized into, dominant (species occurred >80%), abundant (species occurred 60%-80%), less abundant (species occurred 40%-60%) and rare (<40%). Yazdani and Singh 2002 studied Fishfauna of Ujani.They found 54 species belonging to 15 families. Wagh and Ghate 2003 studied 62 species from Mula and Mutha River in Pune. Om Prakash 2004 studied Fish species of Northern part of Raipur district Chhattisgarh. He documented 64 species belonging to 40 genera, 19 families and 7 orders. Desai and Shrivastava 2004 reported 48 species belonging to 32 genera and 15 families in Ravishankar Reservoir in Dhamtari district, Chhattisgarh. Khedkar 2005 studied fish species of Nathsagar Reservoir from Paithan, Dist. Aurangabad. He observed 67 fish species belonging to 7 orders and 19 families. Bakawale and Kanhere 2006 studied Fish fauna of River Narmada in West Nimar M. P. He found 150 species belonging to 26 families. Verma and Kanhere 2007 studied Ichthyofauna of the River Narmada in Western Zone. He enlisted 84 species belonging to 45 genera. Sarkar *et al.* 2008 studied conservation of freshwater fish resources of India. Fish forms highest species diversity among all vertebrates and their loss is one of the world's most pressing crises as human life and livelihood largely depend on the status of biological resources. The freshwater fish is one of the most threatened taxonomic groups due to their high sensitivity to the quantitative and qualitative alteration in aquatic habitats. He enlisted many fish species of India. Dahire 2008 studied fish diversity in the reverine resources of Janjgir-Champa district of Chhattisgarh. He enlisted 67 fish species under 41 genera, 19 families and 7 orders. Singh and Johal 2009 studied fish diversity of River Ganga of India in the vicinity of Allahabad. This river stretch supports 76 fish species belonging to 53 genera 24 families and 10 orders. Bisht *et al.* 2009 studied

ecology and fish fauna of some of the tributaries of Ganga River system. Small hill-streams are highly torrential with huge altitudinal variation. These streams provide variety of habitat for subsistence of varied and large fish fauna. The habitat has been identified as one of the primary criteria on which many biological communities are organised.

Vijaylaxmi 2010 studied Freshwater fishes distribution and diversity status of Mullameri River, a minor tributary of Bheema River of Gulbarga district, Karnataka. The result of the study reveals the occurrence of fourteen fish species belonging to five orders. The order Cypriniformes was dominant with seven fish species followed by order Siluriformes with four species, and the order Channiformes, Mastacembeliformes and Osteoglossiformes each with one species. Atkore *et al.*, 2011studied Patterns of diversity and conservation status of freshwater fishes in the tributaries of River Ramganga in the Shiwaliks of the Western Himalaya. In total, 43 species belonging to eight families and five orders were recorded which included 29 species belonging to the threatened category. Family Cyprinidae was represented by the maximum number of species.

Sharma *et al*., 2011 Studies on Limnological Characteristic, Planktonic Diversity and Fishes (Species) in Lake Pichhola, Udaipur, Rajasthan (India).15 species of fishes belonging to 6 family and 13 genera were reported from Pichhola lake namely *Notopterus notopterus Catla catla, Cirrhinus cirrhinus, Ctenopharygodon idellus, Labeo gonius, Labeo rohita, Puntius sarana sarana, Puntius ticto, Chela cachius, Garra gotyla gotyla, Aorichthys seenghala, Mystus cavasius, Heteropneustes fossilis, Xenentodon cancila and Gambusia affinis.*

Kusmar and Dua (2012) studied fish diversity of River Ravi in Indian region .The main threats to fish diversity of the Ravi are: flow modification, degradation of habitat, availability of water, building of dam and emergence of two canals. In the present study, thirty eight fish species were recorded from the River Ravi. Of these, nine species are vulnerable species and two are endangered species (according to IUCN conservation status).

Bakwale and Kanhere 2013 studied the Fish Species Diversity of the River Narmada in Western Zone. The fish diversity is correlated with biological and various physico-chemical parameters that regulate the productivity and distribution of different species of the fishes. The fish population is abundant and majority of fishes are exploited for human consumption. The survey indicated that 51 species of fish were found in this zone of the river. The major fish abundance was noticed viz. major carps, minor carps and cat fishes. The several species of fish belonging order Clupiformes, Cypriniformes, Beloniformes, Opiocephaliformes, Mastacambelliformes, Siluriformes and Perciformes. In which maximum 37 species belonging to the order Cypriniformes. Some species of fishes like Cirrihinuscirrihosa, Aspidoparia jaya, Colisa fasciatus, Labeo bata, Oreichthys cosuatis, Osteobrama cotio etc. showed a declining trend in this stretch. The fish species diversity was decreasing.

Galib *et al.*, 2013 studied Fish diversity of the River Choto Jamuna, Bangladesh. A total of 63 species of fishes have been recorded belonging to 41 genera, 23 families and 9 orders. Cypriniformes was recorded as the most diversified fish group in terms of both number of species and individuals observed. He found 41.27% species were threatened in Bangladesh including 15.87% vulnerable, 15.87% endangered and 9.52% critically endangered species. Overall values of diversity, richness and evenness indices were found to be 3.717, 6.954 and 0.897, respectively. Cypriniformes was recorded as the most diversified fish group in terms of both number of species and individuals observed.

Sarkar *et al*., 2013 studied Biodiversity of freshwater fish of a protected river in India: comparison with unprotected habitat. Results showed that in the protected area, a total of 87 species belonging to eight orders, 22 families and 52 genera were collected; while a maximum of 59 species belonging to six orders, 20 families and 42 genera were recorded from the unprotected areas. Cyprinids were found to be the most dominant genera and *Salmostoma bacaila* was the most numerous species in the sanctuary area. Other numerous species were *Eutropiichthys vacha*, *Notopterus notopterus*, *Clupisoma garua* and *Bagarius bagarius*. The results indicated more species, greater abundances, larger individuals, and higher number of endangered fishes within the sanctuary area when compared to the unprotected area. Analysis on the mean abundance of endangered and vulnerable species for the evaluated areas in the sanctuary versus unprotected ones indicated significant differences in fish abundance ($p<0.05$). Khedkar *et al.*, 2014 studied DNA Barcodes for the Fishes of the Narmada, One of India's Longest Rivers. This study describes the species diversity of fishes of the Narmada River in India. A total of 820 fish specimens were collected. Fish were taxonomically classified into one of 90 possible species based on morphological characters, and then DNA barcoding was employed using COI gene sequences as a supplemental identification method. A total of 314 different COI sequences were generated, and specimens were confirmed to belong to 85 species representing 63 genera, 34 families and 10 orders. Findings of this study include the identification of five putative cryptic or sibling species and 43 species not previously known from the Narmada River basin. Five species are endemic to India and three are introduced species that had not been previously reported to occur in the Narmada River.

Satapathy and Misra 2014 studied the fish diversity of the River Pilasalunki situated in Phulbani distict, Odisha. A total of 23 fish species belonging to 9 families were recorded. Out of the recorded species, 35% are enlisted as vulnerable, 52 % as lower risk near threatened category. Maximum number of fish species were collected from slow flow site (31.6%) followed by silty sand beds (17.6%), deep water zone (15.8%), gravel habitat (15.8%), fast flow zone (10.5%) and least in shallow water zone. Vishwakarma *et al*., 2014 deals with the fish diversity of Barna River and its tributary in Raisen district, Madhya Pradesh, Central India. 33 fish species belonging to 5 orders, 9 families and 21 genera. The order Cypriniformes was found dominant (24 species) followed by Perciformes and Ophiocephaliformes (3 species) both, Mastacembeliformes (2 species) and Beloniformes (1 species). The most abundant family was Cyprinidae, having 250 individuals (75%) followed by Cobitidae with 32 individuals (10%). Some endangered and rare fish fauna are also reported in the present investigation.
Pathak *et al.*, 2014 Ichthyofauna of Western Region of Narmada River, Madhya Pradesh. Narmada River is the largest Westward flowing river of India. It is also referred as the life line of Madhya Pradesh. Present study was aimed to generate information on the ichthyofauna of Western Region of the River Narmada. During the study period, 58 fish species have

been identified belonging to 38 genera, 16 families and 6 orders. The fishes caught are divided into commercially important species like *Labeo rohita, Catla catla, Cirrhinus mrigala*; locally important species like *Tor spp., Channa spp., Mystus spp.* etc. and ornamental fishes like *Nandus nandus, Nemacheilus botia, Salmostoma bacaila, Colisa fasciatus* etc. *Tor tor* and *Chitala chitala*, once abundant in the river, now are registered under endangered condition.

Banyal and Kumar 2015 studied Fish Diversity of Chambal River, Rajasthan State: The Fish fauna of the Chambal River is rich and diverse. Various types of carps, catfish, and mullet reside in the river waters. Fifty-four species of fishes were reported from the Rajasthan part of the Chambal River.

Bano *et al*., 2015 studied Fish biodiversity and conservation aspects in an aquatic eco-system in River Narmada. Icthyodiversity refers to a variety of fish species, depending on context and scale; it could refer to alleles or genotypes within piscian population, to species of life forms within a fish community, and to species or life forms across aquaregimes. 40 fish species, 25 genera, 15 families and 6 orders were recorded in the three stations of Narmada near Hoshangabad Region. Among them the Cyprinidea contribute 63.64% of their total population. Due to some anthropogenic activities fish diversity of this river is in decline mode. Sarkar *et al*., 2015 studied A Review on the Fish Communities in the Indian Reservoirs and Enhancement of Fisheries and Aquatic Environment. In India, reservoirs are playing a crucial role in the fisheries. Fish communities are often used as indicators of environmental quality. In terms of fish diversity altogether 117 fish species were recorded from Indian reservoirs exhibiting rich fish diversity. These reservoirs have both positive and negative impacts on fishes and other aquatic environment. Therefore, present study is emphasized on synthesizing the available information on fish diversity and community structure of the potential Indian Rseservoirs and its effects on fisheries and other aquatic environment in reservoirs in India.
Jain *et al.*, 2016 studied diversity of Icthifauna in Central India. Biodiversity is the variation in the genetics and life forms of populations, species, communities and ecosystem. Biodiversity affects the capacity of living system to respond to changes in the environment and is essential for providing goods and services from ecosystems. Fish diversity depends on geographical position, varied aquatic ecological conditions, health of aquatic bodies and optimum exploitation of the commercial fish species, enforcement of laws, rules and regulations and their implementation and fish habitat restoration programs. They enlisted many fish species in Central India.

Bhaumik *et al.*, 2017 deals a case study of the Narmada River system in India with particular reference to the impact of dams on its ecology and fisheries. They studied Currently, three dams have been built in Madhya Pradesh and one is under construction in Gujarat. A comparison of pre- and post-impoundment eco-environment and fisheries revealed changes in water quality, productivity, and aquatic flora and fauna of the river system. Among the fish, species like *Tor tor, Labeo fimbriatus* and *Labeo dyocheilus* suffered most. The percentage contributions to total yield of Carp, Catfish, and miscellaneous groups have significantly changed, indicating falls of 17%, 36% and an increase of 410%, respectively. Percentage contributions to catches of *Macrobrachium rosenbergii* and *Tenualosa ilisha* have also declined by 46% and about 75% in the estuarine stretch of the river system. Shukla *et al*., 2017 studied Fish Species Diversity of Benisagar Dam, Turki, Satna (M.P.) India. Fish fauna of Benisagar dam consists of 31 species belonging to 11 families. Among the collections 4 species of Clupeiformes, order Cypriniformes consists of 20 species, order Beloniformes consists of 3 species, Perciformes consists of 03 species and order Mugilidae consists of one species. Saini and Dube 2017 studied Fish diversity of River Narmada, Jabalpur Region (M.P) 29 species of fishes were recorded in these sampling stations. The major fish abundance was noticed viz. major carps, minor carps and cat fishes. The several species of fish belonging to order Cypriniformes, Beloniformes, Ophiocephaliformes, Perciformes and Siluriformes are recorded too. Out of these Cypriniformes is the most dominant group with recorded 22 species of fishes. Some species of fishes like *Cirrhinus cirrihosa, Labeo bata* showed a declining trend in the stretch.

Sayeswara Ha 2017 studied current status of Icthyofaunal diversity of Tunga River at.SMandagadde bird sanctuary, Shivamogga, Karnataka, India. A total of 16 species of fishes belonging to 4 orders, 8 families, and 12 genera were recorded from the study area. Six species sighted in family *cyprinidae, channidae,cichlidae* and *siloridae* were represented by two spsecies each. Families *Bagridae, Hateropneustidae, Notopteridae* and *Schilbeidae* had only a single species each.
Rathore *et al.* 2017 studied Fish biodiversity and fisheries potential of Reservoir Udaisagar (Udaipur, Rajasthan). The reservoir has a fairly rich fish fauna and so far 31 species representing 9 families have been recorded in the present investigation, of these, 12 species predominantly contributed to the commercial fisheries of this reservoir. During study period, the Indian major carps dominated the catch by contributing 90 percent to the total landings from this reservoir. Besides Indian major carps, minor carps and catfishes were reported to be 8.84 and 0.9 %, respectively. Among the Indian major carps, the *Catla catla* (70%) dominated the groups followed by *Labeo rohita* (25%) and *Cirrhinus mrigala* (5%). B. Selakoti 2018 studied Fish Diversity in a Kumaun Himalayan River, Kosi, at Almora Uttarakhand. 12 species of fish fauna were observed. All the recorded fish species belonged to the families Cyprinidae and Botinae. Cyprinidae was the dominant family having 9 fish species out of the 12 species. The family Botinae comprised of 3fish species. Hasan *et al*., 2018 Fish biodiversity of River Dakatia and its conservation aspects in Bangladesh. 72 fish species were recorded including 12 orders and 27 families. Cypriniformes constitutes highest number of fish population (28%). Cyprinidae shares the highest percentage (19%) among the recorded family. Catfish was found to be the biggest group (27%) among the recorded 14 common groups. The biggest habitat was found to be River-Estuary (43%). Among the identified threatened fish species (20) of River Dakatia, 11 species (55%) were recorded as Vulnerable (VU), 8 species (40%) as Endangered (EN) and 1 species (5%) as Critically Endangered (CR). AD Shelke 2018 studied the Ichthyofaunal diversity of Girna River. A total of 35 fish species belongs to 08 orders, 27 genera of 17 families were recorded. Order Cypriniformes was most dominant group represented by 20 (57.14%) species followed by orders Perciformes with 06 (17.14%) species. Siluriformes with 03 (8.57%) species, Synbranchiformes 02 (5.71%) species, Beloniformes 01 (2.85%) species, Synodontidae 01 (2.85%) species, Scorpaeniformes 01 (2.85%) species and Osteoglossiformes 01 (2.85%) species. Thus the Girna River

has good potential for fish fauna. Out of 35 fish species 29 have least concern status, 01 are near threatened, 02 are Vulnerable, 02 are not evaluated and one is data deficient. R.Rawal 2018 studied Diversity of hill stream fishes in Sahastradhara Region of Narmada River Maheshwar, District Khargone, Madhya Pradesh. Total 8 species of hill stream fishes obtain from the Sahastradhara sampling station of Narmada River.

L. Sarkar 2018 studied Seasonal fish faunal diversity and water quality of Jamuna River in South Bengal Region. Altogether 46 fish species belonging to 18 families and 36 genera were collected. Family Cyprinidae (24species) comprised 56% and Notopteridae (1 species); Clupeidae (1 species), Cobitidae (1 species); Claridae (1 species); Heteropneustidae (1 species); Synbranchidae (1 species); Gobidae (1 species); Eletridae (1 species); Anabantidae (1 species); Belontidae (1 species); Channidae (1 species); Mastacembelidae (1 species) comprises 2% each of total catch whereas Bagridae (2 species); Siluridae (2 species); Ambassisae (2 species); Mugilidae (2 species); comprised 4% each of the total catch, out of the 46 species documented, 8 species showed significant variation in catch data in pre monsoon, monsoon and post monsoon period, *Cirrhinus reba, Labeo boga* catch significantly increased in post monsoon period compared to premonsoon and monsoon period. Banyal and Kumar 2019 studied The fish diversity of Mahi River in Rajasthan. Order cypriniformes was recorded with maximum fish diversity (17). Order siluriformes and perciformes each represented with 5 species, order osteoglossiformes, synbranchiformes clupeiformes represented with 2species each, whereas beloniformes only by 1 species.

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