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Original Article

Biodiversity and Conservation Status of Fishes around Kalna and Its Adjacent Areas, Burdwan District, West Bengal, India

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Abstract

A survey was conducted on biodiversity of fish fauna and their conservation status around Kalna and its adjacent area. Burdwan district, West Bengal, India with an objective to prepare a register of fresh water fishes and assess their conservation status. Regular bi-monthly sampling was conducted from January, 2015 to December, 2016 by the help of fishermen using indigenous fishing methods and by using different types of nets. Fishes were also collected from local fish markets. We have collected 28 fish species belonging to 7 orders, 13 families and 24 genera. Order Cypriniformes was the dominant group with 11 species followed by Perciformes 7 species, Siluriformes with 5 species, Osteoglossiformes with 2 species and Clupeiformes, Beloniformes and Synbranchiformes each with 1 species. Out of 28 species, 20 species are least concern, 4 species are near threatened, 2 are vulnerable and 1 each are under not evaluated and data is deficient category as per IUCN (2013) Red List category. According to CAMP (1998) conservation status, 13 species are at lower risk near threatened, 5 species are under not evaluated, 4 species are vulnerable, 3 at lower risk least concern, 2 species are endangered and 1 species is under exotic category. The maximum species richness (26) was recorded at Dhatrigram and low species richness (22) was recorded at Kana. The highest Shannon value was recorded to be (3.107) at Samdruagarh. The low Shannon value was (2.831) at Kalna.

Keywords: Fish Diversity; CAMP; IUCN Status; Biodiversity Indices; Kalna; West Bengal.

Introduction

Fish forms highest species diversity among all vertebrates besides its economic importance. India is one of the mega biodiversity hot spots (North East Region and Western Ghat) contributing about 11.72% of global fish diversity mainly from the greater Himalayan range on the northern plains, long stretches Eastern and Western ghats. Biodiversity is also essential for stabilization of ecosystem, protection of overall environmental quality, for understanding intrinsic worth of all species on earth (Ehrlich and Wilson, 1991). Important work has been done on fish diversity during the last few decades (Day, 1958; Jayaram, 1981; Menon, 1992; Shaji, 1995; Arunachalum, 2000; Daniel, 2001; Sarkar and Banarjee, 2000; Bhat, 2002; Mishra et al. 2003; Bossuyt et al. 2004; Rajalakshmi and Sreelatha 2006; Saha and Patra 2013; Bera et al. 2014; Bhattacharjee et al. 2016).

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Aquatic environments are experiencing serious threats to both diversity and ecosystem stability. Research is being persuade globally to develop systematic conservation planning to protect freshwater biodiversity (Margules and Pressey, 2000; Saunders et al., 2002, Nel et al., 2008). Various methods, strategies and priorities have been proposed (Cowx 1998; Lakra et al., 2006; Sarkar et al., 2008). Kottelat and Whitten (1996) considered the biological

change that environmental degradation brings about, and enumerated pollution, increased sedimentation, flow alteration, water diversion and introduced species as the main causes for decreased ichthyofaunal diversity in Asian countries.

Based on IUCN categories, the CAMP workshop (Molur and Walker, 1998) for fresh water fishes identified certain fish species which have attained the threatened/endangered status.

To achieve sustainable utilization of these resources, appropriate planning for biodiversity conservation and management strategies are of utmost importance and the greatest challenge. Therefore, scientific information about species, conservation status and ecosystems is essential for moving towards more sustainable use and scientific conservation efforts of our invaluable biological resources.

Materials and Methods

Study Area

Samplings are done from three sites around Burdwan. They are Site I: Samudragarh (23°34′N and 88°32′E); Site II: Dhatrigram (23°27′N and 88°31′E) and Site III: Kalna (23°22′N and 88°34′E).

Collection and Identification of Fishes

Sampling involved collection from various sites with the help of fishermen using indigenous fishing methods and by using different types of nets namely gill nets, cast nets and dragnets. Fishes were also purchased from the fishermen on the spot. We also visited local fish markets and look for the presence of any species which were not available during our experimental fishing. Immediately photographs were taken prior to preservation since formalin decolorizes the fish colour on long preservation. The specimens were preserved in 10% formalin and brought to the laboratory. They were fixed in formalin solution based on their size in separate jars. Smaller ones are placed directly while the larger ones were preserved after giving an incision on the abdomen before they were fixed in the formalin solution. Fishes were identified by using standard taxonomic keys for fishes of the Indian subcontinent (Day, 1958; Talwar and Jhingran, 1991; Jayaram, 1981, 1999). The fishes were labeled giving serial number, date of collection, place of collection, systematic position and common name on each jar. Conservation status of each fish was given based on the report on Conservation Assessment and Management Plan (CAMP) for freshwater fishes of India by Molur and Walker, 1998 and IUCN, 2013 Red List of Threatened Species.

Biodiversity Indices

Margalef richness index (M), Simpson's index (D), Simpson's Index of Diversity (1-D), Simpson's Reciprocal Index (1/D), Shannon's diversity index (H) and Pielou's evenness index (J), biodiversity indices were calculated (Chandra et al., 2015; Bhattacharjee et al. 2016).

Results

The periodical survey of the ichthyofauna revealed the occurrence of 28 fish species belonging to 7 orders, 13 families and 24 genera 3 were recorded over a period of one year, from January, 2015 to December, 2016 (Table 1). Among the collected species Order Cypriniformes was the dominant group with 11 species followed by Perciformes 7 species, Siluriformes with 5 species, Osteoglossiformes with 2 species and Clupeiformes, Beloniformes and Synbranchiformes each with 1 species. Number of fish species under different categories of threat as per CAMP / IUCN is presented in Figure 1. Out of 28 species, 20 species are least concern, 4 species are near threatened, 2 are vulnerable and 1 each are under not evaluated and data is deficient category as per IUCN (2013) Red List category. Percentage of fish species under different categories of threat as per IUCN Status is presented in Figure 2. According to CAMP (1998) conservation status, 13 species are at lower risk near threatened, 5 species are under not evaluated, 4 species are vulnerable, 3 at lower risk least concern, 2 species are endangered and 1 species is under exotic category. Percentage of fish species under different categories of threat as per CAMP Status is presented in Figure 3. The data of Diversity Indices are presented in Table 2. The maximum species richness (26) was recorded at Dhatrigram and low species richness (22) was recorded at Kana. The highest Shannon value was recorded to be (3.107) at Samdruagarh. The low Shannon value was (2.831) at Kalna. Habitat loss and environmental degradation has seriously affected the fish fauna. Recent data regarding fish diversity of the study site, aiming to contribute a better knowledge of the fish diversity and a tool for conservation planning of aquatic environments in this region. To maintain fish biodiversity has an immense importance as it is not always possible to identify individual species critically to sustain aquatic ecosystem.

Table 1: Fish species collected at three different sites with their names (common and scientific) and conservation (CAMP and IUCN) Status

Common Name	Scientific Names	Samduragarh	Dhatrigram	Kalna	Order	Family	CAMP Status	IUCN Status
Rohu	*Labeo rohita* Hamilton	14	13	14	Cypriniformes	Cyprinidae	LRnt	LC
Catla	*Catla catla* Hamilton	12	13	11	Cypriniformes	Cyprinidae	VU	LC
Mrigal carp	*Cirrhinus mrigala* Hamilton	11	11	12	Cypriniformes	Cyprinidae	LRnt	VU
Kalbose	*Labeo calbasu* Hamilton	13	10	3	Cypriniformes	Cyprinidae	LRnt	LC
Bata	*Labeo bata* Hamilton	13	6	11	Cypriniformes	Cyprinidae	LRnt	LC
Silver carp	*Hypophthalmichthys molitrix* Valenciennes	13	4	0	Cypriniformes	Cyprinidae	E	NT
Spotfin swamp barb	*Puntius sophore* Hamilton	11	12	12	Cypriniformes	Cyprinidae	LRnt	LC
Mourala	*Amblypharyngodon mola* Hamilton	12	4	4	Cypriniformes	Cyprinidae	LRlc	LC
Common carp	*Cyprinus carpio* Linnaeus	12	11	2	Cypriniformes	Cyprinidae	NE	VU
Kalbose	*Labeo calbasu* Hamilton	0	5	10	Cypriniformes	Cyprinidae	LRnt	LC
Two spot barb	*Puntius ticto* Hamilton	0	6	0	Cypriniformes	Cyprinidae	LRnt	LC
Flat head goby	*Glossogobius giuris* Hamilton	13	2	2	Perciformes	Gobidae	LRnt	LC
Climbing Perch	*Anabas testudineus* Bloch	12	8	11	Perciformes	Anabantidae	VU	DT
Dwarf gourami	*Colisa lalia* Hamilton	12	12	5	Perciformes	Osphronemidae	NE	LC
Glassy perchlet	*Chanda nama* Hamilton	12	3	6	Perciformes	Ambassidae	NE	LC
Snakehead Murrel	*Ophiocephalus striatus* Bloch	12	12	10	Perciformes	Channidae	LRlc	LC
Spotted snake head fish	*Ophiocephalus punctata Bloch*	14	2	0	Perciformes	Channidae	LRnt	LC
Nile tilapia	*Oreochromis niloticus* Linnaeus	13	14	11	Perciformes	Chichlidae	NE	NE
Tangra	*Mystus tengara* Hamilton	11	8	6	Siluriformes	Bagridae	NE	LC
Freshwater cat fish	*Wallago attu* Bloch & Schneider	12	2	2	Siluriformes	Siluridae	LRnt	NT
Pabo cat fish	*Ompok pabo* Hamilton	0	0	2	Siluriformes	Siluridae	EN	NT
Stinging cat fish	*Heteropneustes fossilis* Bloch	12	3	2	Siluriformes	Siluridae	VU	LC
Walking cat fish	*Clarias batrachus* Linnaeus	13	2	3	Siluriformes	Clariidae	VU	LC
Bronze featherback	*Notopterus notopterus* Pallas	11	2	1	Osteoglossiformes	Notopteridae	LRnt	LC
Indian featherback	*Chitala chitala* Hamilton	0	2	0	Osteoglossiformes	Notopteridae	EN	NT
Indian river shad	*Gudusia chapra* Hamilton	0	2	0	Clupeiformes	Clupeidae	LRlc	LC
Freshwater gar fish	*Xenentodon cancila* Hamilton	12	0	0	Beloniformes	Belonidae	LRnt	LC
Indian spiny eel	*Macrognathus pancalus* Hamilton	12	3	2	Synbranchiformes	Mastacambelidae	LRnt	LC

CAMP Status: Lower Risk near threatened (LRnt); Vulerable (VU); Lower Risk least cocern (LRlc); Exotic (E); Not Evaluated (NE); Endangered (EN)
IUCN Status: Least Concern (LC); Vulnerable (VU); Near Threatened (NT); Data deficient (DT); Not Evaluated (NE)

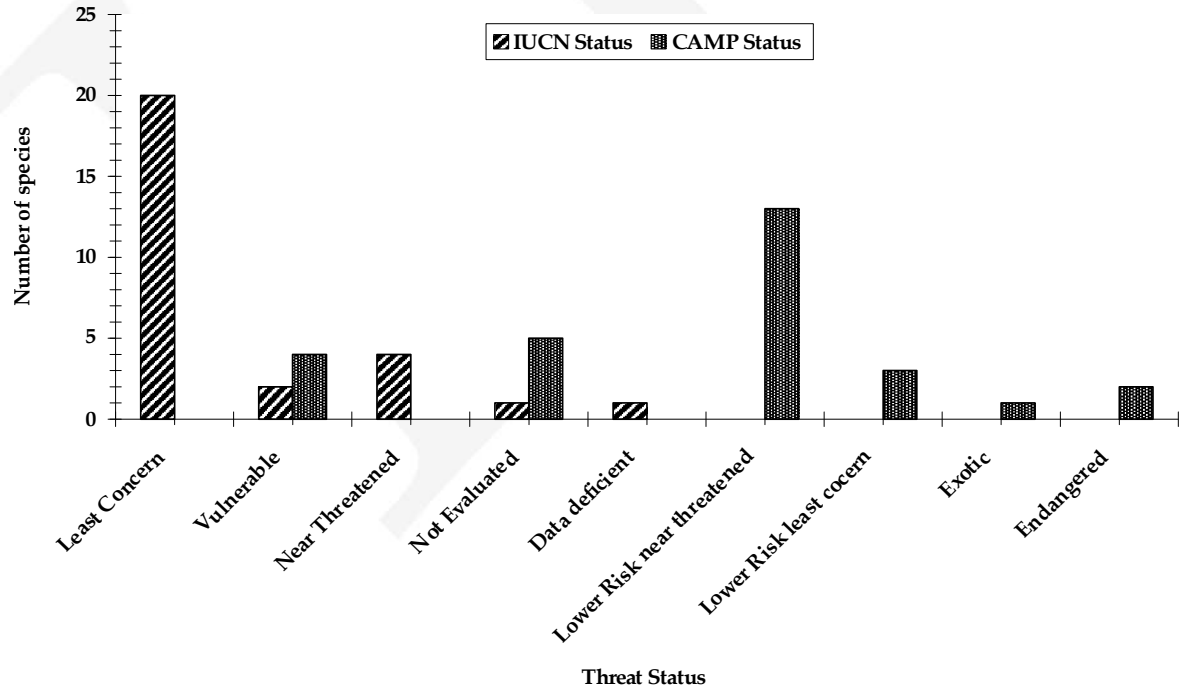

Fig. 1: Number of fish species under different categories of threat as per CAMP / IUCN

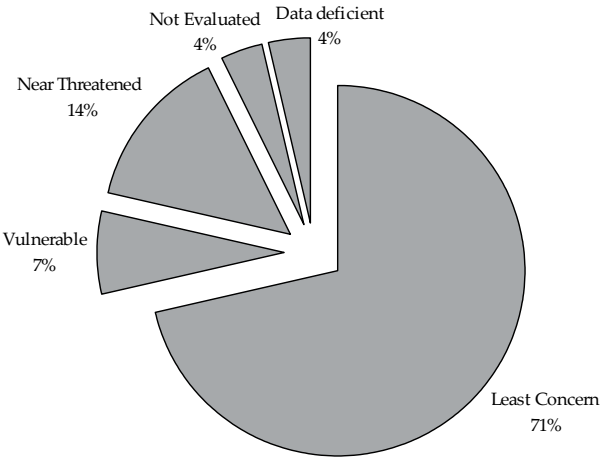

Fig. 2: Percentage of fish species under different categories of threat as per IUCN Status

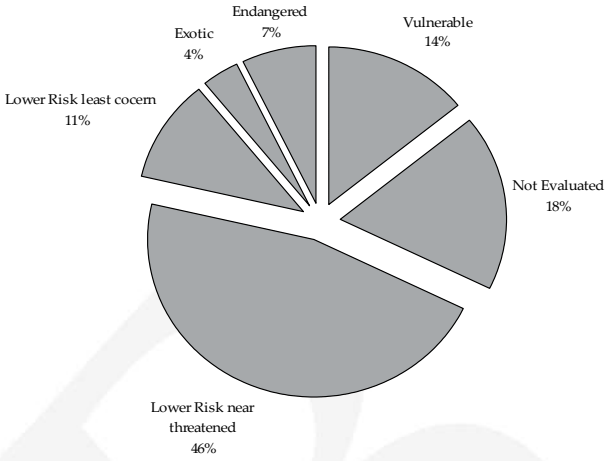

Fig. 3: Percentage of fish species under different categories of threat as per CAMP Status

Table 2: Biodiversity Indices of fish species at three different sites

Indices	Samduragarh	Dhatrigram	Kalna
Total No. of Species (S)	23	26	22
Total No. of Individuals (N)	282	172	142
Natural Log of Species (ln S)	3.13	3.25	3.09
Natural Log of Individuals (ln N)	5.64	5.14	4.95
Margalef's Index (M)	3.90	4.86	4.24
Simpson's Index (D)	0.040	0.046	0.059
Simpson's Index of Diversity (1-D)	0.960	0.954	0.941
Simpson's Reciprocal Index (1/D)	25	21.73	16.94
Shannon Index (H)	3.107	2.982	2.831
Pielou's Index (J)	0.992	0.917	0.916

Discussions

Damming, deforestation, diversion and withdrawal of water for irrigation, urban and industrial consumption have caused large scale changes in the channel bed and hydrology of the river in terms of flow, flow-rate, flood-rhythm and regime. The upland fast-moving habitat has been lost to reservoirs which are unfavorable for rheophilic species (Sarkar et al., 2008). Reckless killing by stupefying methods of brood fishes in spawning season and juveniles during post-monsoon periods have affected a number of food and game fishes. Over-fishing affects heritable life history parameters like growth and age of sexual maturity. Over-exploitation of fishery resources due to its higher economic value has increased the vulnerability of the population in different ecosystems. Global climate change is likely to result in severe droughts and floods with major impact on human health and food supplies, according to the India's report to the United Nations (Xenopoulos, 2005) reduction in river discharge due to combined effect of climate change and water withdrawal will make up to 75% global freshwater fish biodiversity to become extinct by 2070.

Conclusions

Fish biodiversity conservation represents major environmental challenge at the global level, and will continue under threat if there is no strenuous policy action to curb human activity. Important management plans have been considered from the study for the conservation of fish biodiversity in the freshwater body which should be inserted into the fishery policies of the Government, such as, identification and listing of threatened and endangered fish species of freshwater body, determination of population size and distribution, find out the breeding behavior of threatened fish species which is essential for both *ex situ* and *in situ* conservation of the species, development of techniques of captive breeding and brood stock maintenance of fishes of potential economic importance.

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