

A STUDY ON FISH DIVERSITY, CONSERVATION STATUS AND ANTHROPOGENIC STRESS OF CHANDUBI TECTONIC LAKE, ASSAM, INDIA

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ABSTRACT

The Chandubi tectonic lake is located in the west Kamrup district of Assam. The present study revealed that the study area has 63 species of fishes which indicate the high fish diversity. It acts as a breeding ground of large number of major carps, minor carps, air breathing fishes and catfishes. It is much more diverse than the neighboring wetlands. But due to overexploitation and other anthropogenic factors like festival fishing, encroachment, conversion of wetland areas into agricultural land etc., the fish diversity of the wetland is under great threat. Therefore, proper measures such as implementation of fishery laws and regulation strictly, providing alternative livelihood to the local people should be taken immediately for the conservation of the fish diversity.

Keywords: Chandubi, Fish Diversity, Overexploitation, Anthropogenic, Eco-tourism.

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INTRODUCTION

Assam is endowed with 1.03 lakh ha natural lentic water bodies including swamps associated with the river Brahmaputra and Barak and their tributaries. Wetlands are of immense use to mankind both economically and zoologically. They are unique habitats that sustain substantial biodiversity. The wetland ecosystems are very rich in fish diversity (Agarwala, 1996; Deka *et al.*, 2001; Dey, 1981; Kumar & Meenakumari, 2002; Goswami & Goswami, 2006; Nayak & Mishra, 2008). About 217 fish species belonging to 104 genera 37 families and 10 orders have been recorded from the water bodies of Assam including wetlands (Bhattacharjya *et al.*, 2003). The fish production from the wetlands of Assam has been in the decline due to habitat modification, overexploitation and various anthropogenic stresses (Sinha, 1994; Sarkar & Ponniah, 2000). The study area Chandubi tectonic lake is situated within the Loharghat range of Kamrup, West division bordering Meghalaya. Chandubi tectonic lake came into being on June 12, 1897 as a result of devastating earthquake. The lake is surrounded by natural forest and hilly terrain represented by Rajapara and Mayang hill range on its North-West and South-West respectively. In the West there is a river named Kulsi. The area covered by the lake is about 56 square kilometers. Though various works have been done by different workers on ichthyofauna, the study area has no basic biological information of fish species. It becomes major hindrance for conservation action plan. Therefore, the present study has been conducted to evaluate

the fish diversity, conservation status and anthropogenic stress of the lake.

MATERIALS AND METHODS

A thorough survey of the aqua-bodies of the study area is being pursued from April, 2009 to December, 2011. Various data and information were collected by physical verification and interview with the local fishermen of the study area. The sampling was carried out twice in every month. The annual cycle was divided into four seasons as Pre-monsoon (March-May), Monsoon (June-August), Retreating monsoon (September-November) and Winter (December-February). The collected specimens were immediately dipped in 10% formalin in a large container that allowed proper spreading of their fins. Two changes of 10% formalin were adopted during the sampling time. Then the specimens were examined on field and classified into families which were carried in separate containers. Each container was labeled properly against the physical data sheet of sampling and brought to the laboratory for further taxonomic exercise. Collected specimens were identified as per Talwar and Jhingran, (1991); Jayaram, (1999); Vishwanath, (2002). The evaluation of the conservation status has been followed by the Conservation Assessment and Management Plan (CAMP, 1998). The analysis of the constraints has been evaluated through surveys and interaction with the local people living near the concerned area. The collected specimens were immediately dipped in 10% formalin in a large container that allowed

proper spreading of their fins. Two changes of 10% formalin were adopted during the sampling time. Then the specimens were examined on field and classified into families which were carried in separate containers. Each container was labeled properly against the physical data sheet of sampling and brought to the laboratory for further taxonomic exercise. Collected specimens were identified as per Talwar and Jhingran, (1991); Jayaram, (1999); Vishwanath, (2002). The evaluation of the conservation status has been followed by the Conservation Assessment and Management Plan (CAMP, 1998).

Species diversity, abundance and richness is determined by following Solow (1993) and May (1975) and used following diversity indices-

1. Simpson's Index

$$D = 1 - \sum \frac{N_i(N_i - 1)}{N(N - 1)}$$

2. Shannon-Weinner Index

$$H = -\sum \left\{ \frac{n_i}{N} \log_2 \frac{n_i}{N} \right\}$$

3. Margalef's Index

$$MD = S - 1 / \log N$$

Where S= total number of species

N= total density

N_i= density of individual species

Table-1 Diversity of piscian fauna in Chandubi tectonic lake (Results bold in parenthesis were significantly higher than other at 5% level)

Diversity indices	PRM	MON	RMON	WIN
Species	29	55	46	63
Individuals	538	690	746	934
Shannon_H	2.938	3.474	3.334	3.602
Simpson_1-D	0.9238	0.9476	0.9469	0.9591
Evenness_e^H/S	0.6513	0.5868	0.6096	0.5824
Margalef_MD	4.453	8.261	6.803	9.065

Table: 2 - List of the Endangered and the Vulnerable species of the study area

Class	Order	Scientific Name	Status
Pisces	Osteoglossiformes	<i>Chitala chitala</i>	Endangered
	Cypriniformes	<i>Lebio nandina</i>	Endangered
	Cypriniformes	<i>Puntius sarana</i>	Endangered
	Cypriniformes	<i>Lepidocephalus bordermorrei</i>	Endangered
	Cypriniformes	<i>Bengala elenga</i>	Vulnerable
	Cypriniformes	<i>Catla catla</i>	Vulnerable
	Cypriniformes	<i>Cirrhinus reba</i>	Vulnerable
	Cypriniformes	<i>Puntius cola</i>	Vulnerable
	Cypriniformes	<i>Puntius conconius</i>	Vulnerable
	Siluriformes	<i>Mystus vittatus</i>	Vulnerable
	Siluriformes	<i>Ompok pabda</i>	Endangered
	Siluriformes	<i>Ompok pabo</i>	Endangered
	Siluriformes	<i>Ompok bimaculatus</i>	Endangered
	Siluriformes	<i>Alia coila</i>	Vulnerable
	Siluriformes	<i>Clupisoma gerua</i>	Vulnerable

The diversity of fish species was estimated in terms of species evenness, using Margalef's D index, Shannon Wiener and Simpson's D and bootstrap method was used to calculate 95% confidence intervals. In order to test for differences in diversity among fishes in different seasons of the year (Pre-monsoon, Monsoon, Retreating monsoon and Winter), pair wise randomization tests were carried out, abundance data following Solow (1993). The analyses were performed as per the method of May (1975) using Species Diversity and Richness software and Microsoft Excel sheet.

RESULTS AND DISCUSSION

The study sampled altogether 2908 individuals belonging to 63 fish species. Among all the 63 species recorded in study area one species (*Cyprinus carpio*) was exotic and other species were indigenous to Assam. Altogether 7 endangered species and 8 vulnerable species were recorded in the study site (Table-2). 20 economically important large fish species were found in study site, some of which are *Labeo rohita*, *Catla catla*, *Labeo calbasu*, *Channa marulius*, *Channa striatus*, *Chitala chitala*, *Notopterus notopterus*, *Chirrhinus mrigala*, *Wallago attu*, *Clarius betrachus*, *Heteropneustes fossilis*, *Rita rita* etc. Study

also showed that the lake supports 11 species of important ornamental fishes which includes *Colisa fasciatus*, *Colisa laila*, *Badis badis*, *Botia derio*, *Brachidanio verio*, *Brachidanio rario*, *Chanda nama*, *Chanda ranga*, *Denio devario*, *Parluciosoma daniconius* and all puntius species. To evaluate the diversity of fish fauna study has been done in four different seasons viz: Winter season (WIN), pre-monsoon (PRM), retreating-monsoon (RMON) and monsoon seasons (MON). Analysis of the Shannon Weiner index, Margalef's D index and Simpson D index of diversity showed that, diversity of fish fauna was higher in Winter season than pre-monsoon, retreating-monsoon and monsoon season (WIN, Shannon H = 3.602; MON, Shannon H = 3.474; RMON, Shannon H = 3.334; PRM, Shannon H = 2.938; WIN, Simpson D = 0.9591; MON, Simpson D = 0.9476; RMON, Simpson D = 0.9469; PRM, Simpson D = 0.9238; WIN, Margalef's MD = 9.065; MON, Margalef's MD = 8.261; RMON, Margalef's MD = 6.803 and PRM, Margalef's MD = 4.453 Table-1).

The fish resources of the Chandubi tectonic lake is listed in the tables-2 with the conservation status and taxonomic criteria. The study also revealed that the Chandubi tectonic lake acts as a breeding ground for many indigenous fish species including major carps, intermediate carps and minor carps. The fish fauna of the study area is almost similar with the neighbouring Deepor beel Ramsar site (Saikia, 2005) indicating high diversity of fish fauna. In fact the Chandubi lake harbours more diverse fish fauna than Deepor beel (61 species, Saikia, 2005), Dara beel (52 species, Devi, 2008)

and Koya Kujiya beel (45 species, Kalita *et.al.*, 2011). However the density of various economically important fish species is very low. This is due to over exploitation of fishes by local fishermen as well as various anthropogenic impacts. Some of the important anthropogenic stresses were discussed below-

1) Fishing of fries, fingerling and gravid fish:

The fish species of the study area is under heavy pressure due to indiscriminate killing of fries, fingerlings and gravid fish. Killing of gravid fishes causes heavy loss of eggs per day during the breeding season.

2) Festival fishing:

Festival fishing is another major constraint which causes depletion of fish species because during this practice a sizeable number of breeders are lost. Festival fishing is associated with the celebration of different festivals by different ethnic communities; as a result it occurs many times in a year.

3) Agricultural activities:

Due to the decreasing fish catch many fishermen converted into agriculturists as a result they converted the wetland areas into agricultural field. Thus the agricultural activities become the most dangerous practice which causes harm not only to the fish fauna but also the entire community of the ecosystem. They used artificial fertilizers, insecticides and pesticides for agriculture which causes water pollution. It also causes loss of breeding ground, eutrophication, increased turbidity of the water, creation of algal blooms which effect

many species.

4) Permanent closure of outlet:

The Chandubi tectonic lake was earlier connected with river Kulshi which provides breeding ground for various fish species. But the encroachment and siltation causes permanent closure of the outlet which not only decreases the fish density but also greatly effects on the reproductive strategies of the fishes and their habit and habitats.

5) Non implementation of Fishery acts and legislation:

There are various legislations on fishing regarding the use of fishing gear, regulation of mesh size of nets, time of fishing and size of the catch. But they are not implemented anywhere, which highly increases the depletion of fish fauna of the study area.

Conservation Measures:

After going through the various problems of the study area it is clear that immediate steps should be implemented for the conservation of the fish species. But to make conservation meaningful participation of the local people is must. Therefore providing alternative livelihood to the local people of the study area is one of the prime factors which can be done only by the help of Eco-tourism. The study also reveals that Chandubi tectonic lake and its surrounding area is very rich in biological, cultural and traditional diversity. It has all the ingredients necessary for development of ecotourism. The scenic beauty of the lake Chandubi, hilly terrain and river Kulsi is incomparable with any other area. The unique dendritic shape of the lake, the remnant of the “Sal” trees, dead

short branches sub-merged in the lake can attract tourists to see the creation of nature under destruction as it was the creation of earthquake during 12th June 1897. The location of the lake is another added advantage from the communication, as it is only 35 km away from the Barzar air port and only 55 km from the gateway of North-East. The area is suitable for adventure sports like rafting, climbing, jungle trekking etc. The area also has many important harpeto-fauna including python, varanus, and many species of turtle and amphibian species. The lake is also breeding and feeding ground of many residential and migratory birds including rare ducks, storks, sandpiper, various species of kites etc. So it can be an idle place for bird watching. The area also harbors a number of mammalian species including different species of primate, carnivores and rodents etc. Besides these, the study area has also many important timber and medicinal plants and invertebrate species including butterflies.

The cultural and traditional diversity of the indigenous people including Rabha and Garo of the nearby tribal villages is another important resource for the development of ecotourism. From ancient time tribal people have been associated with protection of nature by various means such as one or more plants and animal as spiritual ancestors, restraint on hunting female animals, conserving certain species for rituals, keeping aside patches of forest and water bodies in the name of local deities. The tribal people of the area are also associated with conservation of landscape known as “Than” dedicated to their ancestral deities. Their traditional knowledge, food and other

culture including folk song and dance etc. can be utilized to develop ecotourism. Therefore, proper utilization of all the ingredients will surely make the Chandubi Lake and surrounding area a popular ecotourism destination. Ecotourism can play a great role as a livelihood tool for rural communities and also sustainable management of natural resources. Therefore the study area can be a successful ecotourism destination, if appropriate importance is given by the government and other groups. For this reason, the following recommendations are made

Attempts should be made to conserve the physical ecology as well as the cultural ecology of the ethnic communities by empowering them.

The tribal communities of the area should be encouraged to enrich their ethnic heritage and skills so as to make their traditions more attractive.

There should be a strong implementation of conservation laws and acts to make free from illegal encroachment and conversion of forest into other use.

Culture of the tribal people is honored on the right perspective, not merely on income generation.

Enthusiastic participation of the local communities must be entertained.

Thus we can save not only the fish resources of the study area but also provide alternative livelihood and employment to the local people.

ABBREVIATIONS

CAMP- Conservation Assessment and Management Plan; MON- Monsoon ; PRM- Pre-monsoon; RMN- Retreating Monsoon; WIN- Winter; H- Shannon-Weinner Index; D- Simpson Index; MD- Margalef's Index

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