Fish Diversity and Fish Assemblage Analysis in Shatiya Wetland of North Bihar

Manisha Pallvi

Research Scholar, Jai Prakash University, Chapra
Corresponding author: manisha789pallavi@gmail.com

ABSTRACT

The fish diversity of the wetlands has been decreasing during the last few years due to some extrinsic and intrinsic factors. The total number of fish species recorded so far during the present study is 47 at site 1 and 37 at site 2 belonging to 5 families. Cyprinidae is the most dominant family represented by major group species (12), intermediate group species (7) and minor group species (3) of high commercial value. Among these three groups, the diversity of fish species is higher in the minor group fish.

Keywords: Diversity, Assemblage, Wetland, Fish group, Fish catch

INTRODUCTION

Wetlands are dynamic, highly productive lentic and lotic water bodies with rich biodiversity. William (1990) defined wetland as the "threatened landscapes" and most productive farm land of aquatic environment. The wetlands occupy only 6.4% of earth surface (William, 1990). As the wetland of India is mostly situated on flood plains of river, they are better designated as flood plain wetlands. (Sugunan and Sinha, 2001).

Wetlands are areas of wild life habitat and some other ecological functions of the wetlands are maintenance of biodiversity, water cycle and hydrology, flood control, biogeochemical cycle functioning and climatic stability. Wetlands provide tremendous economic benefits to the mankind through production of various types of fishes. In general two thirds of world's inland fish harvest comes from the wetlands (Jhingran, 1991). The wetlands have to be identified and distinguished from other ecosystem by their ecological characteristics alone. To ensure management and conservation of wetland resources, the ecological studies about the ecosystem components are most essential which provide a baseline data regarding sustainable management measures of a particular wetland ecosystem. The ecological studies of wetlands will help to derive material benefits from the environment on sustained basis without destroying it.

The aquatic ecosystem structurally comprised of biotic and abiotic components. The abiotic components include physico-chemical characteristics of water and soil and also the climatic conditions. The Chaur (wetland) in Bihar are traditionally used as natural fisheries which are extremely rich in nutrients, other aquatic resources and have immense production potential for various types of flora and fauna. Fish is an important constituents of diet of about 90% population of the state, but the state is not self sufficient in fish production. The chaurs are the natural source for supplying fish and provide employments to the fishermen population. However, in recent years, the wetland ecosystem is over exploited for every available resource. Therefore, the conservation and management of wetlands for sustainable use have been a major concern.

Fishes are primarily aquatic vertebrates. Fishes are nekton of the aquatic system. They are the chief component of aquatic productivity. Fishes are heterotrophic and are secondary/ tertiary producer as well as consumer of the aquatic system. Fishes are adapted to its environment. The environmental alteration limits species interaction between fishes. A species is characterized by a relative morpho-physiologo-ecological stability, which is the result of adaptation to a particular environment under the condition of which the species was formed and with which the species in the unity (Kaur, 1981).

Fish being rich in proteins, can supplement the protein deficient diet of the people. Fisheries occupy an important position in the economy of the state or country. Now a day the wetlands such as reservoirs, lakes, tanks, and beels are developed for fisheries. For the development of fishery, understand the theoretical and practical problems relating to conservation and management of fishery, an in depth knowledge of fish population dynamics is utmost important Fernando and Ghosh and Sen (1987) stated that problems of fishing are non availability of credit, high input price, lack of contact with fishery extension officers, scarcity of seeds both indigenous and exotic, diseases of fish, lack of water and soil testing facility. Need improvement of above and market, storage and transport facilities and establishment of fish farmers co-operative and organization.

METHODS AND MATERIALS

In the present study, the fish diversity in the floodplain wetlands was examined by using two methods - (i) through spot verification of fish catch during the harvesting seasons and (ii) fish species reported by the fishermen in the questionnaire. Fish catch composition and fish species diversity had been collected by spot verification during physical survey at the fish landing stations. Only for those fish species which could not be recorded during physical survey were recorded from questionnaire. In the first method the fish species were indentified on the spot during fish landing in the fish landing stations. The species which could not be identified on the spot were brought to the laboratory and these were identified by using different keys of various standard literatures. The fish diversity was calculated as-

Diversity index H′ (Shannon and Reid, 2003) was estimated following the formulae-

Shannon-Wiener index: $H' = -\Sigma\, pi\, \ln pi$

Pi = n/N, n = diversity of individual and N = total density

To determine the composition of fish, the fish species were classified into three categories based on size ranges - (i) major group, (ii) intermediate group and (iii) minor group. Major group fish is composed of fish species with the size above the size of juveniles and are generally the large growing fishes. On the other hand, the intermediate group includes the sizes equivalent to or less than the size of juveniles of Indian Major Carp (IMC), and minor group fish includes all fish species with a size equivalent to or less than the fingerlings of IMC. The fishermen while selling their catch in the auction center commonly follow this categorization. This principle/definition was, however, not being applied while analyzing the fish diversity in the wetlands.

For the analysis of fish diversity, the classification into three groups was based on the size consideration at the maturity stage. For instance, the juveniles of IMC are considered under intermediate group for determination of fish biomass composition, whereas the same was considered under major group for analysis of fish diversity. Similarly, the fingerlings of IMC were considered under minor group in terms of biomass composition, and under major group for analysis of fish diversity.

The fish biomass composition of each category was observed on the spot at the time of fish selling in the auction center (fish landing center). The biomass composition was than expressed in terms of percentage. Since, the spot observations were made for three to four days in each wetland, the data collected through spot observation may not be adequate for analysis of biomass composition. Hence, the second method was also adopted simultaneously to know more about fish biomass composition of the individual wetlands. In the second method, individual fishermen were asked to indicate the total fish biomass production of individual group and also the fish species available in the wetland. The final composition of fish in terms of weight was determined by taking the aggregate of data procured from spot observation and report from local fishermen.

The collections of small- sized fishes were made with the help of a "Bag net" which is like a butterfly net strongly built with thick mesh and long handle. Details of other types of nets and tackles will be discussed in the Fish productivity chapter. They were preserved in 10 % formalin and brought to the laboratory for identification. The identification of fishes were made with the help of available literature of Jhingran (1991), Jayaram (1981), Talwar and Jhingran (1991).

RESULTS AND OBSERVATIONS

The Satiya wetland have rich diversity of fishes during study period, however, fish production in recent years dramatically declined as a result of anthropogenic disturbances in wetland area. The community characteristics presented in Table 1.

Table 1: Fish assemblage in Shatiya wetland during study period.

Family	Genus	Site 1	Site `2	Richness	Abundane
Cyprinidae	Catla	12	13	3	34
	Labeo	7	7	4	26
	Mystus	7	-	2	6
	Puntius	3	3	2	11
Bagridae	Mystus	-	-	1	4
Siluridae	Ompok	-	-	2	7

Family	Genus	Site 1	Site `2	Richness	Abundane
Mastacembelus	Mastacambelus	8	4	3	27
Notopteridae	Notopterous	10	10	3	25

The survey of wetland sites revealed differences in fish

catches of the sites of wetland. It is more or less correlated with anthropogenic disturbances as site 1 has excessively encroached for agricultural practices and also domestic drainage is higher than site 2. This difference also altered chemical variables at both sites which also affecting fish catches in these sites as analysed (Table 2 and Table 3).
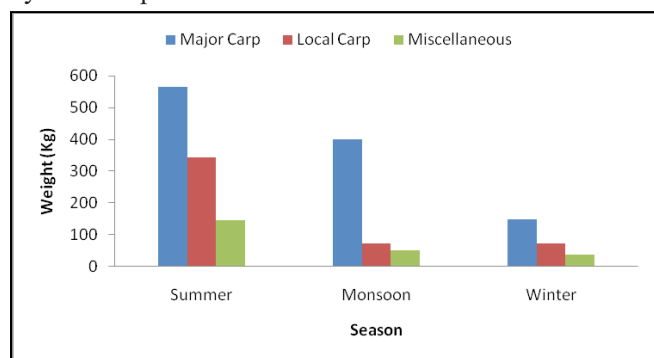
Table 2: Monthly fish group catches at site 1 of Satiya wetland

Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Major carp	73	104	113	213	134	248	82	41	30	28	27	21
Local carp	64	82	87	132	43	41	19	7	5	3	4	2
Miscellaneous	16	23	38	40	44	23	13	9	7	6	5	11
Total	153	211	238	385	221	312	114	57	42	37	36	34

Table 3: Monthly fish group catches at site 2 of Satiya wetland

Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Major carp	86	117	123	174	137	187	72	37	29	21	19	17
Local carp	73	96	93	153	52	47	36	21	23	20	18	20
Miscellaneous	19	25	47	39	56	31	21	19	21	18	15	16
Total	178	241	263	366	245	265	129	77	73	59	52	53

The seasonal variation in fish catches are presented in Figure 1 and Figure 2. This analysis showed maximum catches in summer and minimum in winter season. It is also clear that more abundant group is major carp followed by local carp and miscellaneous fishes.

The month wise catch analysis revealed maximum in April and June and minimum in November and December for Major carp, maximum in April and minimum in November for Local carp, while maximum in March and April and minimum in November for miscellaneous fishes (Figure 1 and Figure 2). The Major carps are abundant at site 1, Local carp and miscellaneous fishes at site 2 respectively (Figure 3, 4 and 5).

Fig. 1: Seasonal fish catches at site 1 of Satiya wetland

Fig. 2: Seasonal fish catches at site 1 of Satiya wetland
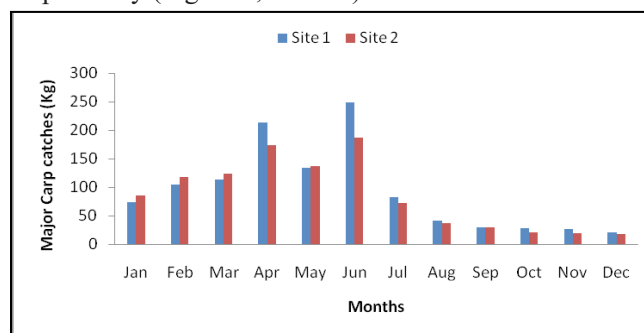
Fig. 3: Monthly Major carp catches at sites of Satiya wetland
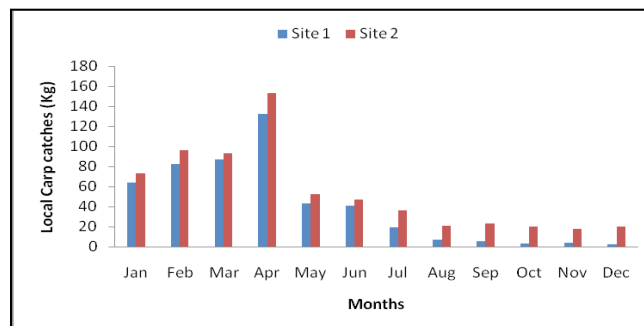
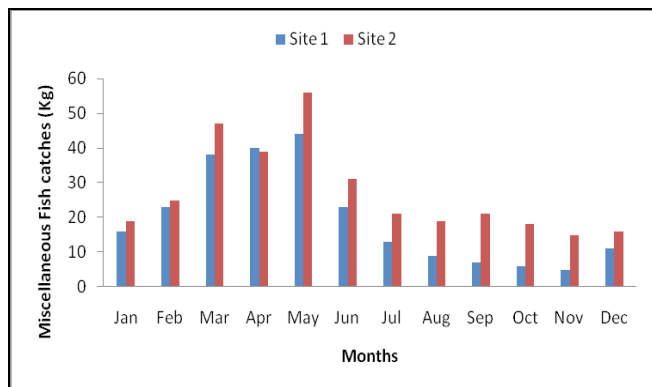**Fig. 4: Monthly Local carp catches at sites of Satiya wetland**

Fig.5: Monthly Miscellaneous catches at sites of Satiya wetland

DISCUSSION

Forty seven species at site 1 and thirty seven species existed at site 2 of Shatiya wetland showed rich fish diversity. The rich fish diversity in the wetlands has been reported by a number of previous workers (Dey, 1981; Goswami, 1985) from their studies in a limited number of wetlands.

The breeding habitat is also one of the important parameter from the point of view of fish diversity. The breeding environment of the wetlands has been observed to be conducive in most of the wetlands. The surrounding physiographic conditions of the wetlands create an environment for the fish species to breed in the wetlands. During breeding season, the brooders come to the nearby catchment area which is provided with the breeding facilities. The brooders generally prefer the shallow catchment areas provided with grasses, submerged emergent macrophytes and shallow paddy fields. A similar finding was also put forward by Weller (1978) in the floodplain wetlands of USA. He reported that fishes find their shelter and food in the littoral plants of lake or in emergent marshes. He also opined that several fish species move into marshes from adjacent lakes to breed and some fish species also use marshes as their nursery ground/ habitat.

Five number of Indian Major Carp (IMC) species namely *L.rohita, L. calbasu, L. gonius, Catla catla* and *Cirrhinus mrigala* are found significantly in most of the wetlands. The existence of these coveted fish resources in the wetlands of Assam also reported in the previous studies. The wetlands of Bihar provide the fishes with favorable breeding environment because of which IMC species are still continuing their life in the wetlands in spite of several constraint (Dey, 1981).

Emergence of exotic carps is a significant event in the context of fish diversity in the wetlands of Bihar. Their presence in the wetlands was not reported in the study made before 1987. In contrast, the present study identifies three number of exotic carps species namely *Hypophthalmichthys molitrix, Ctenopharyngodon idella,* and *Cyprinus carpio* in this wetland. Presently, the populations of these species are not high and have not reached an alarming position. However, if population of these species increase in the future, they will compete with the indigenous species as a result they are likely to suffer and may lose their population. This fact is quite evident from the study of Goswami, (1985) and Chakraborty, (1997) which ascertained that decline of fish diversity has also been aggravated by the introduction of exotic species which are damaging the indigenous carp and other fish species through competition for food and space in the floodplain wetlands. Though in Bihar, the competition between exotic and indigenous carp species in the wetlands is not yet significant, the newly introduced cat fish species *Clariaus garipenius* (Thai magur) may intensify the competition for food in some wetlands of Bihar. Unless this exotic catfish species is prevented from its emergence into the wetlands, a large number of minor and intermediate group fish species may disappear from the wetlands.

The catch composition of major, intermediate and minor group fish species varies from wetland to wetland depending on topography of the basin as well as zoogeographic situation of the fish species. The present status of the fish composition in the wetland indicates that the minor variety fish population dominates over the major and intermediate (minor>major>intermediate) variety fish population. But it is reported by the fishermen that major variety fish population in terms of weight was higher than the intermediate and minor variety fish population in the long past. The present reversal trend in catch composition convincingly establishes the low yielding habitat condition of the wetlands for the major group. The major group is also suffering due to indiscriminate fishing of brooders during breeding season, killing of fry and fingerling, destruction of eggs and spawn, and use of *Musarijal* (an encircling net) of 1.0 to 3.0 mm mesh size. This finding is in conformity with the findings of Jha (1997).

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