



Aquatic Biodiversity of Nimbavade Reservoir of Sangli District, Maharashtra, India

Patil Alaka A.

Department of Botany, Padmabhushan Dr. Vasantodada Patil Mahavidyalaya, Tasgaon Dist. Sangli, MS, INDIA

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Abstract

Wetlands play a vital role in maintaining the biodiversity and lively hood of the human being. Atpadi is one of the drought prone tahsil of Sangli district of Maharashtra. In aquatic ecosystem of Nimbavade, a total number of ten macrophytes were reported. The phytoplankton play an important role in aquatic ecosystem as a primary producers, and have a unique ability to fix inorganic carbon to build up organic substances through primary production. The Chlorophyceae represented by 18 species. The Cyanophyceae members were represented by 07 species. The Bacillariophyceae observed 04 species. Dinophyceae and Euglenophyceae represented by 01 species each. This wetland is secondarily being used for capture fishery. Important major carps, common carp, Chinese carp and 09 local fish species occurred in this reservoir. There were 24 species of aquatic birds were observed in the vicinity of Nimbavade reservoir. Attempts have been made to observe the diversity of macrophytes, phytoplankton, fish and bird diversity to obtain the baseline data from Nimbavade reservoir of Sangli district from June 2013 to May 2015.

Keywords: Biodiversity, wetland, Nimbavade reservoir, Sangli district, macrophytes, Phytoplankton, fishes and birds.

Introduction

Aquatic biodiversity has a lot of aesthetic as well as economic value and is largely responsible for maintaining and supporting overall environmental health of that respective region. The wetlands are suitable habitats for variety of animals, many birds and also aquatic plant forms, which form a typical food web and all responsible for several biological products. Biodiversity of Bargaon Wetland of Maharashtra was reported¹.

Most of the area of the tahsil is hard, rocky with small hills, ravines and bare plateaus of several kilometers with xeric habitat. The annual rainfall is also scanty since last many years. The average annual rainfall is 19.56 inches. The agriculture is either rain-fed or well water irrigated. Since last few years the numbers of the bore wells are tremendously increased for agriculture and drinking water, the underground water table has considerably decreased. All these conditions are increased day by day and the importance of man-made reservoirs in the tahsil.

Attempts are made to collect the information and update the biological data of Nimbavade reservoir as untouched water body in respect to macrophytes, phytoplankton, fishes and birds which will be of use in studying and conserving the fresh water resources of our country.

The Nimbavade is small village of Atpadi and 95 km away from district place. In 1981-88 Irrigation Department has constructed earthen dam riveted with stones. The water is used for irrigation also for vehicle and clothes washing, bathing and fishing activities. The reservoir is much influenced by human activities.

Materials and Methods

Study area: Southern Maharashtra includes Sangli, Satara and Kolhapur districts. Out of these three districts, Sangli district is one of the most important district as far as agricultural development is concerned. Sangli district is situated between 16.46 to 17.1° N and 73.43 to 75.0° E latitudes.

Geographically, Sangli district is divided into two zones viz. area adjoining Krishna river basin and eastern drought prone area away from basin with low rainfall and typical arid geographical set up. The overall water level is up to 6 meters down but varies according to geographical area, strata and location of the particular village. The eastern part of the district shows low fertile soil because of natural set up where man-made reservoirs have become source of irrigation besides the well.

Several limnological studies have been carried out in this region²⁻⁴. Most of the studies were carried out in water bodies of urban area. Sustainable development is not possible without proper management of wetlands.

Catchment area of reservoir is 108.49 sq.km. The maximum length of dam including slipway is 887.50 M, in which length of slipway is near about 183 M is of clear overflow type. This is shallow water body near margin. The total capacity of water storage is 235.69 Mcft where as dead storage is about 35.35 Mcft. The bottom of reservoir is rocky hence sustaining poor growth of aquatic macrophytes. Submergence area of reservoir is of 66 hectare. Average rainfall in the area is 19.56 inches. The

total water spread is 71.35 hectares. Total height of dam is 16.31 M. This reservoir is constructed during 1981 to 1988.

Aquatic macrophytes: During every visit aquatic macrophytes and marginal macrophytes were studied, photographed and collected from reservoir and kept in polythene bags for further process. In laboratory they were identified by using ‘The Flora of Presidency of Bombay’,⁵ Flora of Kolhapur district⁶ and other relevant published literature.

Phytoplankton: The phytoplanktons were collected using plankton net. It was prepared by using bolting silk No. 125. Total 100 liters of water sample was filtered and concentrate was collected in 200 ml plastic bottle. Two separate sets of concentrate samples were preserved by adding 4% formalin and 1 ml of Lugol’s Iodine. Identification of phytoplankton was made following standard methods⁷⁻¹⁰ and consulting experts. The qualitative analysis of phytoplankton was performed under Olympus trinocular 20C Hi microscope by focus 10 X 45x with 7.5 mega pixel camera.

Fishery: The fishes captured by fishermen were observed during the regular visits of study period. Fishermen and their family members were interviewed about their whole activity and their profit. Fishes were identified following the state keys^{11, 12, 13}.

Avifauna: The birds observed in and around the reservoir were identified by using standard keys^{14,15}.



Figure-2
 Map of Maharashtra location of showing location of Sangli district



Figure -3
 Map of Sangli District



Figure-1
 Map of India showing Maharashtra State

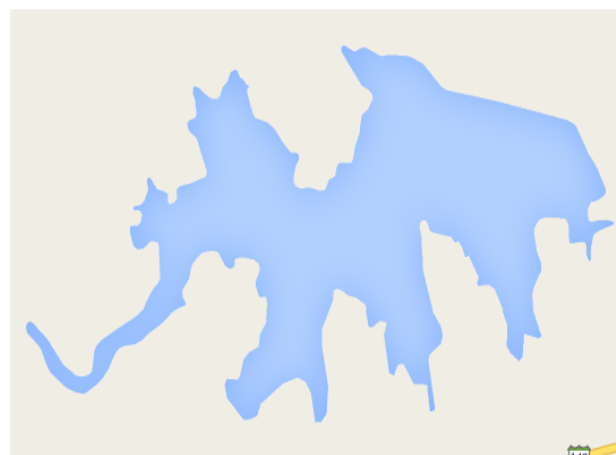


Figure-4
 Submergence Area of Nimbavade Reservoir

Results and Discussion

Macrophytes: The study on aquatic macrophytes is important to limnologist in order to understand functioning of aquatic ecosystem. The aquatic vegetation in Nimbavade reservoir consists of ten macrophyte species. Out of that *Ipomoea carnea* Jacq. Subsp *fistulosa*, *Typha angustata* Bory and Chaub. and *Cyperus rotundus* L. ssp. *rotundus* *Fimbristylis dichotoma* Vahi and *Bacopa monniera* (Linn) are of emergent macrophytes.

Submerged macrophytes in same reservoir are represented by five species viz. *Chara sps*, *Vallisneria spiralis* L., *Ceratophyllum demersum* L., *Hydrilla verticillata* (L.f.) Royle and *Najas minor* sensu Hook. f. This reservoir is devoid of free floating and rooted floating macrophytes.

Chemical nature of water is most important factor for distribution of aquatic plants. Physical nature of water, bottom of reservoir, fluctuations in water temperature and water level affect the distribution of aquatic plants.

The occurrence of *Ipomoea carnea* Jacq. subsp *fistulosa*, *Najas minor* might be because of partial contamination by human and cattle washing and bathing.

The area around water body was occupied by many weeds. They represent original natural set up of the region with typical xerophytes. These were *Argemone maxicana* L., *Tridax procumbens* L., *Parthenium hysterophorus* L., *Calotropis procera* (Ait.) R. Br., *Calotropis gigantea* L. R. Br., *Euphorbia hirta* L., *Euphorbia microphylla* Heyne., *Celosia argentea* L., *Cassia tora* L., *Acacia arabica* (Lamk.) wild., *Acacia nilotica* (L.) wild., *Tephrosia purpurea* (L.) Pers., *Lantana camara* L. var *aculeata* (L.) Moldenke, *Pongamia glabra* Vent. and *Azadirachta indica* Juss. Surround the water body and on dam line also.

The dicotyledons were dominated over monocotyledons.

Phytoplankton: The phytoplankton community on which, whole aquatic population depends is largely influenced by the interaction of number of physico-chemical factors^{16,17}.

The phytoplankton members represent the families' viz. Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae and Dinophyceae. The Chlorophyceae members are found to be dominant throughout the study period (table-1).

During rainy season phytoplankton diversity was less, while in summer it increases. During the study total number of species was 17, 22 and 31 in rainy, winter and summer season respectively. *Pediastrum biradiatum*, *P. tetras*, *Scenedesmus acuminatus*, *Ankistrodesmus spiralis*, *Palmella mucosa*, *Spirogyra spp.*, *Aphanizomenon spp.*, *Oscillatoria spp.*, *Navicula spp.*, *Synedra acus*, *Cyclotella comta*, *Euglena acus* var *rigida*

and *Ceratium cornutum* observed during all seasons of investigation. *Sperocystis spp.*, *Tetraedron muticum* var *punctulatum*, *Scenedesmus quadricauda*, *Chlorococcum hunicola*, *Merismopedia tenuissima*, *Anabaena spp.* and *Cylindrospermum doryphorum* were absent during rainy season. *Dictyosphaerium pulchellum*, *Volvox spp.* And *Tetraspora gelatinosa* were absent only during winter season.

The total number of 18 species of Chlorophyceae is distributed from 14 genera. Total 7 species of Cyanophyceae belongs to 6 genera and 4 species of 3 genera of Bacillariophyceae and from Dinophyceae 2 species were reported during the study period.

Algal abundance was noted higher during summer and declining during rainy season due to turbidity, current velocity, water runoff causing dilution effect, loss of water through outlet and fluctuating water level. Similar observations are reported^{18,19}.

The chlorophyceae found to be dominant over other groups²⁰. The highest species diversity of Chlorophyceae (green algae) in fresh water bodies of south west Maharashtra was recorded²¹. In all 34 species of phytoplankton amongst were observed in Mani reservoir, Hosanagar, Karnataka²², 13 species of Chlorophyceae, Bacillariophyceae with 11 species, 7 species of Cyanophyceae and Euglenophyceae with 3 species. Phytoplankton diversity of Western Yamuna Canal and River Yamuna in Yamunanagar, Haryana also reported²³. Algal spectrum of a wetland and its correlation with the physico-chemical parameters were studied²⁴. In the Bhambarde reservoir of Sangli district, the total number of 22 species of Chlorophyceae, 5 species of Cyanophyceae, 4 species of Bacillariophyceae and 2 species from Dinophyceae²⁵.

Fish diversity: Fishes constitute economically a very important group. The nutritional and medicinal value of fishes has already been recognized^{9, 26-28}. Fish is an important food resource in fresh waters as well as marine waters as it is rich in proteins, carbohydrates and other nutritional constituents²⁹.

The fishermen have established Bismilla fishery co-operative society, Nimbavade the co-operative society. This society obtains the right of fishing from government authorities for a period of five years on lease. If a tank is on lease by person or supported by co-operative society then, fisherman has to pay 10 Rs. per kg per day to lease man or co-operative society. The collected amount is used to purchase the seed of carp.

The prominent major carps are *Labeo rohita* (Rohu), *Catla catla*, *Cirrhinus mrigala* (Mrigal). The common carp is *Cyprinus carpio*. The Chinese carp is *Hypophthalmichthys molitrix* (silver carp) (table-2).

Labeo rohita is commonly occurring fresh water major carp fish, available in the local ponds and rivers³⁰.

The catch from rivers and reservoirs includes two species of family Masacembalidae that is *Mastocembelus armatus* and *Mastocembelus aculatus*, from which *Mastocembelus armatus* species was found more common. *Mastocembelus armatus* species was already enlisted in the threatened checklist of Ichthyofauna from Marathwada region of Maharashtra³¹.

Cirrhinus mrigala, *Catla catla*, *Labeo calbosu*, *Labeo rohita*, *Ompok*, *Mastocembelus armatus* were recorded in the 11 water bodies of Assam³². Ichthyofaunal Diversity of the Righth bank of Congo River (Pool Malebo), Congo³³. Preliminary biodiversity inventory of Ichthyofauna of Tsieme River, A tributary of Congo River (Pool-Malebo)³⁴.

Table-1
Seasonal variations in phytoplankton species in Nimbavade reservoir

S. N.	Name of the species	Nimbawade		
		Rainy	Winter	Summer
	Chlorophyceae			
1	<i>Sperocystis spp.</i>	-	+	+
2	<i>Pediastrum biradiatum</i> Meyen	+	+	+
3	<i>Pediastrum duplex</i> var <i>glacilimum</i> West and West	-	-	+
4	<i>Pediastrum tetras</i> var <i>tetradon</i> (Corda) Rabenhorst	+	+	+
5	<i>Tetraedron muticum</i> var <i>punctulatum</i> (Reinsch) De Toni	-	+	+
6	<i>Dictyosphaerium pulchellum</i> Wood	+	-	+
7	<i>Scenedesmus quadricauda</i> var <i>longispina</i> (Chod.) G.M. Smith	-	+	+
8	<i>Scenedesmus acuminatus</i> (Lag.) Chodat	+	+	+
9	<i>Ankistrodesmus spiralis</i> (Turner) Lemmermann	+	+	+
10	<i>Ankistrodesmus falcatus</i> var <i>mirabilis</i> (West and West) G.S. West	-	-	+
11	<i>Volvox spp.</i>	+	-	+
12	<i>Chlorella vulgaris</i> Beyerineck	-	-	+
13	<i>Chlorococcum hunicola</i> (Naeg.) Rabenhorst	-	+	+
14	<i>Tetraspora gelatinosa</i> (Vauch.) Desvauz	+	-	+
15	<i>Palmella mucosa</i> Kuetzing	+	+	+
16	<i>Spirogyra spp.</i>	+	+	+
17	<i>Cosmarium depressum</i> Lundell	-	-	+
18	<i>Dinobryon sociale</i> Eherenberg	+	+	+
	Cyanophyceae			
19	<i>Merismopedia tenuissima</i> Lemmermann	-	+	+
20	<i>Merismopedia elegans</i> var <i>major</i> G.M.Smith	-	-	+
21	<i>Anabaena spp.</i>	-	+	+
22	<i>Aphanizomenon spp.</i>	+	+	+
23	<i>Oscillatoria spp.</i>	+	+	+
24	<i>Cylindrospermum doryphorum</i>	-	+	+
25	<i>Gleotrichia natans</i>	-	+	+
	Bacillariophyceae			
26	<i>Navicula spp.</i>	+	+	+
27	<i>Synedra capitata</i> Ehrenberg	-	-	+
28	<i>Synedra acus</i> Kuetzing	+	+	+
29	<i>Cyclotella comta</i> Kuetzing	+	+	+
	Euglenophyceae			
30	<i>Euglena acus</i> var <i>rigida</i> Huebner	+	+	+
	Dinophyceae			
31	<i>Ceratium cornutum</i> (Ehrenb.) Claparede and Lachmann	+	+	+
	Total	17	22	31

+ indicates present species.

Table-2
Checklist of fishes from Nimbavade reservoir

Sr. No.	Varieties	Local name	Scientific name	Family
1	Major Carps	Rohu	<i>Labeo rohita</i>	Cyprinidae
		Catla	<i>Catla catla</i>	Cyprinidae
		Mrigal	<i>Cirrhinus mrigala</i>	Cyprinidae
2	Common carps	Cyprinus	<i>Cyprinus carpio</i>	Cyprinidae
3	Chinese carp	Silver carp	<i>Hypolithalmichthys molitrix</i>	Cyprinidae
4	Local varieties	Tambir	<i>Labeo fimbriatus</i>	Cyprinidae
		Kanas	<i>Labeo calbasu</i>	Cyprinidae
		Dokrya	<i>Chana gachua</i>	Cyprinidae
		Murrel	<i>Chana marulius</i>	Cyprinidae
		Vam	<i>Mastocembelus armatus</i>	Mastacembelidae
		Khaprya	<i>Ompok bimaculatus</i>	Siluridae
		Putia	<i>Glossogobius girris</i>	Cyprinidae
		Shingati	<i>Mystus malbaricus</i>	Bagridae
		Mallya	<i>Garra mullya</i>	Cyprinidae

Table-3
Avifauna of Nimbavade reservoir of Sangli district

Sr. No.	Aquatic birds	Scientific name
1	Little cormorant	<i>Phalacrocorax niger</i>
2	Large egret	<i>Casmerodius albus</i>
3	Grey Heron	<i>Ardea cinera</i>
4	Painted Stork	<i>Mycteria leucophala</i>
5	Black Ibis	<i>Pseudibis papillosa</i>
6	Graylag Goose	<i>Anser anser</i>
7	Brahminy shelduck	<i>Tandorna ferruginea pall</i>
8	Lesser whiting duck	<i>Dendrocygna javanica</i>
9	Nothern shoveller	<i>Anus clypeata</i>
10	Garganey	<i>Anas querquedula</i>
11	Common coot	<i>Fulica atra</i>
12	Bronz winged jacana	<i>Metopidius indicus</i>
13	Common sandpiper	<i>Actitis hypoleucas</i>
14	House crow	<i>Corvus splendens</i>
15	Median egret	<i>Mesophoyx intermedia</i>
16	Indian pond Heron,	<i>Ardeola grayii</i>
17	Cattle Egret,	<i>Bubulcus ibis</i>
18	Little Egret,	<i>Egretta garzetta</i>
19	Common Quail,	<i>Coturnix coturnix</i>
20	Indian peafowl ,	<i>Pavo cristatus</i>
21	Indian grey Hornbill,	<i>Oclyceros birostri</i>
22	Plumheaded Parakeet,	<i>Psittacula cyanocephala</i>
23	Common Hoopoe	<i>Upupa epops</i>
24	Rock Bush Quail ,	<i>Perdicula argoondah</i>
	Total	24

Avifauna: Aquatic vegetation, bank side flora, trees in catchment area attracts the birds in reservoir. Even though birds are not aquatic in the real sense but they are dependent on aquatic habitat for food. At Nimbavade 24 species were recorded (table-3).

Large egret, Black Ibis, Shovellar, Brahmini duck, coot in the wetland areas of Raichur³⁵. Physicochemical Characterization of Lonar Lake Effecting Biodiversity studied³⁶.

Conclusion

For the purpose of management of any wetland ecosystem monitoring is essential. It may be biological or physico-chemical. It is very difficult to evaluate each and every parameter regularly. The reservoir is significant for aquaculture. The fisherman community is dependent on this reservoir for fish catch as income source. Now these days are of conservation of aquatic biodiversity. Few local diversity of aquatic ecosystem has maintained well in this reservoir.

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