



Biodiversity of Bhambarde Reservoir of Sangli, Maharashtra, India

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Abstract

Reservoirs play an important role in providing food to fish and other aquatic animals; provide support to algae; shelter and habitat to some animals, also in cycling of nutrients in the water body. A total number of seven macrophytes were reported from Bhambarde reservoir. In aquatic ecosystem, the phytoplankton play an important role of primary producers. They have a unique ability to fix inorganic carbon to build up organic substances through primary production. The Chlorophyceae represented by 14 genera and 19 species. The Cyanophyceae members were represented by 05 species of 04 genera. The Bacillariophyceae observed 03 genera and 04 species. Dinophyceae represented by Ceratium and Peridinium with 1 species each. The reservoir is secondarily being used for reservoir capture fishery. Important major carps, common carp, Chinese carp and 10 local fish species along with a crab variety occurred in this reservoir. There were 13 species of aquatic birds were observed in the vicinity of Bhambarde reservoir. Attempts have been made to observe the diversity of macrophytes, phytoplankton, fish and bird diversity to obtain the baseline data from Bhambarde reservoir of Sangli district in the duration August 2011 to July 2013.

Keywords: Biodiversity, Bhambarde reservoir, Sangli district, macrophytes, phytoplankton, fishes and birds.

Introduction

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

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

The Bhambarde is small village located at central part of Khanapur tahsil and northern part of district 71 km away from district place. In 1969-72 Irrigation Department has constructed earthen dam riveted with stones. The water is used for irrigation also for washing, bathing and fishing activities. The reservoir is much influenced by human activities.

Material 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 13.47 sq.km. The maximum length of dam including slipway is 688 M, in which length of slipway is near about 88 M is of clear overflow type. This is shallow water body near margin. The total capacity of water storage is 46.61 Mcft where as dead storage is about 7.31 Mcft. The bottom of reservoir is rocky hence sustaining poor growth of aquatic macrophytes. Submergence area of reservoir is of 40 hectare. Average rainfall in the area is 17.64 inches. The total water spread is 40 hectares. Total height of dam is 16.52 M. This reservoir is constructed during 1969 to 1972.

Reservoir was visited monthly for the period of two consecutive years (August 2011 to July 2013). Three sampling sites were selected for monthly analysis.

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 phytoplankton 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 keys¹¹⁻¹³.

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



Figure-3
 Map of Sangli District

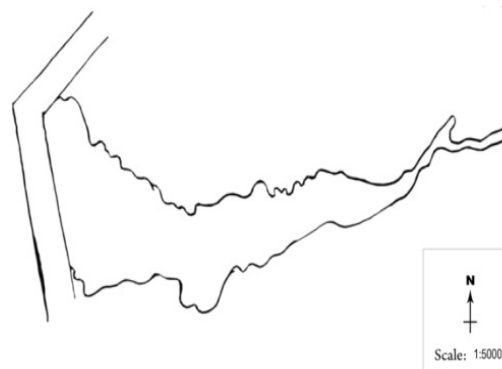


Figure-4
 Submergence Area of Bhambarde Reservoir

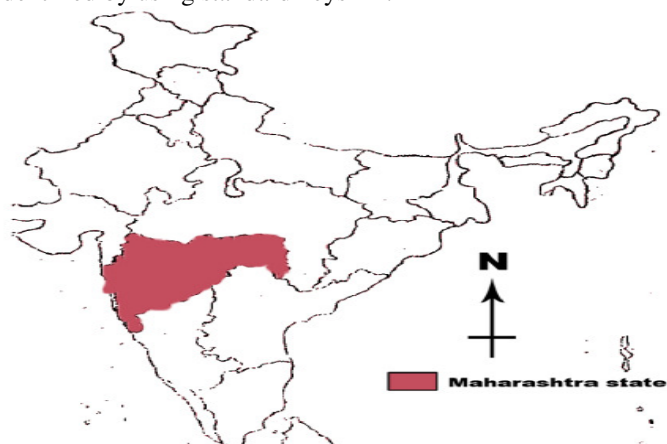


Figure-1
 Map of India showing location of Maharashtra State



Figure-2
 Map of Maharashtra showing location of Sangli district

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 Bhambarde reservoir consists of seven macrophyte species. Out of that *Phyla nodiflora* (L.) Greene, *Ipomoea carnea* Jacq. Subsp *fistulosa*, *Typha angustata* Bory and Chaub. and *Cyperus rotundus* L. ssp. *rotundus* are of emergent macrophytes.

Submerged macrophytes in same reservoir are represented by three species viz. *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 reservoir was occupied by many weeds. They represent original natural set up 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., *Azadirachta indica* Juss. etc. 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 factors¹⁶⁻¹⁷.

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

During rainy season phytoplankton diversity was less, while in summer it increases. During first year, the total number of species was 17, 19 and 26 in rainy, winter and summer season respectively. In the next year of study same seasonal pattern was observed with 13, 15 and 25 during rainy, winter and summer respectively. *Chlorella ellipsoidea* observed during all seasons of consecutive years of investigation. *Chlorella vulgaris* also reported during both the years except summer of first year study. *Pediastrum biradiatum*, *P. duplex*, *P. simplex* were absent during rainy season of both years. *Sperocystis spp.* was absent during only rainy season of second year. *Dictyosphaerium pulchellum*, *Spirogyra spp.* and *Lyngbya aestuaril* were absent only during winter of both the years.

The total number of 22 species of Chlorophyceae is distributed from 14 genera. Total 5 species of Cyanophyceae belongs to 4 genera and 4 species of 3 genera of Bacillariophyceae. From Dinophyceae 2 species namely *Ceratium cornutum* and *Peridinium polonicum* were identified.

Algal abundance was noted during summer and its declining state 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 in fresh water bodies of south west Maharashtra was recorded²¹. In all 34

species of phytoplankton amongst were observed in Mani reservoir, Hosanagar, Karnataka²², Chlorophyceae with 13 species, Bacillariophyceae with 11 species, Cyanophyceae with 7 and Euglenophyceae with 3 species. Malhotra Priyanka *et. al.* 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.

Fish Diversity: Fishes constitute economically a very important group. The nutritional and medicinal value of fishes has already been recognized^{9, 25-27}. Fish is an important food resource in fresh waters as well as marine waters as it is rich in proteins, carbohydrates and other nutritional constituents²⁸.

The fishermen have established Bismilla fishery co-operative society, Bhambarde 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 *Hypolithalmichthys molitrix* (silver carp) (table-2).

Labeo rohita is commonly occurring fresh water major carp fish, available in the local ponds and rivers²⁹.

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 Maharashtra³⁰.

Cirrhinus mrigala, *Catla catla*, *Labea calbosu*, *Labeo rohita*, *Ompok*, *Mastocembelus armatus* were recorded in the 11 water bodies of Assam³¹. Ichthyofaunal Diversity of the Right bank of Congo River (Pool Malebo), Congo³². Preliminary biodiversity inventory of Ichthyofauna of Tsieme River, A tributary of Congo River (Pool-Malebo)³³.

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 Bhambarde 13 species were recorded (table-3).

Large egret, Black Ibis, Shovellar, Brahmini duck, coot in the wetland areas of Raichur³⁴. Physicochemical Characterization of Lonar Lake Effecting Biodiversity studied³⁵.

Table-1
Seasonal variation in phytoplankton species in Bhambarde reservoir

Sr. No	Name of the species	Rainy		Winter		Summer	
		I year	II year	I year	II year	I year	II year
*	Chlorophyceae						
1	<i>Sperocystis spp.</i>	+	-	+	+	+	+
2	<i>Pediastrum biradiatum</i>	-	-	+	+	+	+
3	<i>Pediastrum duplex</i>	-	-	+	+	+	+
4	<i>Pediastrum simplex</i>	-	-	+	+	+	+
5	<i>Dictyosphaerium pulchellum</i>	+	+	-	-	+	+
6	<i>Scenedesmus quadricauda</i>	-	+	+	-	+	+
7	<i>Ankistrodesmus spiralis</i>	+	-	-	-	+	-
8	<i>Ankistrodesmus falcatus</i>	+	-	-	-	+	-
9	<i>Zygnema spp.</i>	+	+	+	+	-	-
10	<i>Chlorella ellipsoidae</i>	+	+	+	+	+	+
11	<i>Chlorella vulgaris</i>	+	+	+	+	-	+
12	<i>Chlorococcum hunicola</i>	+	-	-	-	+	-
13	<i>Tetraspora gelatinosa</i>	-	-	-	+	+	+
14	<i>Haematococcus lacustris</i>	-	+	+	+	-	+
15	<i>Asterococcus superbus</i>	-	-	+	-	+	-
16	<i>Spirogyra spp.</i>	+	+	-	-	+	+
17	<i>Cosmarium depressum</i>	-	-	+	+	+	+
18	<i>Cosmarium tetraphtalmun</i>	-	-	+	-	+	+
19	<i>Dinobryon sociale</i>	-	-	-	-	+	-
*	Cyanophyceae						
20	<i>Anabaena spp.</i>	+	+	-	-	+	+
21	<i>Gloeocapsa aeruginosa</i>	-	-	+	+	-	+
22	<i>Lyngbya aestuaril</i>	+	+	-	-	+	+
23	<i>Lyngbya spp.</i>	-	-	+	-	+	+
24	<i>Oscillatiria spp.</i>	+	+	-	+	+	+
*	Bacillariophyceae						
25	<i>Cymbella spp.</i>	+	-	+	+	-	+
26	<i>Melosira granulata</i>	-	-	+	+	+	+
27	<i>Melosira varians</i>	-	-	+	-	+	+
28	<i>Navicula spp.</i>	+	-	-	-	-	+
*	Dinophyceae						
29	<i>Ceratium cornutum</i>	-	+	-	-	+	+
30	<i>Peridinium polonicum</i>	+	-	+	-	+	-
	Total	15	12	18	13	24	23

+ indicates present species.

Table-2
Checklist of fishes from Bhambarde 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>Hypophthalmichthys 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
	Singi	<i>Barbus minor</i>	Saccsranichidae	

Table-3
Avifauna of Bhambarde reservoir of Sangli district

Sr. No.	Aquatic birds	Scientific Name
1.	Little cormorant	<i>Phalacrocorax niger</i> (RM-Crow)
2.	Large egret	<i>Casmerodius albus</i> (RM-Vulture)
3	Grey Heron	<i>Ardea cinera</i> (RM-Vulture)
4	Painted Stork	<i>Mycteria leucophala</i> (RM-vulture)
5	Black Ibis	<i>Peeudibis papillosa</i> (R-Village hen)
6	Graylag Goose	<i>Anser anser</i> (M-Duck)
7	Brahminy shelduck	<i>Tandorna ferruginea pall</i> (RM-Duck)
8	Nothern shoveller	<i>Anus clypeata</i> (M-Duck)
9	Garganey	<i>Anas querquedula</i> (M-Duck)
10	Common coot	<i>Fulica atra</i> (RM-Duck)
11	Common sandpiper	<i>Actitis hypoleucas</i> (RM- Quail)
12	House crow	<i>Corvus splendens</i> (R-Pigeon)
13	Median egret	<i>Mesophoyx intermedia</i> (RM – Village hen)

* R = Resident, M = Migrant, RM = Resident migrant.

Conclusion

The reservoir is significant for in land fishery. The fisherman community is dependent on this water body for fish catch as income source. It may be species conservation, habitat conservation, fresh water management and conservation, aquatic biodiversity conservation. Few local fishes are identified from the water body i e. local diversity of aquatic ecosystem has maintained well.

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