



Phytoplanktonic diversity study in Deothan reservoir (Maharashtra)

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Abstract

Present study was carried out during 2014 and 2015 to study the phytoplankton diversity of Deothan reservoir (Maharashtra). Three different locations (D1, D2 and D3) were selected for collection of algal samples. Algae from seven classes have been observed and identified in the Deothan reservoir. The dominant class was Chlorophyceae (37 genera and 72 species). It was followed by 15 Genera and 37 species of Cyanophyceae and 9 genera and 24 species of Bacillariophyceae. The quantitative growth of algal density was found in winter and monsoon seasons, while minimum growth was observed in summers during this period. The maximum algal diversity observed in D1 and D3 location of Deothan reservoir.

Keywords: Deothan, diversity studies, phytoplankton and reservoir

Introduction

Deothan fresh water reservoir is an important reservoir near the village Deothan of Akole tahsil, Ahmednagar. It was constructed in 1993 and the total catchment area is 67.50sq miles. The storage capacity of the Deothan reservoir is 1060 mcft. and 230.67ha is a command area of this reservoir. This reservoir is situated in the northern part of Akole tahsil. The Deothan reservoir was constructed on Adhala River, the tributary of Pravara River. It originates near village Ekdara, 18 km upstream of the dam. This reservoir is mostly used for drinking, irrigation and domestic purposes. So, the human interface is directly involved and they affect phytoplankton diversity. In the present environmental situation, there is a need to analyze phytoplankton diversity of Deothan water reservoir.

The phytoplanktonic study is a very useful tool for water quality assessment and also contributes to an understanding of the basic nature and general economy of the lake ecosystem (Pawar *et al.*, 2006) [17] and (Wagh and Jondhale, 2021A) [33]. The numbers of species of phytoplankton play an important role in determining the quality of the water body. Therefore, certain algae may grow in a specific quality of water. Hence, algal growth in a habitat that influences the ecosystem and also it directly affects the aquatic environment mainly the nutrient contents. However, the identification and assessment of biodiversity composition of a lake results in the conservation of the aquatic system (Goswami, 2012) [12].

Several researchers have been published their work on phytoplankton diversity in freshwater reservoirs. Rana and Palria (1988) [27] have surveyed the River Ayad which receives high amounts of domestic and industrial wastes and calculated the percentage of algae, where 50% belongs to blue greens, 33% to green algae, 10% to diatoms, and the remaining Euglenophyceae members. Pulle and Khan (2003) [26] also analysed the phytoplankton and recorded 43

species of which 18 were Chlorophyceae, 10 Bacillariophyceae, 10 Cyanophyceae and 5 Euglenophyceae. A number of research workers have published their work on aquatic environment and ecology of Phytoplankton in freshwater. More and Nandan (2003) [18], Sirsat *et al.*, (2004) [30], Sushmita *et al.*, (2017) [32], Priyanka and Nilima, (2017) [25], Alifha *et al.*, (2018) [2], Halder *et al.*, (2019) [14] and Wagh and Jondhale, (2021B) [34]. In the present study attempt was made to study seasonal diversity and population density of phytoplankton in Deothan reservoir of Akole taluka.

Materials and Methods

Deothan fresh water reservoir is in the geographic region of the taluka Akole in the district Ahmednagar, Maharashtra (Figure 1). It is situated on Adhala river, near Deothan villages. The water samples for phytoplankton analysis were collected from the Deothan freshwater reservoirs. Monthly collection of algal samples has been carried out from three different sampling stations that were selected after survey such as D1 (Towards the Savargaon pat village), D2 (near the canal alignment) and D3 (southern region near pump house) of the Deothan reservoirs. Phytoplankton sampling on a monthly basis was carried out for a period of two year from January 2014 to December 2015. The samples were collected monthly in the morning between 6.00 a.m. to 10.00 a.m. The samples were observed on the spot in natural conditions and was preserved in 4% formalin and Lugol's solution. Samples were collected using plankton net, of mesh size 20. The macroscopic algae were collected in bottles and polythene bags. Fresh as well as preserved algal forms were observed under research microscope and identified with the help of standard literature and monographs Fritsch (1931) [9], Smith (1950) [31], Prescott (1950) [24], Desikachary (1959) [8], Iyengar (1940) [15] and Sarode and Kamat (1984) [29].

Results and Discussion

The algal samples were collected from selected three different locations of Deothan water reservoir and have been identified. The total number of algal taxa recorded at each sampling location are given in Table 1. Monthly and seasonal collection have been made and given in tabular form from Table 2, 3 and 4. In the present study seven algal groups were identified viz. Chlorophyceae, Cyanophyceae, Bacillariophyceae, Euglenophyceae, Charophyceae, Xanthophyceae and Dinophyceae.

Throughout the study, Chlorophyceae is a dominating group of algae in Deothan fresh water reservoir then the other group. It has been observed that the 37 genus and 72 species are found in the Chlorophyceae group. This class has been represented by the orders Volvocales, Tetrasporales, Ulotrichales, Chaetophorales, Cladophorales, Oedogoniales, Chlorococcales, Siphonales, Zygnematales and Ulvales. The species of *Cosmarium* (8), *Scenedesmus* (7), *Pediastrum* (6) and *Tetraedron* (05) were the most common and major species observed during the present investigation. The other common taxa are *Ankistrodesmus*, *Actinastrum*, *Euastrum*, *Coelastrum*, *Staurastrum*, *Spirogyra* were observed. The highest occurrence of Chlorophyceae was reported at D3 sampling location during the post monsoon period of Deothan water reservoir as compared to other sampling locations. These results were compiled with Anand (1975) [4], Anand (1998) [3], Mishra and Saksena (1993) [17] and Deshkumh (2006) [7].

The blue green algae were represented by orders Chlorococcales, Nostocales and Stigonematales. The group Cyanophyceae represents 15 genera and 37 species and *Nostoc* (6), *Oscillatoria* (7) were the dominant genera. *Microcystis*, *Chlorococcus*, *Scytonema*, *Lyngbya* was commonly occurring from the Deothan water reservoir. Maximum composition of Cyanophyceae was reported during monsoon period at D2 location of Deothan reservoir during 2014 and 2015. Maximum species (18) was observed in March at D1 location of Deothan water reservoir in 2014. These observations are also at par with observations of Deore (1978) [6], Gore and Pingle (2003) [11]. Bacillariophyceae was represented with 9 genera and 24 species. Genus *Fragillaria* with five species and *Navicula* with four species were the dominating among this class. The other common genera were *Melosira*, *Cymbella*, *Synedra*,

Enotia. Highest species composition was recorded at D2 location of Deothan reservoir and maximum species diversity of Bacillariophyceae was reported during summer period from D2 sampling locations in the both years. These results are also correlated with, Kamat (1974) [16], Fritsch (1979) [10], Balkrishnan and Rao (1977) [5], Pingle (1988, 2003) [21, 23] and Sagar (1987) [28].

Xanthophyceae represented by only two genus viz. *Botryococcus* and *Vaucheria*, belong to families Botryococcaceae and Vauchriaceae respectively. The occurrence of Xanthophyceae was found common during monsoon and post monsoon period at D1, D2 and D3 locations. Maximum species was observed at location D1 during the monsoon period in both years. Euglenophyceae is represented by species of *Euglena* and *Phacus*. Euglenoids are generally observed in D1 and D3 sampling locations and they do not show continuous periodicity. Highest composition of Euglenoids was noted at location D3 during summer period. The results were correlated with the findings of Pingle (1981) [22], Agarkar and Garode (2001) [1], Gunale and Chaugule (1980) [13], More and Nandan (2003) [20] and Zaware (2006) [35].

The population of Charophytes (*Chara* and *Nitella*) was reported throughout the period of investigation at the Deothan reservoir. However, *Nitella mirabilis* Nordstedt ex. J Groves was reported from Deothan reservoir at D3 sampling location. Five species, belonging to 2 genera viz., *Nitella* and *Chara* were observed during investigation. Dinophyceae show very low concentration in Deothan the reservoirs. The maximum periodicity was observed at D3 sampling location during summer season in both years. This group represents by two genus, with single species of each genus i.e. *Glenodinium quadridens* (stein) Schiller and *Ceratium hirundinella* (O.F. Muell) Dujardin.

In the present study, among the 67 genera and 145 species was observed in Deothan fresh water reservoir and the most dominant genera are *Cosmarium*, *Scenedesmus*, *Pediastrum*, *Oscillatoria*, *Nostoc*, *Fragillaria*, *Navicula* and *Tetraedron*. Zaware (2006) [35] reported 57 species of Bacillariophyceae; 50 species of Chlorophyceae, while 25 of Euglenophyceae, from Pashan Lake. Deshmukh (2006) [7] studies water quality of Pravara river and reported 298 species belonging to 108 genera, representing 21 orders and 34 families.

Table 1: Phytoplankton diversity in Deothan reservoir

Sr. No.	Algal Taxa	D1	D2	D3
Cyanophyceae				
1	<i>Microcystis flos-aquae</i> (Wittr.) Kirchner	+	+	+
2	<i>Microcystis protocystis</i> Crow	+	+	+
3	<i>Microcystis aeruginosa</i> Kuetz.	+	+	+
4	<i>Merismopediatenuissima</i> Lemm.	+	+	+
5	<i>Merismopedia glauca</i> (Ehrenb.) Naeg.	+	+	+
6	<i>Gloeocapsa violacea</i> (Corda) Rebenh.	+	-	+
7	<i>Chlorococcus giganteus</i> West, W.	+	+	+
8	<i>Chlorococcusturgidus</i> (Kuetz.) Naeg.	+	-	+
9	<i>Chlorococcus minor</i> (Kuetz.) Naegeli	+	+	+
10	<i>Aphanothece pallida</i> (Kuetz.) Rabenh.	+	-	+
11	<i>Aphanothececastagnei</i> (Breb.) Rabenh.	-	+	+
12	<i>Gomphosphaeria aaponina</i> var. <i>delicatula</i> Virieux	+	+	+
13	<i>Oscillatoria tenuis</i> Ag. ex Gomont	-	+	+
14	<i>Oscillatoria mougeotii</i> Kuetz.	-	+	-
15	<i>Oscillatoria subrevis</i> Schmidle	-	-	+
16	<i>Oscillatoria agardhii</i> Gomont	-	+	+
17	<i>Oscillatoria limosa</i> Ag. ex Gomont	-	+	+

18	<i>Oscillatoria princeps</i> Vaucher ex Gomont	-	+	+
19	<i>Oscillatoria curviceps</i> Ag. ex Gomont	-	+	+
20	<i>Phormidiumcalcicola</i> Gardner	+	-	+
21	<i>Lyngbya major</i> Menegh. ex Gomont	+	+	+
22	<i>Lyngbyamajuscula</i> Harvey ex Gomont	+	+	+
23	<i>Nostoc linckia</i> var. <i>arvense</i> Rao, C. B.	-	-	+
24	<i>Nostoc punctiforme</i> (Kuetz.) Hariot	+	+	-
25	<i>Nostoc hatei</i> Dixit	-	-	+
26	<i>Nostoc commune</i> Vaucher ex Born. et Flah.	+	-	-
27	<i>Nostoc verrucosum</i> Vaucher ex Born. et Flah.	-	+	-
28	<i>Nostoc spongiaeforme</i> Ag. ex Born. et Flah.	-	-	+
29	<i>Anabaena variabilis</i> Kuetz. ex Born. et Flah.	-	+	-
30	<i>Anabaena constricta</i> (Szafer) Geitler	+	-	-
31	<i>Nodulariaspumigena</i> Mertens ex Born. et Flah.	+	+	-
32	<i>Nodulariaharveyana</i> (Thw.) Thuret	-	+	+
33	<i>Scytonemascheri</i> Bharadwaja	+	+	-
34	<i>Scytonema mirabile</i> (Dillw.) Bornet	-	+	+
35	<i>Scytonemacoactile</i> Montagne ex Born. et Flah.	-	-	+
36	<i>Gloeotrichiaghosei</i> Singh, R. N.	-	+	-
37	<i>Rivularia aquatica</i> De wilde	+	-	+
Chlorophyceae				
1	<i>Pandorina morum</i> (Muell.) Bory	+	+	+
2	<i>Eudorina elegans</i> Ehrenberg	+	-	-
3	<i>Volvox globator</i> Linn.	-	-	-
4	<i>Sphaerocystis schroeteri</i> Chodat	+	-	-
5	<i>Pseudosphaerocystis lacustris</i> (Lemm.) Novakova	-	-	-
6	<i>Chlamydocaspa ampla</i> (Kuetz.) Fott	+	+	-
7	<i>Ulothrix cylindricum</i> Prescott	-	-	+
8	<i>Chaetophora elegans</i> (Roth) C. A. Agardh	+	-	-
9	<i>Cladophora glomerata</i> (L.) Kuetzing	-	+	+
10	<i>Pithophoramooreana</i> Collins	-	+	+
11	<i>Rhizoclonium crassipellitum</i> West & West	+	-	-
12	<i>Oedogonium biformae</i> (Nordst.) Hirn.	-	-	-
13	<i>Oedogonium latiusculum</i> Tiff.	-	-	-
14	<i>Golenkinia radiata</i> (Chod.) Wille	+	-	-
15	<i>Characium acuminatum</i> A. Braun in Kuetzing	-	-	+
16	<i>Hydrodictyon reticulatum</i> (L.) Lagerheim	+	+	-
17	<i>Pediastrum simplex</i> (Meyen) Lemm.	+	+	+
18	<i>Pediastrum simplex</i> var. <i>duodenarium</i> (Bailey) Rabenhorst	+	+	+
19	<i>Pediastrum ovatum</i> (Ehr.) A. Braun	+	+	+
20	<i>Pediastrum duplex</i> var. <i>reticulatum</i> Lagerheim	+	+	+
21	<i>Pediastrum duplex</i> var. <i>subgranulatum</i> Raciborski	-	+	+
22	<i>Pediastrum boryanum</i> (Turp.) Meneghini	+	+	+
23	<i>Sorastrum spinulosum</i> Naegeli	-	+	+
24	<i>Coelastrum cambricum</i> Archer	+	+	+
25	<i>Coelastrum microporum</i> Naegeli	+	+	+
26	<i>Coelastrum reticulatum</i> (Dang.) Senn	+	+	+
27	<i>Chlorella vulgaris</i> Beyerinck	-	+	+
28	<i>Dictyosphaerium ehrenbergianum</i> Naegeli	-	+	+
29	<i>Oocystis borgei</i> Snow	+	+	-
30	<i>Oocystis elliptica</i> W. West.	+	-	-
31	<i>Ankistrodesmus spiralis</i> (Turner) Lemm.	+	+	+
32	<i>Ankistrodesmus falcatus</i> (Corda) Ralfs	+	+	+
33	<i>Selenastrum bibraianum</i> Reinsch	+	+	+
34	<i>Kirchneriella lunaris</i> (Kirchner) Moebius	+	+	+
35	<i>Tetraedron regulare</i> Kuetzing	+	+	+
36	<i>Tetraedron pusillum</i> (Wallich) W. et G. S. West	+	+	-
37	<i>Tetraedron enorme</i> var. <i>pentaedricum</i> Prescott	+	+	-
38	<i>Tetraedron limneticum</i> Borge	+	+	-
39	<i>Tetraedron gracile</i> (Reinsch) Hansgirg	-	+	+
40	<i>Scenedesmus bijugatus</i> (Turpin) Kuetzing	-	+	+
41	<i>Scenedesmus bijugatus</i> var. <i>irregularis</i> Wille	-	+	-
42	<i>Scenedesmus acuminatus</i> (Lagerheim) Chodat	-	+	+
43	<i>Scenedesmus dimorphus</i> (Turpin) Kuetzing	-	+	+
44	<i>Scenedesmus indicus</i> sp. nov.	-	+	-
45	<i>Scenedesmus denticulatus</i> Lagerheim	-	+	+
46	<i>Scenedesmus quadricauda</i> (Turpin) Brebssion	-	+	+
47	<i>Actinastrum hantzschii</i> Lagerheim	+	+	+

48	<i>Crucigenialauterbornii</i> Schmidle	+	+	+
49	<i>Micractiniumpusillum</i> Fresenius	+	+	-
50	<i>Dichotomosiphontuberosus</i> (A. Braun) Ernst	-	-	+
51	<i>Mougeotiaabnormis</i> Kisselew	-	-	+
52	<i>Spirogyra mirabilis</i> (Hass.) Kuetzing	-	-	+
53	<i>Spirogyra crassa</i> Kuetzing	-	-	+
54	<i>Spirogyra communis</i> (Hass) Kuetzing	-	-	+
55	<i>Zygnemapectinatum</i> (Vauch.) C. A. Agardh	-	-	+
56	<i>Zygnema sterile</i> Transeau in Transeau	-	-	+
57	<i>Closterium gracile</i> Breb.	+	+	+
58	<i>Closterium cynthica</i> De. Not.	-	+	+
59	<i>Cosmariumcyclicum</i> Lund	+	+	+
60	<i>Cosmariumcontractum</i> Kirchn	+	+	+
61	<i>Cosmarium granatum</i> Breb.	+	+	-
62	<i>Cosmariumhexagonum</i> Nordstedt	+	-	+
63	<i>Cosmarium botrytis</i> Ehr.	+	+	+
64	<i>Cosmariumviridis</i> (Chorda) Josh	+	+	+
65	<i>Cosmariumbipunctatum</i> Borgesesen	+	+	-
66	<i>Cosmariumdispersum</i> Johnson	+	+	+
67	<i>Euastrum dubium</i> Nageli	+	+	+
68	<i>Euastrumspinulosum</i> Delponte	+	+	+
69	<i>Staurastrummanfeldtii</i> Delp.	+	+	+
70	<i>Staurastrumanatinum</i> Cooke and Wills	-	+	-
71	<i>Staurastrumlunatum</i> Ralf	+	-	-
72	<i>Micrasteriaszeilanica</i> Fritsch	+	+	-
Charophyceae				
1	<i>Nitellamirabilis</i> Nordstedt ex. J. Groves	-	-	+
2	<i>Nitella opaca</i> C. A. Agardh	-	+	-
3	<i>Chara corallinawildenow</i>	-	-	+
4	<i>Chara hatei</i> Dixit	+	-	-
5	<i>Chara globularis</i>	+	-	-
Euglenophyceae				
1	<i>Euglena gracilis</i> Klebs	+	-	+
2	<i>Euglena ehrenbergii</i>	+	-	+
3	<i>Phacuscurvicauda</i> Swirenko	+	+	-
Xanthophyceae				
1	<i>Botryococcusbraunii</i> Kuetzing	+	+	-
2	<i>Vaucheria terrestris</i> (Vauch.) De Candolle	-	-	+
Bacillariophyceae				
1	<i>Melosirajuergensii</i> Agardh	-	+	+
2	<i>Melosiragranulata</i> (Ehr.) Ralfs	-	+	+
3	<i>Melosiraislandica</i> O. Muell	+	-	-
4	<i>Cyclotella meneghiniana</i> Kuetzing	+	+	-
5	<i>Fragilaria virescens</i> Ralfs.	+	+	+
6	<i>Fragilaria intermedia</i> Grun.	+	-	+
7	<i>Fragilaria brevistriata</i> Grun.	+	+	+
8	<i>Fragilaria ungeriana</i> Grun.	+	+	-
9	<i>Fragilaria capucina</i> Dems.	-	+	+
10	<i>Synedra tabulata</i> (Ag.) Kutz.	+	+	+
11	<i>Synedra ulna</i> (Nitz.) Ehr.	+	+	+
12	<i>Eunotiaformica</i> A ⁰ . Berg	+	+	-
13	<i>Eunotiarostellata</i> Hustedt	+	-	-
14	<i>Naviculacuspadata</i> Kuetz.	-	+	+
15	<i>Naviculacuspadata ver. ambigua</i> (Ehr.) Cleve	-	+	-
16	<i>Navicularhynchocephala</i> Kuetz.	-	+	+
17	<i>Naviculasubhamulata</i> Grun.	-	+	-
18	<i>Pinnulariascythica</i> (Pant.) Gandhi	+	-	+
19	<i>Pinnulariaacrosphaeria</i> (Breb.) W. Smith	-	+	-
20	<i>Cymbellaventricosa</i> Kuetz.	+	+	+
21	<i>Cymbellagracilis</i> (Rabh.) Cleve	+	-	-
22	<i>Cymbellasagarensis</i> Gandhi	+	+	-
23	<i>Hantzschiaamphioxys</i> (Ehr.) Grun.	+	+	+
24	<i>Nitzschia palea</i> (Kutz.) W. Smith	-	+	-
Dinophyceae				
1	<i>Glenodiniumquadridens</i> (Stein) Schiller	+	+	+
2	<i>Ceratiumhirundinella</i> (O.F.Muell.) Dujardin	+	+	-

Table 2: Number of algal species recorded at Station D 1

Algal Group	2014												2015											
	J	F	M	A	M	J	Jl	A	S	O	N	D	J	F	M	A	M	J	Jl	A	S	O	N	D
Chlorophyceae	26	18	15	9	8	6	8	12	15	12	30	21	27	21	11	9	7	5	9	15	19	27	27	28
Cyanophyceae	7	9	18	8	7	9	13	10	13	11	10	9	5	9	8	7	5	5	9	7	11	11	13	14
Bacillariophyceae	5	7	7	8	8	4	3	1	1	0	1	3	7	9	7	8	8	5	4	3	3	3	2	2
Euglenophyceae	1	1	1	3	3	1	2	2	2	0	0	0	0	1	1	2	2	1	0	0	0	0	0	1
Charophyceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xanthophyceae	0	0	0	0	1	1	1	1	2	1	1	0	0	0	0	0	0	0	0	2	2	1	1	1
Dinophyceae	0	1	1	2	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	1
Total Species	39	36	32	30	28	21	27	26	33	24	42	33	40	41	28	27	23	17	23	27	35	42	43	47

Table 3: Number of algal species recorded at Station D2

Algal group	2014												2015											
	J	F	M	A	M	J	Jl	A	S	O	N	D	J	F	M	A	M	J	Jl	A	S	O	N	D
Chlorophyceae	4	4	3	3	5	3	5	11	16	16	19	8	10	5	4	4	4	2	3	7	13	13	12	15
Cyanophyceae	9	5	5	6	5	12	12	14	11	10	8	3	4	3	3	3	2	3	5	7	14	17	17	9
Bacillariophyceae	5	6	8	8	7	2	2	0	0	0	2	3	3	9	8	5	2	2	2	1	2	1	2	
Euglenophyceae	1	1	1	1	1	0	0	0	1	1	1	1	1	2	2	1	1	1	0	0	0	0	0	
Charophyceae	1	2	2	1	1	1	1	1	1	2	1	1	1	2	1	2	2	1	1	2	1	1	1	
Xanthophyceae	0	0	0	0	0	0	1	1	2	2	1	0	0	0	0	0	0	0	0	1	1	1	0	
Dinophyceae	1	1	1	2	2	1	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1	
Total Species	21	19	20	21	21	20	21	27	30	31	20	15	19	15	21	18	13	11	12	18	31	34	32	28

Table 4: Number of algal species recorded at Station D 3

Algal Group	2014												2015											
	J	F	M	A	M	J	Jl	A	S	O	N	D	J	F	M	A	M	J	Jl	A	S	O	N	D
Chlorophyceae	9	8	5	3	2	2	12	23	25	22	14	14	11	9	9	5	3	3	7	6	9	18	17	18
Cyanophyceae	3	5	5	5	3	1	1	0	0	4	3	7	5	4	4	2	2	2	1	0	0	4	4	5
Bacillariophyceae	4	5	9	6	8	5	2	4	1	1	1	1	3	5	5	4	6	8	4	3	1	1	1	1
Euglenophyceae	0	1	1	1	1	0	0	0	0	0	0	0	1	1	2	2	1	0	0	0	0	0	0	0
Charophyceae	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
Xanthophyceae	0	0	0	0	0	0	1	2	2	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Dinophyceae	1	1	1	1	2	2	0	0	0	0	0	0	0	1	2	2	2	1	1	0	0	0	0	0
Total Species	17	20	22	17	17	11	16	29	28	28	18	22	20	21	23	16	14	14	14	10	11	24	23	25

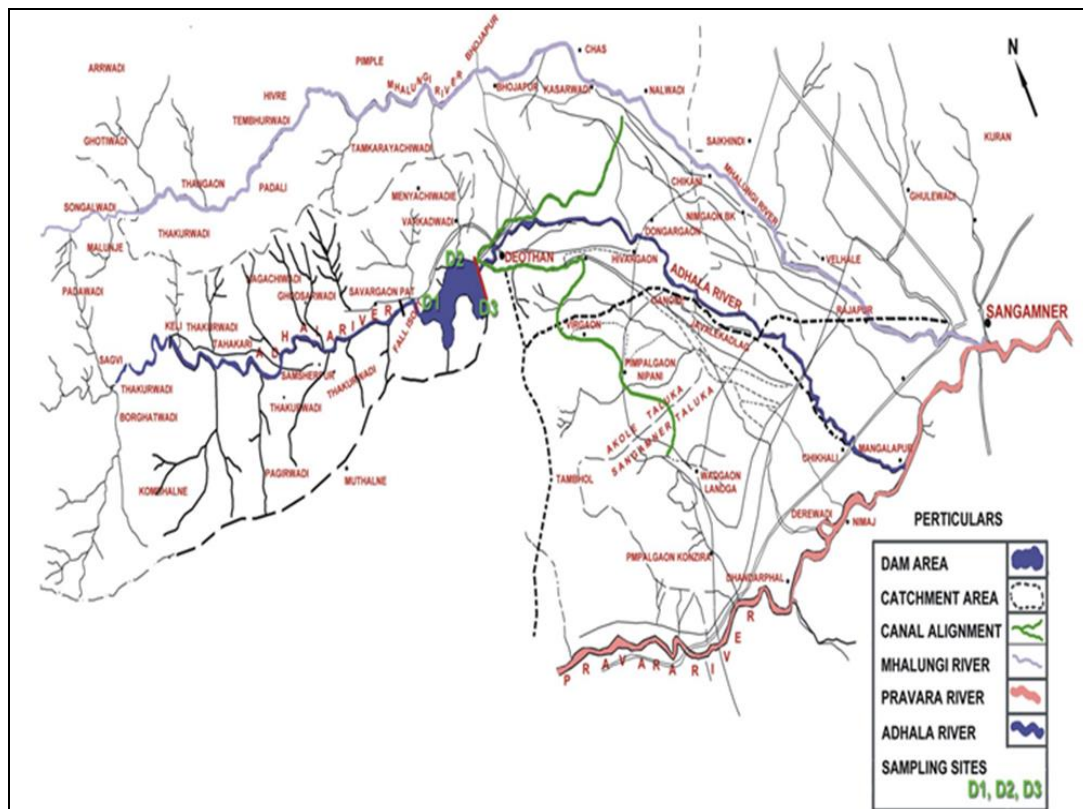


Fig 1: Deothan reservoir map of sampling site

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