



## EVALUATION OF PRESENT LIMNOLOGICAL STATUS OF NAVARGAON LAKE IN MAREGAON TALUKA, DISTRICT-YAVATMAL (M.S) INDIA

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**Abstract:** Navargaon lake was constructed as part of irrigation projects by Government of Maharashtra in the year 1997. Nearest city to Lake is Maregaon and the Lake is situated in Maregaon Taluka of Yavatmal District of Maharashtra in India. It is built on and impounds Nirguda River. The study was conducted during February 2016 to January 2017. The samples were analyzed at monthly intervals for a period of one year. Navargaon lake has greatest importance for humankind. The physico-chemical parameters are water temperature, electric conductivity, total dissolved solids, total hardness, total alkalinity, turbidity, pH, dissolved oxygen, chlorides, COD, BOD, etc. The biological factors considered were macro-zoo benthos and plankton of the lake. Lake was highly productive as presence of various class and order of benthos, zooplankton and phytoplankton although there were no sign of problem like eutrophication. Biological studies indicate that lake water was fit for aquatic organism, such as fishes because of there were plenty of food.

**Key words:** - Physico-chemical, Macro-zoo benthos, Navargaon Lake

### Introduction:

Biological production in any aquatic body gives direct correlation with its physico-chemical status which can be used as trophic status and fisheries resources potential (Jhingran et al., 1965). Life in aquatic environment is largely governed by physico-chemical characteristics and their stability. The physico-chemical as well as the biological factor of lake have vital role in aquaculture and productivity of fishes. The quality of water determines the quality of fish to be produced in it. The physical factors are water temperature, water current and turbidity of water, whereas the chemical parameter of lake comprise pH, dissolved oxygen, total alkalinity and total hardness of water. The biological factors considered were macro-zoo benthos and plankton of the lake. The seasonal changes in different physico-chemical parameters are responsible for annual variation and growth of biological factors viz., macro-zoo benthos and plankton etc.

Tepe et al., (2005) found that the water quality attributes such as water temperature, light penetration, dissolved oxygen, total alkalinity and total hardness are the representative of the seasonal fluctuation. Ali et al., (2006) showed that the water quality of fresh water ecosystem

undergoes complex changes due to all physico-chemical factors and water quality as a sequence disrupting the aquatic life. Hayat et al., (1996) and Jena et al., (1998) revealed that temperature and ecological conditions are responsible for the fluctuation of salt contents, which in turn influence the production, and growth of fish.

### Materials and Methods:

The sampling was carried out in Navargaon lake at five different sites (Latitude: 20.0763283N and Longitude: 78.7675095E), monthly between Feb.2016 to Jan.2017 for one year. About 12 water samples were collected in each month. The physico-chemical factors are water temperature, water current, turbidity of water pH, dissolved oxygen, total alkalinity and total hardness of water, whereas biological factors were macro-zoo benthos and plankton of the lake. Study of physico-chemical factors was carried out by using standard methods (APHA, 2005). For the qualitative estimation safe water quality standards were used (Boyd and Tucker, 1998; Ali et al., 2006). Macro-zoo benthos collected from 1m<sup>2</sup> area of lake at the depth of 15cm. The plankton was sampled at each spot by filtering 100liters of water. Preservation was made on the spot in 4% formalin. The quantitative analysis of

plankton was made with the help of Sedgwick-Rafter counting slide as suggested by Welch (1952).

### **Result and Discussion:**

#### **Water temperature**

The average water temperature of lake was found to be varying from 14.12°C to 21.58°C during Feb to August respectively. Thus, water of Navargaon lake is coldest in winter and hottest in monsoon. (Table- 1)

#### **Water velocity**

While calculating the velocity of water, we observed that the rate of water flow is fluctuated from a minimum value of 0.307m/s in Feb.to a maximum value of 0.899m/s in Aug. Thus the water current with a rate of 0.313m/s in winters to 0.849m/s in monsoon is useful for fish survive (Table 2).

#### **Turbidity**

It has been observed that the water is highly turbid during monsoon period (July-August) with a value of 92.9NTU. Thus is obvious because water becomes turbid due to the rainfall and flash flood. With an unusual variation water was found extremely less turbid during rest of the seasons with the minimum of 7.9NTU in winter. (Table 3).

#### **pH**

pH fluctuation occur only within a narrow range. The pH of lake was found to be varying from 7.6 to 8.32 during July to December. Therefore, during monsoon the water is least basic and it seems more basic during winter (Table 4)

#### **Dissolved Oxygen**

In December, the oxygen content dissolved in water was found to be highest with the value of 10.72mg/l. The lake has less D. O. content in July with the value of 7.6mg/l. Thus the fish can endure water having the dissolved oxygen content from 7.93mg/l (during monsoon) to 10.57mg/l (during winter). (Table 5).

#### **Total Alkalinity**

In our observation it has been observed that the lake water was alkaline and the magnitude was varying from 59.34mg/l to 100.46mg/l from August to February. Thus, the water of Navargaon Lake is most alkaline during winter and then with a regular decrement is least alkaline during monsoon. (Table 6)

#### **Total Hardness**

The degree of hardness calculated in the lake water was lowest in July (78.52mg/l) and highest in February (109.26 mg/l). The study summarized that the water in winter is highly hard, while least hard during monsoon.(Table 7).

#### **Macro-zoo benthic Density**

The number of Ephemeroptera (211 Units / m<sup>2</sup> in December while 12 Unit/m<sup>2</sup> in July), Trichopteran (210 Unit/m<sup>2</sup> in December while 8Unit/m<sup>2</sup> in July), Dipteran (13 Units/m<sup>2</sup> in July while 145 Units/m<sup>2</sup> in February), Plecopteran nymphs (51Units/m<sup>2</sup>in January while 1 Units/m<sup>2</sup> in August), Coleopteran larvae (99 Units/m<sup>2</sup>in December while 9 Units/m<sup>2</sup> in July). Odonata larvae (130 Units/m<sup>2</sup> in December while 7 Units/m<sup>2</sup> in June). The average total macro-zoo benthos observed (815Units/m<sup>2</sup> in December while 56 Units/m<sup>2</sup>in July) and (in winter season 646.33 Units/m<sup>2</sup> while during monsoon 114 Units/m<sup>2</sup>). (Table 8).

#### **Plankton Diversity**

The total phytoplanktons were Chlorophyceae and Cyanophyceae (2925 Units/l in January while 400 Units/l in August). The total zooplanktons were Crustaceans and Rotifers (25Units/l in August and 400 Units/l in January ). The total plankton density vary (3110 Units/l in January to 425 Units/l in August.(table9).

In the present study, the water temperature of the lake was observed to be moderate throughout the year. This moderate water temperature is due to its spring-fed nature of origin. It is also supported by Odum (1971) that photoperiod was shorter in winter than summer which is directly related to temperature and hence water temperature is highest in June. The velocity of water current was observed to be fluctuated from a minimum of 0.307 m/s (February) to a maximum of 0.899 m/s (August). It is also obvious from our study that the average rate of water is highest in monsoon whereas lowest in winter.

In present study water was highly turbid during Monsoon (July-August) while very low during rest of the seasons with the minimum of 7.9 NTU in winter. These observations are also supported by Jhingran (1965) who reported that turbidity generally

increased to a maximum value in monsoon due to the suspended solids in the flooded water whereas, during the post monsoon months the turbidity values were low but increased again during the summer months with the increase in tidal management and intensity. Upadhyay (1997) calculated the turbidity variation from 2 to 162NTU.

pH is gradually increased from a minimum of 7.83 during monsoon to a maximum of 8.28 during summer. Similar variations in pH of the lake Khoh were recorded by Kumar et al.(2006) in Garhwal Himalayas. They concluded that winter maxima for pH might be due to algal growth and minima in monsoon might be due to influx of organic and inorganic ions in to the lake caused by flash flood.

In our study D O highest during winter whereas lowest during, Ali(1999) reported that the dissolved oxygen variation shows inverse relationship with water temperature variation. Bhatt et al (1984) also reported high D O and low free CO<sub>2</sub> concentration in winter.

In present study, the water of Navargaon lake was found to be most alkaline during winter and least during monsoon. Total hardness show minimum during monsoon to a maximum during winter.

Density of total macro-zoo benthos and total plankton populations were plenty in winter while rarely during monsoon. Detritus standing stock is the main reason for high density of benthos in winter and substratum stability too. Moderate temperature low gradient of velocity favors the growth of biotic communities. Similar study was carried out by Rautela et al.,(2006) who reported that the macro-zoo benthos had a maximum population during winter(325 Units/m<sup>2</sup>) and the minimum (15 Units/m<sup>2</sup>) during monsoon season.

#### **Conclusion:**

Briefly, present study concluded that physico-chemical parameters levels indicate the moderate quality of water, lake water of the study area was not polluted in respect to physico-chemical assessment. But biological studies indicate that lake water was fit for aquatic organism, such as fishes because of there were plenty of food in the form of benthos, zooplankton and phytoplankton.

Navargaon lake water was habitable for fishes and fit for development of aquaculture. There were no sign of problems like eutrophication. It is also concluded that the higher growth of macro-zoo benthos and planktons in the lake is favoured by low water temperature, low current velocity, moderate turbidity with high D O, high alkalinity and high hardness during winters season.

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Table.1 Average monthly and seasonal variation in water temperature (°C) of NavargaonLake (2016-2017)

Month	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	12.3	14.7	15.5	17.8	20.4	21.5	21.9	20.4	19.7	17.9	14.5	12.7
Spot B	15.5	17.3	17.3	19.6	20.5	20.4	20.8	19.5	18.6	17.7	16.4	15.6
Spot C	11.2	15.6	17.2	19.7	19.5	20.7	22.4	20.6	18.8	16.9	13.4	11.6
Spot D	16.3	17.8	18.5	20.5	20.8	21.5	21.3	19.6	18.6	17.6	16.8	15.3
Spot E	16.5	17.9	18.3	20.8	20.2	20.3	21.5	19.5	18.8	17.3	16.7	15.4
Average	14.36	16.66	17.36	19.68	20.28	20.28	21.58	19.92	18.9	17.48	15.56	14.12
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table.2 Average monthly and seasonal variation in water current velocity (m/s) of Navargaon Lake.

Month	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	0.289	0.364	0.393	0.416	0.576	0.663	0.849	0.615	0.433	0.269	0.281	0.274
Spot B	0.304	0.337	0.393	0.428	0.438	0.864	0.957	0.813	0.522	0.391	0.324	0.314
Spot C	0.271	0.366	0.398	0.421	0.421	0.633	0.765	0.651	0.434	0.354	0.265	0.261
Spot D	0.337	0.351	0.598	0.924	0.924	0.963	0.972	0.811	0.614	0.483	0.388	0.391
Spot E	0.334	0.349	0.598	0.944	0.923	0.877	0.951	0.813	0.619	0.433	0.335	0.325
Average	0.307	0.353	0.476	0.627	0.656	0.656	0.899	0.741	0.524	0.386	0.319	0.313
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table.3 Average monthly and seasonal variation in turbidity(NTU) of NavargaonLake.

Month	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	09	11	17	10	12	95	86	51	31	11	08	10
Spot B	06	05	11	09	17	91	96	64	41	18	07	10
Spot C	05	08	09	11	22	88	99	59	39	14	05	07
Spot D	07	09	06	13	21	89	94	61	31	12	11	08
Spot E	09	07	05	09	19	94	97	57	27	10	09	08
Average	7.2	8.0	9.6	10.4	18.2	91.4	94.4	58.4	33.8	13	8.0	8.6
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table.4 Average monthly and seasonal variation in pH of NavargaonLake.

Month	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	8.2	8.3	8.2	8.1	8.2	7.9	7.9	8.3	8.2	8.6	8.2	8.1
Spot B	7.4	8.3	8.2	8.7	8.6	7.6	7.6	7.3	7.4	7.7	8.1	8.3
Spot C	8.1	8.6	8.2	7.9	7.9	7.2	7.8	8.2	8.3	8.1	8.7	8.4
Spot D	8.2	8.1	8.2	8.3	8.5	8.1	8.1	7.9	7.8	8.3	8.5	8.2
Spot E	8.0	8.1	8.2	8.3	8.3	8.0	8.1	7.6	7.8	8.0	8.1	8.2
Average	7.98	8.28	8.2	8.26	8.3	7.76	7.9	7.86	7.9	8.14	8.32	8.24
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table.5 Average monthly and seasonal variation in dissolve oxygen (mg/l) of NavargaonLake.

Month	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	9.1	8.9	8.4	8.6	7.8	7.2	8.1	8.5	9.3	9.8	10.5	10.3
Spot B	8.3	8.9	7.8	7.2	7.4	7.4	7.1	8.6	9.3	10.1	10.4	10.8
Spot C	9.2	8.9	9.5	8.3	7.9	8.2	8.7	8.7	9.4	9.2	10.9	10.1
Spot D	8.4	9.3	8.7	7.4	7.4	8.2	8.3	9.3	9.9	10.5	11.1	10.9
Spot E	8.4	9.3	8.6	7.9	7.5	7.9	8.2	9.5	9.8	10.5	10.7	11.2
Average	8.68	9.06	8.6	7.88	7.6	7.78	8.08	8.92	9.54	10.02	10.72	10.66
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table.6 Average monthly and seasonal variation in Total alkalinity (mg/l) of Navargaon Lake.

Month	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	91.9	80.1	76.2	71.0	64.2	62.4	60.8	64.4	73.5	85.9	89.9	92.4
Spot B	96.2	87.1	80.8	74.1	63	61.7	61.8	62.5	79.8	89.1	99.2	101
Spot C	99.6	83.4	78.5	74.7	62.7	65.4	59.9	67.8	77.6	81.1	101.5	99.2
Spot D	103.3	97.1	79.7	70.2	71.1	60.1	57.6	70.4	91.1	95.3	98.2	99.8
Spot E	111.3	97.1	81.7	73.2	73.1	62.8	56.6	71.1	87.1	91.3	91.9	108.2
Average	100.46	88.96	79.38	72.64	66.82	62.48	59.34	67.24	81.82	88.54	96.14	100.16
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table.7 Average monthly and seasonal variation in total hardness (mg/L) of Navargaon Lake.

Month	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Spot A	101.2	93.7	91.2	89.1	75.4	77.5	78.2	77.2	82.5	90.6	92.3	97.5
Spot B	109.3	98.8	85.9	78.2	77.1	75.9	74.9	78.2	82.1	89.2	96.7	101.2
Spot C	104.3	98.5	99.8	92	90	84.4	81.7	84.9	89.6	98.4	99.6	103.1
Spot D	112.4	96.5	94.7	87.5	85.1	74.9	82.4	88.2	91.5	101.4	106.1	109.2
Spot E	119.1	107.4	96.2	86.3	84.6	79.9	84.3	86.9	87.5	98.2	106.3	108.5
Average	109.26	98.98	93.56	86.62	82.44	78.52	80.3	83.08	86.64	95.56	100.2	103.9
Season	Spring			Summer		Monsoon		Autumn			Winter	

Table 8. Average monthly and seasonal variations in Macro-zoo benthic density (Units/m<sup>2</sup>)

Macrobenthic groups (Units/m <sup>2</sup> )	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Ephemeroptera	149	73	52	24	21	12	35	64	110	144	211	155
Trichoptera	140	77	35	21	10	08	35	64	110	144	210	150
Diptera	145	116	63	43	34	13	29	62	88	139	145	110
Plecoptera	48	39	43	40	21	02	01	14	03	14	20	51
Coleoptera	46	61	22	38	11	09	22	22	94	88	99	39
Odonata	42	76	39	29	07	12	50	52	92	110	130	52
Total Macro-zoo benthos (Unit/m <sup>2</sup> )	570	442	254	195	104	56	172	278	497	639	815	557
Season	Spring		Summer			Monsoon		Autumn			Winter	

Table 9. Average monthly and seasonal variations of Plankton density (Units/L)

Plankton group (Units/L)	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.
Chlorophyceae	375	725	325	510	135	275	Nil	230	475	650	500	600
Cyanophyceae	225	175	Nil	200	125	125	Nil	125	75	150	200	250
Total phytoplankton	600	900	325	710	260	400	Nil	355	550	800	700	850
Crustaceans	175	100	50	175	25	75	25	75	100	225	155	125
Rotifers	Nil	100	200	220	75	Nil	Nil	25	25	175	100	60
Total Zooplankton	175	200	250	395	100	75	25	100	125	400	215	185
Total Plankton (Units/L)	2350	1925	1800	1815	1050	877	425	1180	2975	3029	2850	3110
Season	Spring		Summer			Monsoon		Autumn			Winter	

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