

# Comparative study of physicochemical analysis of Nandgaon and Arwat lakes of Chandrapur district with respect to seasonal variation.

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## ABSTRACT

The present study deals with the comparative assessment of the water quality of two different lakes, Nandgaon and Arwat lake of Chandrapur District, [M.S.] India. The physico-chemical characteristics were studied and analyzed for the periods of 24 months i.e. February 2016 to February 2018. Seasonal variations at three different sampling sites of both the lakes were observed. The result revealed that the condition of lakes in different seasons showed variations in physico-chemical parameters. Nandgaon Lake has found more organic pollution as compared to ArwatLake.

**Keywords:** must be 4-6 words. type in Book Antiqua font size 10.

## INTRODUCTION

Access for clean water and adequate water is a major problem the world is facing today. Even though, water is a renewable resource, there is a scarcity of water in many regions of the world facing shortage in fresh water supply. Thus, water scarcity may be a consequence of variation in seasonal or annual precipitation. Even scarcity is caused by over exploitation & contamination of water sources due to its overuse and pollution making it unfit. In India, it is reported that about 70 % of available water is polluted. The chief source of pollution is identified as sewage constituting 84 - 92 % of the waste water. Industrial waste water comprises 8 - 16 %, [1].

Discharge of untreated or partially treated sewage, agricultural runoff and industrial effluents in water bodies are major contaminants.

Fresh water systems are commonly divided into two major categories - the lentic (standing) water systems and the lotic (running) water systems. Both systems share certain chemical, physical and biological characteristics. Lakes have numerous features, such as drainage basin, inflow and outflow, nutrient content, dissolved oxygen [2]. During their flow they cover land area of varying physical, chemical and geological features and with their great capacity for work to remove material from the substratum and carry load to the elevation as particulates as well as dissolved fractions of both organic and inorganic nature[3].

Chandrapur district has about 6000 small, medium and large scale industries. It has large deposits of coal and lime stone. It is located between Latitude 19°27'1N and Longitude 78°10'9E occupying an area of 11,443 km<sup>2</sup> which constitutes 3.72 percent of the total area of the state. Physiographically, the district is situated on the Wainganga and Wardha river basin. The eastern and western boundaries of the district are well defined by these rivers which are the tributaries of Godavari. The climate of the district can be classified as a tropical hot climate with a high range of temperature throughout the year. In severe heat conditions, the temperature is among the highest temperatures in the South Asian region. The highest temperature was recorded in Chandrapur was 49°C on 2 June 2007. The southwest monsoons bring a lot of rainfall during rainy season. The average annual rainfall is about 1420 mm. The relative humidity is very high during monsoon season.

In past few years in India, increasing concern about pollution of fresh water bodies is the results of eutrophication. Hence, several attempts have been made periodically to study ecology of fresh water resources. There are many workers associated for such studies include - Sewell, Gopal, et al, Munnawar, Trivedi and Goel, Shastry and Pendse, Moundiotiya, et al, Dixit, et al., Dahegaonkar, Joshi, et al., Bhosale, et al., Pradhan, et al., Fule, et al., Khan, et al., Patil, et al., Bhatnagar, et al., Gorde, et al., Abdar, Harney, et al., Adhoni, et al., Chavan, et al., Deshmukh, et al., Pareek, et al., Aghashariaimadary, et al.,

Bhattacharyya,, Krupanova, et al., Kumar & Sharma, Raj & Sevarkodiyone, Raj & Kani and Sharma & Tiwari.[1,4-31]

#### **Study Area:**

Chandrapur district is located between Latitude 19°27'1N and Longitude 78°10'9E occupies an area of 11,443 km<sup>2</sup> which constitutes 3.72 percent of the total area of the state.

Arwat Lake is a perennial water body which has been formed due to the inflow of Irai river in mines pit, which spreads over 9.95 hectares area. The main source of water is Irai river and surface drainage. Arwat lake is 5 km away from Chandrapur and is situated South-West part of the Chandrapur district, Maharashtra.

Nandgaon Lake is a perennial water body since British time. The main source of water is rain and surface drainage. This is spread over 29.4 hectares area. Nandgaon Lake is 19 km away from Chandrapur and is situated South-West part of the Chandrapur district, Maharashtra, India. Villagers are using water from both the lakes for domestic, irrigation as well as for fishery purpose. Both the lakes have different entity from each other with respect to inflow source, depth, vegetation and surroundings.

## **METHODOLOGY**

The water samples for physico-chemical analysis was collected from both the lakes, at three different sites viz zone 1 (Silent zone), zone 2 (Inflow Zone) and zone 3 (Human Activity) in morning between 8 to 11 am of every month at regular interval from February 2016 to February 2018. The water samples were collected from the marginal area at 5 to 20 cm depth at each zone in dried plastic cans. Separate samples were collected for dissolved oxygen and biological oxygen demand in 250 ml BOD bottles and were fixed in the field by adding wrinkler -A and wrinkler -B solution immediately after collection. The samples were analysed immediately in the laboratory as per standard methods APHA (2012)[32] and Maiti (2011)[33].

## RESULTS AND DISCUSSION

The result obtained from analysis of water samples of the two lakes Nandgaon & Arwat lakes are shown in table 1.

The results indicate that the quality of water shows seasonal variation. Temperature variation is found in both the lakes. Water temperature is lower than atmospheric temperature. Highest temperature is found in the month of May in both the lakes. The water temperature was recorded between  $17.8 \pm 9.7^\circ\text{C}$  to  $33.3 \pm 1.5^\circ\text{C}$ , while atmospheric temperature ranges from  $21 \pm 3.2^\circ\text{C}$  to  $36 \pm 1.9^\circ\text{C}$ . The highest conductivity was found in Arwat lake A3 site ( $522 \pm 50\mu\text{mhos/cm}$ ). Total dissolve solids also affect the water quality which was found between the ranges of  $149 \pm 24.1\text{mg/l}$  to  $321.3 \pm 36.9\text{mg/l}$  highest value was found in Arwat Lake during summer season may be due to decrease water level. Total suspended solids were recorded maximum  $3.61 \pm 3.8\text{mg/l}$  from Arwat lake A2 site during summer season.

$\text{P}^{\text{H}}$  of Arwat Lake ranges between  $7.2 \pm 0.1$  to  $8.23 \pm 0.4$ , while Nandgaon lake  $\text{P}^{\text{H}}$   $7.3 \pm 0.2$  to  $8.5 \pm 0.7$  shows Nandgaon Lake is more alkaline in nature. Significant changes in  $\text{P}^{\text{H}}$  occur due to runoff, discharge of agricultural and domestic waste. The  $\text{P}^{\text{H}}$  9.7 (January month N-2 & 3) value is slightly higher than standard value of ICMR, BIS & WHO. Arwat Lake ranges between  $3.2 \pm 0.2$  to  $4.88 \pm 0.9\text{mg/l}$ , while Nandgaon Lake dissolved oxygen  $2.6 \pm 0.2$  to  $5.28 \pm 0.7\text{mg/l}$  the minimum DO was recorded in summer

season & maximum in winter season. The DO value was high in Nandgaon Lake. The COD of Arwat Lake ranges between  $5.6 \pm 1.3$  to  $12 \pm 0.5\text{mg/l}$ , while Nandgaon lake COD ranges from  $6.15 \pm 2.3$  to  $14.9 \pm 0.8\text{mg/l}$ . The minimum COD was recorded in winter season & maximum in summer season. Highest value was found in summer season from Nandgaon Lake indicating Nandgaon lake have more polluted water. The value of COD is greater than standard value given by WHO. Arwat Lake ranges between  $2.45 \pm 1.9$  to  $4.3 \pm 0.2\text{mg/l}$ , while Nandgaon lake BOD ranges from  $2.35 \pm 0.4$  to  $4.6 \pm 0.6\text{mg/l}$ . The minimum BOD was recorded in winter season & maximum in summer season. Highest value was found in summer season from Nandgaon Lake.

Free carbon dioxide was found throughout the year. The free carbon dioxide of Arwat lake ranges between  $1.88 \pm 0.1$  to  $4.5 \pm 0.5\text{mg/l}$ , while Nandgaon lake free carbon dioxide ranges from  $2.38 \pm 0.3$  to  $4.3 \pm 0.3\text{mg/l}$ . The minimum free carbon dioxide was recorded in monsoon season & maximum in summer season. Total alkalinity of Arwat Lake ranges between  $87.3 \pm 2.2$  to  $299 \pm 21\text{mg/l}$ , while Nandgaon lake total alkalinity ranges from  $88.3 \pm 4.0$  to  $169 \pm 43.6\text{mg/l}$ . The minimum total alkalinity was recorded in monsoon season & maximum in summer season. Total hardness of Arwat Lake ranges between  $100.8 \pm 18.6$  to  $175.8 \pm 6.1\text{mg/l}$ , while Nandgaon lake total hardness ranges from  $92.5 \pm 10.1$  to  $188.3 \pm 6.8\text{mg/l}$ . The minimum total hardness was recorded in winter season & maximum in monsoon season.

**Table No 3.1:** Morphometric features of lakes:

SR.NO.	MORPHOMETRIC FEATURES	NANDGAON	ARWAT
1	Latitude	19.8857 °N	19.9079 ° N
2	Longitude	79.3099 °E	79.2874 °E
3	MSL (Mean Sea Level)	189 M	189.90 M
4	Maximum depth	22 feet	96 feet
5	Water spread area (winter)	9.95 hectares	29.4 hectares
6	Tehsil	Chandrapur	Chandrapur
7	District	Chandrapur	Chandrapur

Table No.1 Total Comparative variation of physico-chemical parameter of Nandgaon &amp; Arwat lake during 2016-18

Sr.No.	Parameters	Nandgaon Lake										Arwat Lake													
		N-1			N-2			N-3			Total			A-1			A-2			A-3			Total		
PHYSICAL PARAMETER																									
1	Atm. Temp.	33.0	±	3.0	26.0	±	4.0	30.0	±	0.0	29.6	±	1.7	29.9	±	0.0	30.0	±	0.0	30.0	±	0.0	29.9	±	0.0
2	Wat. Temp.	30.0	±	2.8	23.2	±	3.7	27.2	±	0.1	26.8	±	1.5	26.7	±	0.0	26.5	±	0.5	27.2	±	0.4	26.8	±	0.2
3	Transparency	38.3	±	5.4	33.3	±	0.7	30.4	±	2.0	34.0	±	2.0	35.7	±	0.9	32.2	±	0.5	31.4	±	0.8	33.1	±	0.2
4	Conductivity	386.2	±	43.8	312.8	±	11.0	350.2	±	2.4	349.7	±	17.8	350.1	±	4.6	350.8	±	7.9	359.2	±	6.7	353.3	±	1.4
5	T.D.S.	264.2	±	23.0	218.0	±	8.0	251.1	±	8.6	244.4	±	6.9	245.5	±	4.6	248.3	±	3.0	246.5	±	13.1	246.8	±	4.4
6	T.S.S.	1.4	±	0.0	1.7	±	0.0	1.9	±	0.1	1.7	±	0.0	1.3	±	0.1	1.9	±	0.3	1.4	±	0.1	1.5	±	0.1
7	T.S.	259.0	±	17.0	290.1	±	22.4	329.3	±	6.4	292.8	±	6.6	241.7	±	1.9	263.6	±	1.9	273.8	±	16.8	259.7	±	7.0
CHEMICAL PARAMETER																									
8	PH	8.0	±	0.2	8.1	±	0.1	8.1	±	0.1	8.1	±	0.1	7.5	±	0.1	7.6	±	0.1	7.6	±	0.0	7.6	±	0.0
9	D.O.	3.2	±	0.4	4.3	±	0.6	3.7	±	0.0	3.7	±	0.2	3.6	±	0.1	3.9	±	0.0	3.5	±	0.1	3.7	±	0.0
10	B.O.D.	4.2	±	0.4	3.0	±	0.7	3.7	±	0.0	3.6	±	0.3	3.6	±	0.2	3.4	±	0.1	3.8	±	0.0	3.6	±	0.1
11	C.O.D.	11.9	±	1.1	9.2	±	1.9	10.6	±	0.9	10.6	±	0.4	8.5	±	0.4	8.7	±	0.7	8.7	±	0.3	8.6	±	0.2
12	CO2	3.0	±	0.1	3.0	±	0.4	3.4	±	0.1	3.1	±	0.1	3.0	±	0.0	3.0	±	0.2	3.2	±	0.1	3.0	±	0.1
13	Alk. Total	132.9	±	12.4	113.0	±	5.5	124.3	±	2.2	123.4	±	4.3	109.3	±	5.9	140.8	±	27.1	112.1	±	10.0	120.8	±	9.2
14	Hard. Total	135.8	±	4.0	125.8	±	20.1	152.8	±	6.8	138.1	±	7.0	137.8	±	4.3	146.3	±	8.8	142.8	±	1.3	142.3	±	3.1
15	Calcium	60.8	±	0.2	60.7	±	3.3	70.2	±	4.4	63.9	±	1.8	68.0	±	8.5	69.1	±	17.0	69.8	±	11.3	69.0	±	3.5
16	Magnesium	45.0	±	25.7	31.7	±	10.1	47.8	±	24.5	41.5	±	7.1	41.7	±	24.0	45.1	±	23.9	41.4	±	19.1	42.7	±	2.3
17	Chlorides	7.6	±	1.7	4.4	±	2.1	6.2	±	0.2	6.1	±	0.8	3.8	±	0.1	4.0	±	0.4	3.9	±	0.1	3.9	±	0.1
18	Phosphate	2.3	±	0.1	2.3	±	0.3	2.7	±	0.1	2.4	±	0.1	1.4	±	0.2	1.6	±	0.4	1.6	±	0.2	1.5	±	0.1
19	Sulphate	4.3	±	0.0	4.5	±	0.4	5.1	±	0.1	4.6	±	0.2	6.5	±	2.5	7.0	±	3.0	6.9	±	2.5	6.8	±	0.2
20	Nitrate	3.6	±	0.4	4.2	±	0.2	4.3	±	0.5	4.0	±	0.1	2.0	±	0.0	2.2	±	0.2	2.1	±	0.0	2.1	±	0.1
(All Parameters are in mg/l, except Atm. Temp, Water Temp. = °C, Transparency = cm, Conductivity = μmhos/cm, PH)																									





## CONCLUSION

The result revealed that there was significant seasonal variation in physicochemical parameters and some of the parameters were in the normal range but  $P^H$  & alkalinity of Nandgaon Lake, COD & calcium level of both the lakes was slightly higher than standard value ICMR, BIS & WHO. Hence, the water analysis shows Nandgaon lake has more organic pollution than Arwat Lake. The reason behind it has more anthropogenic activities, continuous discharge of domestic sewage, agricultural runoff, washing clothes and cleaning cattle are more in Nandgaon Lake.

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