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# HYDROLOGICAL STUDIES OF BARUL RESERVOIR AT NANDED DISTRICT, MAHARASHTRA

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**ABSTRACT : The physico-chemical parameters of Barul dam water were studied and analyzed over a period of one year during January to December,2005. Seasonal variations in water temperature, transparency, pH, dissolved oxygen, carbon dioxide, total alkalinity, total hardness, chlorides and total solids were estimated. The results revealed that most of the parameters were in the normal range and indicated better water quality of Barul dam.**

**Key words :** *Hydrology, Water quality, Barul reservoir.*

## INTRODUCTION

Barul dam is located in Nanded district at 18°50' N latitude and 77°19'E longitude, 10 miles away from Kandhar town, having catchment area of 1560 ha. It is an earthen dam constructed on Manar River near Warawant village under the major irrigation project by the Government of Maharashtra during the year 1958-1968. It brings under irrigation an area of 66000 acres. Dam was constructed for multipurpose, such as irrigation, agriculture, drinking, conservation of water and pisciculture etc. Such a vast water body can't be neglected; hence, the present paper aims to access its water quality for its best utilization like drinking, irrigation, fisheries purposes and also understand the complex processes, interaction between the climatic and biological processes in the water.

## MATERIAL AND METHODS

Monthly analysis of various physico-chemical parameters of Barul dam water was carried out during January to Deceber,2005. Considering the large area, water samples were collected from four sampling station namely, A (near irrigation gate-Barul village), B (near the overflow wall-Warwant village), C (in the middle of reservoir- from Dharmapuri village) & D (Wakhrad village). The temperature was recorded at the time of sampling on the spot using Centigrade thermometer. pH was measured with standard - pH meter and Transparency was measured using Sacchi disk. Chemical parameters were estimated separately for each stations immediately on return to the laboratory within three hours, following procedures given by Trivedy & Goel (1986) and Kodarkar (1992).

## RESULTS AND DISCUSSION

The mean value of 4 stations was considered for general discussion. The hydrological parameters were given in Table 1 and presented graphically in Figs.1-9.

**Water temperature :** The climatic factors such as rainfall, temperature, atmospheric temperature and humidity help in understanding the complex process of interaction between the climate and the biological process in water bodies. The temperature of water is one important physical parameter which influences some chemical reactions in aquatic ecosystems. The water temperature varies with the variation of atmospheric temperature. During the study period the value of water temperature ranged between 16.80° to 37.10°C being minimum in the month of November,2005 and maximum in the month of May,2005. The result reveals a well marked seasonal fluctuation in the temperature. Similar results were also reported by Chandrashekhar (1996) based on Sarovar Nagar Lake, Hyderabad.

**Transpaency :** The productivity of water body is greatly influenced by the photosynthetic activity. The process of photosynthesis is energized only by light penetration in a water body. Light penetration in fact depends partly on the light flux but mainly on the optical properties of water such as turbidity, pollution density of plankton, depth, silt discharge etc. Transparency of water is also affected by the mixing phenomenal causing turbulence. Turbidity may be due to suspended clay and silt or due to Planktonic organisms. Some of the contributors on this field are Khan& Siddiqui (1974), Dor & Rober (1990) and Lendhe (2004). Water of Barul reservoir found to be most clear. Transparency ranging between 31.81 cm to 91.50 cm. Minimum was recorded in the month August,05 and maximum in May,2005. In general the water is less transparent in pre monsoon period and early monsoon period compared to late monsoon and

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**Table. 1 Monthly values for Hydrological parameters of Barul reservoir-2005.**

| Parameters Months | Water temp. °C | Trans. (cm) | pH | DO (mg/l) | CO2 (mg/l) | TA (mg/l) | TH (mg/l) | Cl (mg/l) | TS (mg/l) |
|---|---|---|---|---|---|---|---|---|---|
| January | 29.02 | 53.75 | 7.24 | 9.72 | 5.67 | 149.50 | 63.98 | 53.26 | 122 |
| February | 30.02 | 61.50 | 7.33 | 8.85 | 7.09 | 153.25 | 74.57 | 60.21 | 179.3 |
| March | 31.05 | 72.50 | 7.33 | 7.25 | 8.26 | 158.50 | 79.36 | 74.44 | 281.8 |
| April | 34.10 | 84.00 | 7.53 | 6.37 | 9.27 | 170.00 | 85.4 | 85.99 | 281.5 |
| May | 37.95 | 91.50 | 7.59 | 5.54 | 9.88 | 168.50 | 84.61 | 86.44 | 288.3 |
| June | 27.05 | 48.25 | 7.36 | 7.31 | 18.45 | 142.75 | 100.8 | 45.13 | 283.5 |
| July | 26.05 | 35.00 | 6.81 | 7.71 | 7.51 | 114.50 | 96.25 | 38.41 | 277.3 |
| August | 25.02 | 32.46 | 6.80 | 8.39 | 7.33 | 98.93 | 62.95 | 45.10 | 233.8 |
| September | 24.00 | 32.25 | 6.72 | 9.01 | 6.07 | 99.94 | 51.51 | 47.82 | 165.8 |
| October | 20.05 | 32.00 | 6.70 | 9.75 | 5.16 | 100.09 | 52.37 | 51.34 | 155.3 |
| November | 16.80 | 32.37 | 6.88 | 9.95 | 5.28 | 108.25 | 66.43 | 61.08 | 102.3 |
| December | 18.00 | 31.81 | 6.87 | 9.73 | 4.79 | 116.25 | 66.28 | 52.52 | 106.3 |

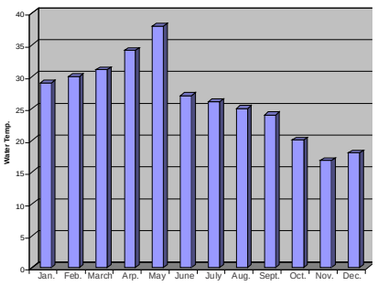


**Fig. 1 Monthly variation in Water temp. of Barnul reservoir**

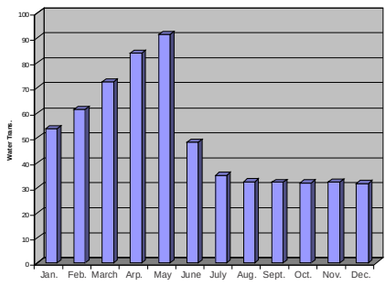


**Fig. 2 Monthly variation in Water transparency of Barnul reservoir.**

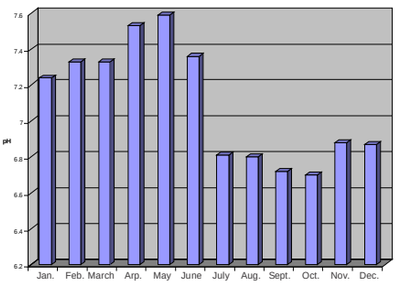


**Fig. 3 Monthly variation in pH of Barnul reservoir.**

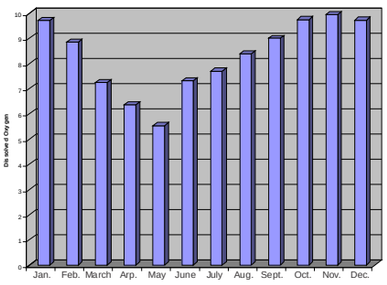


**Fig. 4 Monthly variation in Disolved oxygen of Barnul reservoir.**

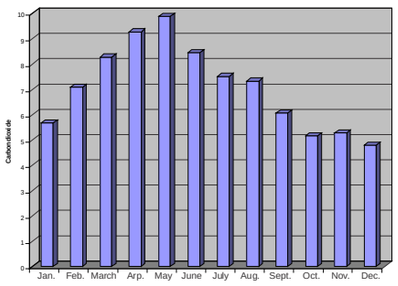


**Fig. 5 Monthly variation in Carbondioxide of Barnul reservoir.**

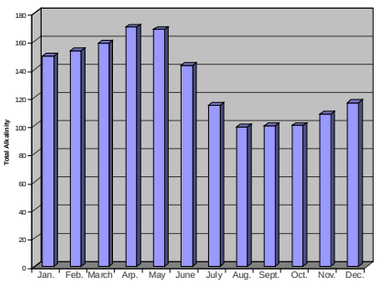


**Fig. 6 Monthly variation in Total alkalnity of Barnul reservoir.**

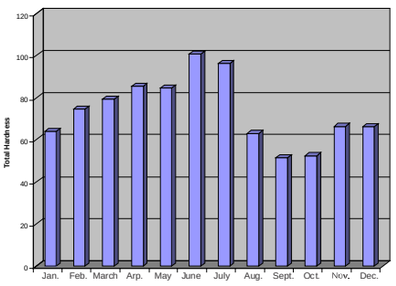


**Fig. 7 Monthly variation in Total hardness Barnul reservoir.**

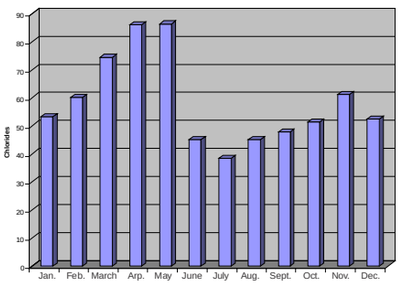


**Fig. 8 Monthly variation in Chlorides of Barnul reservoir.**

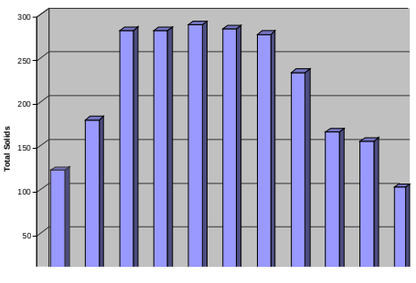


**Fig. 9 Monthly variation in Total solids Barnul reservoir.**

post monsoon period. This may be due to evaporation of water, leading to accumulation of suspended particles causing turbidity. But at Barul reservoir minimum transparency during monsoon may be due to heavy rain resulting in soil erosion causing turbidity or it may be due to highly suspended organic matter. The high transparency in the month of May is due to evaporation of water resulting in the increase of suspended organic matter in a water body. A similar observation was made by Sakhre and Joshi (2003) from Hilegaon reservoir in Osmanabad district, Maharashtra.

**Hyderogen ion concentration :** pH value is a good indicator for measuring a relative acidity or alkalinity of water bodies. pH has proved to be an ecological factor of major importance in controlling the distribution of aquatic flora and fauna. Goswami & Devraj (1993) and Das *et al.* (1995) studied to search out optimum or ideal pH range for better yield. The maximum pH recorded of Barul reservoir is 7.59 in May,2005 and the minimum pH is 6.70 in September,2005. The water of reservoir is fairly good for organic growth according to Jhingran (1991). The vast differences in pH may be due to climatic differences at four stations. Similar observation was made by Anand & Sharma (2000) in Mansar lake ranging from 6.66 to 7.61

**Dissolved oxygen :** It is essential for the metabolism of all aerobic aquatic organisms. Ideally the Oxygen producing and consuming process in natural water should be balanced so as to keep the dissolved oxygen concentration within a range congeals to all organisms. There is marked diurnal fluctuation in the oxygen contents of the water where the abundant phytoplanktons are present. Dissolved oxygen (DO) is formed by absorption from the atmosphere at the surface of pond and by photosynthesis of the chlorophyll bearing organisms inhabiting in water body. Oxygen acts as an indicator of Planktonic development, Jayaraju *et al.* (1994). DO below 3.0 mg/l causes asphyxia for most tropical fish. Dissolved Oxygen recorded at Barul reservoir, ranged between 5.54 to 9.95 mg/l in the months May and November,2005 respectively. Low oxygen values at high temperature indicates the inverse relation between Water temperature and DO. Similar observation was noted by Mazhar and Sharif (2004).

**Carbondioxide :** $CO_2$ in natural water provides a convenient measure of organic production and decomposition and it forms the base of most methods of measuring primary productivity. As $CO_2$ is highly soluble in water and is a product of respiration by all living organisms it is found to be in large amount in polluted water compare to fresh water body. Decomposition of organic matter and the diffusion of atmospheric carbon dioxide in water contribute to free $CO_2$. This free $CO_2$ combines chemically with water to form carbonic acid and dissociates partly to produce hydrogen ions and bicarbonate ions. Bicarbonate ions further dissociate to form the hydrogen and carbonate ions. $CO_2$ also shows diurnal fluctuation due to photosynthetic and respiratory activities in the water bodies. The $CO_2$ calculated for reservoir water ranged between 4.79 to 9.88 mg/l in December and May,2005 respectively. The minimum $CO_2$ value is recorded in winter and high in smmer. Similar observation was recorded by Dwivedi and Pandey (2002) and Ganpati (1943).

**Total alkalnity :** Alkaline water has the acid neutralizing capacity which depends on the strength of carbonates in the water body and determines the productivity. Alkalinity in fresh water bodies results from the presence of hydro oxides, carbonates and bicarbonates of calcium, magnesium, sodium, potassium and ammonia. Alkalinity creates favorable conditions for rapid bacterial decomposition of organic matter which normally accumulates at the bottom. Alkaline water is more productive and supportive to the diversity of aquatic life. According to Swingle (1967) total alkalinity has universal adoption. Generally calcareous water with alkalinities more than 50 mg/l is most productive for fish production at the Barul reservoir alkalinity is recorded between 98.93 mg/l - 170 mg/l indicating the good productive status of the reservoir. The reservoir shows maximum values in the month of May and minimum in August,2005 the low values in August is due to heavy rain, diluting water. Similar observation was made by Mookerjee and Bhattacharya (1949).

**Total hardness :** Hardness of water depends on a mixture of cations and anions. It is predominantly contributed by the concentration of calcium and magnesium ions. Usually bicarbonate ions of calcium and magnesium causes temporary hardness where as the permanent hardness of water is caused due to calcium and magnesium, carbonates and salts of inorganic acids. Ecological significance of nature cations *i.e.* calcium and magnesium in the biotic dynamics of aquatic flora and fauna is well established fact. Total hardness of Barul dam ranged between 63.98 to 100.77 mg/l in the months September and June,2005 respectively. Similar results were observed by Hiware and Jadhav (2001) found the values of Total hardness were 48.75 mg/l Mishra and Tripathi (2001) reported high values of 295 mg/l in Ganga river. In the light of classification given by Kannan (1991) the water of Barul reservoir was moderately hard.

**Chlorides :** The ecological significance of chloride in its potential is to regulate the salinity of water and extend the consequent osmotic stress on biotic communities. A chloride in the form of chlorine ions is one of the major inorganic ions in water. These ions are required by photosynthesizing cells for the photolysis of water to release oxygen, for ATP formation and for certain phosphorylation reactions. The maximum value of Barul water ranged between 38.41-86.44 mg/l. The minimum values in the month of July and August could be attributed to dilution effect and renewal of water mass after summer stagnation and also may be due to high sedimentation rate on relatively stable environmental conditions. Maximum values in May month could be due to higher concentration of chloride resulted from evaporation. Same results were also observed by Gonsalves & Joshi (1946), Singh (1960) and Zafar (1964).

**Total solids :** It measures suspended as well as dissolved solids. Their values have been found highly significant. The concentration of Total solids is influenced by the activity of planktons and organic matter. TS may affect water quantity and quality in many ways. At the reservoir the values for chlorides ranged between 102.25-288.25 mg/l. The maximum values were recorded in the month of May,2005 and minimum in the month of November and December,2005. The high contents of total solids elevate the density of water and such medium increases osmoregulatory stress on aquatic biota Verma *et al.* (1978). Similar observation was made by Khobragade (2003).

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