



Seasonal Variations in Physico-Chemical Properties of Water from Kas Lake, Satara, Maharashtra State, India

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Abstract

Water is an essential natural resource and the most important environmental factor in the ecosystem. Water is essential for the metabolic activities of living organisms. Fresh water from various sources like lake, river, dam and ground water is used for domestic, industrial and agricultural purposes. Kas lake located near Satara is important water reservoir from Western Ghats. It provides water for domestic and agricultural use and is a tourist point also. Study of seasonal variation in physico-chemical water quality of Kas Lake is essential to understand the impact of monsoon cycles, tourism, and human activity on lake health, and to ensure its sustainable use for drinking water, biodiversity, and tourism. Hence, the present work was undertaken to study physico-chemical analysis of water parameters (viz. Temperature, pH, Total alkalinity, Dissolved Oxygen, Free CO₂, Total Hardness, Phosphate, Total alkalinity and Silica) for a period of 2 years. Data obtained in this study reveals higher values of pH, Turbidity, Phosphorus, Silica, Electrical conductivity and Total dissolved solids in the summer season as compared to winter and monsoon, which indicates increased influx of organic material in the reservoir.

Keywords: Kas lake; Physico-chemical parameters; Seasonal variations

Introduction

Water is a valuable natural resource on the earth planet. About three fourth of earth surface has been covered by water. The aquatic ecosystem forms the largest ecosystem in the biosphere. It forms the habitat for immense varieties of species. Fresh water exists as surface and underground water. Surface water occurs in the form of lakes, river and dams. Water is essential for life and survival of humans and is used for drinking, industrial purposes, irrigation, aquaculture, recreational purposes, hydropower generation, etc. The water from these sources becomes gradually unfit for mankind due to either natural or induced anthropogenic pollution (Vandysh, 2004). Water quality of determines the essence and wellbeing of aquatic ecosystems. Water quality in aquatic environments relies on physical, chemical and biological factors (Upadhyay et al., 2012).

Kas lake is also attractive tourist place near to Satara city. Tourist inflow to this place is seasonal, peaking in summer and post-monsoon, which affects organic load into the water reservoir due to recreational activities, and nearby eateries. The seasonal variation study will allow the monitoring of seasonal changes when human activity impacts the lake most. This study will help to assess the ecosystem health as the seasonal changes in organic matter content will affect fish and aquatic biodiversity. So, the understanding seasonal stressors will help in biodiversity conservation. The water from Kas lake reservoir is the source of drinking water to Satara city and adjoining villages. So, the seasonal variation in parameters will affect its suitability for drinking, irrigation and recreation. Also, the seasonal study will help to identify and pinpoint the critical pollution period and suggest targeted management.

There are some reports on studies of water quality of reservoirs from Satara district. Lubal *et al.* (2012) determined the physico-chemical aspects of the Mhaswad water reservoir from Satara district. Bhosale *et al.* (2010) determined the phytoplankton diversity of four lakes from Satara district. Pawar and Sonawane (2011) studied diversity of phytoplanktons in relation to physico-chemical parameters of Kas reservoir, Kanher dam and Mahadare reservoirs

from Satara region. Pawar and Sonawane (2012) measured the water quality profile of the Kas reservoir. However the data is not available regarding seasonal changes in physico-chemical analysis of water from Kas lake and hence the present work was undertaken to study the physico-chemical parameters of water monthly to determine the seasonal variations in the values.

Materials and Methods

Study area

Kas Lake is situated in the western Ghat on the Kas Plateau of the Satara district. It is about 28 km west of Satara city. The morphometric feature of the Kas lake are represented as per Table 1. In 1844, the artificial lake and the dam were built. Kas Lake is a large reservoir of water covering an area of 15.6859 km². The Kas plateau is part of the Sahyadri sub cluster, which in 2012 was declared a UNESCO World Natural Heritage Site. The lake is the primary source of Satara City's drinking water supply. Water is used for irrigation as well.



Fig.1. Kas lake

Physico-chemical analysis of water

The water samples from Kas lake were collected monthly from October to September for a span of two years at regular monthly intervals in acid washed plastic cans with a capacity of 1 litre at a depth of one foot. The surface water samples were collected. The physico-chemical parameters like pH, temperature, free CO₂, total alkalinity, turbidity, total hardness, nitrogen, orthophosphate, silica, dissolved oxygen, total dissolved solids and electrical conductivity of water samples collected from different sampling locations were carried out using standard methods (Elser et al., 2008; APHA, 1998; Trivedy and Goel, 1986; Moore, 1939). The data was organized and analyzed statistically.

Results and Discussion

A total number of 13 physico-chemical parameters of water from Kas lake reservoir were studied monthly for analyzing seasonal variations in their values. These parameters showed seasonal fluctuations in the values (Table 1).

Table 1. Seasonal variations in physico-chemical parameters

Sr. No.	Parameters	Seasons		
		Winter (Oct. Nov. Dec., Jan.)	Summer (Feb March, Apr. May)	Rainy (June, July, Aug. Sep.)
1.	Air Temperature (°C)	22.5±4.23	23.13±3.52	21.48±2.41
2.	Water Temperature (°C)	23.13±2.36	22.88±2.03	23.75±2.90
3.	pH	7.9±0.37	8.38±0.23	8.15±0.73
4.	Free CO ₂ (mg/L)	21.45±19.39	14.8±21.40	15.34±8.09
5.	Total alkalinity (mg/L)	21.25±1.67	23.3±2.20	23.5±2.78
6.	Turbidity (NTU)	1.13±0.18	2.16±0.78	1.25±1.12
7.	Total hardness (mg/L)	26.75±4.59	31.25±3.15	31.5±2.98
8.	Nitrates (mg/L)	0.3±0.31	0.26±0.29	0.95±1.06
9.	Phosphate (mg/L)	0.04±0.07	1.08±0.84	0.08±0.16
10.	Silica(mg/L)	1.58±2.85	8.37±3.64	0.59±0.18
11.	D.O.(mg/L)	5.78±1.32	6.99±2.21	7.83±0.86
12.	TDS(mg/L)	8.81±3.31	13.62±7.65	11.22±11.36
13.	EC (mhos/cm)	0.02±0.01	0.04±0.01	0.04±0.02

Temperature affects physico-chemical properties of water and the life of organisms living in water body (Bhadija and Vaghela, 2013). During the present study, seasonal changes were observed in air temperature in which maximum value is observed in summer followed by winter and monsoon. Seasonal variations were maximum during summer and minimum during monsoon season. All physico-chemical and biological parameters directly depend on pH. The pH value was high in winter season followed by monsoon and summer season. Free CO₂ is essential for the autotrophs to prepare their food. Maximum Free CO₂ was recorded during winter season followed by monsoon and summer season. Our observations resembled with Manjare et al. (2010).

Total alkalinity indicates buffering capacity of water. Seasonal variations in the range of alkalinity values showed remarkable differences. Maximum value of total alkalinity was observed in monsoon season followed by summer and winter season. Turbidity of water is due to the transmitting properties of water and colloidal suspended matter such as clay, slit organic matter plankton and other microscopic organisms. Maximum turbidity was noted in summer season followed by monsoon and winter season. Siddiqi and Khan (2002) recorded highest turbidity in monsoon season. Total hardness is an important parameter for assessing potability of water. Maximum value of total hardness was observed in monsoon season followed by summer and winter season.

Nitrate is important factor for occurrence and abundance of phytoplanktons. Maximum values of nitrate was observed in monsoon season while lowest during summer season. Phosphate is considered as one of the important nutrient which is limiting factor for growth of phytoplanktons. Phosphate values were maximum in summer season followed by monsoon and winter season. Maximum value of silica was recorded in summer season followed by winter and monsoon season. Dissolved oxygen is an important factor which regulates the metabolic processes of plants and animals in aquatic ecosystem. Maximum value of dissolved oxygen was reported during monsoon season followed by summer and winter seasons. Koshy and Nayar (2000) also recorded maximum dissolved oxygen during monsoon season due to the rain water.

The level of dissolved solids is affected by geographical basin of water body, rainfall, human activities, etc. Maximum value of TDS was observed during summer season followed by monsoon and winter seasons. The similar reports were revealed by Gonzalves and Joshi (1946). Electrical conductivity is an indicative of the salt concentration. It is mainly due to TDS. Maximum EC was observed in both summer and monsoon season while minimum in winter season.

Conclusions

Kas lake is an important aquatic ecosystem located in Sahyadri ranges of Western Ghats near Satara. It is main source of water for drinking and agriculture to adjoining and basin areas. Further, it is a tourist point. The present study performed for the period of 2 years revealed seasonal variations in the values of physico-chemical parameters of water from this water reservoir. In post-monsoon season (i.e. winter), there was increase in only Free CO₂ value. In summer season, higher values of air temperature, pH, Turbidity, Phosphorus, Silica, Electrical conductivity and Total dissolved solids as compared to winter and monsoon also indicates increased influx of organic material in reservoir. So, it is evident that mostly in summer there is enrichment of nutrients in this water reservoir. There is need to differentiate between the causes for the influx of nutrients in the reservoir whether it is a natural seasonal change or it is due to anthropogenic impacts due to increased tourists, to take appropriate measures to control these influxes and there is need to design and follow strictly the policies for conservation of lake and eco-tourism management.

References

- APHA, AWWA and WEF (1998) Standard methods for the examination of water and wastewater. 20th ed. American Public Health Association, American Water Works Association and Water Environmental Federation, Washington D.C.
- Bhadija P and Vaghela A (2013) Assessment of physico-chemical parameters and water quality index of reservoir water. *International Journal of Plant, Animal and Environmental Sciences* 3(3):89-95.
- Bhosale LJ, Dhumal SN and Sabale AB (2010) Phytoplankton diversity of in four lakes of Satara district, Maharashtra state. *The Bioscan* 5(3):449-454.
- Elser J, Bracken M, Cleland E et al. (2008) Global analysis of nitrogen and phosphorus limitation of primary producers in freshwater, marine and terrestrial ecosystems. *Ecology Letters* 10:1135-1142.
- Gonzalves EA and Joshi DB (1943) The algal flora of temporary water around Bombay –I, An ecological study of the algae in some rain water pools at Borivilli. *Journal of the University of Bombay* 11(3):34-45.
- Koshy M and Nayar TV (2000) Water quality of river Pamba at Kozhencherry. *Pollution Research* 19(4):665-668.
- Lubal MJ, Sutar AU and Pawar KW (2012) Studies of physicochemical aspects of Mhaswad water reservoir of Satara district (Maharashtra), India. *International Journal of Plant, Animal and Environmental Sciences* 2(3):12-15.

Manjare SA, Vhanalakar SA and Muley DV (2010) Water quality assessment of Vadgaon tank of Kolhapur (Maharashtra), with special reference to zooplankton. *International Journal of Advanced Biotechnology and Research* 1:91-95.

Pawar SM and Sonawane SR (2011) Diversity of phytoplankton from three water bodies of Satara district (M.S.) India. *International Journal of Biosciences* 1(6):81-87.

Pawar SM and Sonawane SR (2012) Water quality profile of Kas reservoir of Satara district, Maharashtra, India. *Nature, Environment and Pollution Technology* 11(1):173-176.

Siddiqi SZ and Khan RA (2002) Comparative Limnology of few man-made lakes in and around Hyderabad, India. *Records of the Zoological Survey of India, Occasional Paper No. 203*:1-64.

Trivedy RK and Goel PK (1986) Chemical and biological method for water pollution studies. Environmental Publications, Karad.

Moore EW (1939) Graphic determination of carbon dioxide and the three forms of alkalinity. *Journal of the American Water Works Association* 31:51-53.

Upadhyay R, Pandey AK, Upadhyay SK et al. (2012) Limno-chemistry and nutrient dynamics in upper lake, Bhopal, India. *Environmental Monitoring and Assessment* 184:7065-7077.

Vandysh OI (2004) Zooplankton as an indicator of the state of lake ecosystems polluted with mining wastewater in the Kola Peninsula. *Russian Journal of Ecology* 35(2):110-116.

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PSV and PVS conceived the concept, wrote and approved the manuscript.

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