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PRIMARY PRODUCTIVITY STATUS IN AYYANAKERE LAKE, CHIKMAGALORE DISTRICT, KARNATAKA

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Abstract:

The present study is intended to know the status of primary productivity of freshwater Lake Ayyanakere, Karnataka. Primary productivity is determined by using standard 'Light and Dark bottle' method of Garden and Gran at an interval of every month for a period of one year from April 2008 to March 2009. Gross primary production in Ayyanakere recorded as 4.572 gC/m^3/day, 9.1464 gC/m^3/day and 6.4056 gC/m^3/day. In the present study,GPP, NPP and CR was maximum in monsoon season and lowest in pre-monsoon season. The lowest yield was observed in pre-monsoon season when it was 4.572 gC/m^3/day it is due to the decrease in the water level. The higher production was observed in monsoon due to high phytoplankton content.

Key Words: Primary Productivity, Ayyanakere Lake, Seasons & Water Quality

Introduction:

The primary productivity of the aquatic ecosystem is adversely affected by anthropogenic activity. The overall productivity of a water body can easily be deduced from its primary productivity, which forms the backbone of the aquatic food chain (Ahmed and Singh, 1989). It gives information related to support bioactivities of the system. According to Odum and Barrett (2008) the primary productivity of an ecosystem is the rate at which radiant energy is converted to organic substances by the photosynthetic and chemosynthetic activity of the producer organisms. The aquatic resources have been till date the potential source of organic production for the entire living organisms. Many ecologists of the world have laid emphasis on the importance of the primary productivity as an important functional attribute of the biosphere because of its controlling effects on the rate of multiplication and growth of the living organisms of the ecosystem (Westlake, 1963; Gajanan K. Sontakke and Satish S. Mokashe, 2014). Therefore, the present study has been undertaken to analyze the seasonal variations of primary productivity in Ayyanakere lake of Chikmagalore district, Karnataka.

Materials and Methods:

Study Area:

Ayyanakere is an Anicut Lake (Figure 1) constructed by Rukumanda Raya, chief of Sakharayapatna and renovated later in 1156 A.D. during the Hoysalas period. The large lake situated at the eastern base of Dattapeetha (Baba Budan) range, 18 kms northeast of Chikmagalur town provides irrigation facilities to more than 1574 hectares of registered land on a hillock adjacent to the lake. Ayyanakere area possess evergreen to deciduous forest type. It is one of the most coffee and tea growing regions in India. The climate of the region is cool and dominated by many hillocks. The water body is completely surrounded by the small to larger hillocks with perennial streams.

Figure 2 shows the location of the study area. The geographical location of this lake is 13°41'42" north latitude and 75°04'46" eastern longitude. This lake constructed

to the upper Veda River. The water from this lake along with some other small tributaries forms river Veda and joins the river Avathi at Yagatipura to form Vedavathi. The Vedavathi joins to Krishna River which ultimately joins Bay of Bengal.

Many hillocks surrounded to the lake which forms the natural reservoirs. It is a shallow lake has an area of 15 sq. kms. The catchment area of 116.59 sq. kms water spread area 118.54 ha. The bund forms from the natural hills and stones with length of 450 m and height 4.80 m. The bund front slope is 1.5:1, the rear slope 2:1 and the top width of 4 m. The maximum depth of the lake is 30 m and an average depth is 20 m.

Methods:

Water Quality Parameters:

The sampling was carried out during morning between 8.00 AM to 9.00 AM. For physico-chemical analysis samples were collected weekly during April 2008 to March 2009. Water samples were collected in 2 litre capacity plastic cans. The water and air temperature were recorded at the sampling site itself by mercury thermometer. Dissolved oxygen was fixed on the spot itself in BOD bottles. The parameters like free CO_2, alkalinity, total hardness, total dissolved solids, calcium, magnesium, phosphates and chlorides were estimated as per the standard methods of APHA (1995) and Trivedy and Goel (1986).

Primary Production:

Primary production of the water body can be determined by Garden and Gran (1927) light and dark bottle method as given by Trivedy and Goel (1986). The sampling of water for primary productivity is same as for dissolved oxygen. 3 BOD bottles were required one is for initial DO, white bottle of 250-300 ml capacity and black bottle. The black bottle is darkened by covering black carbon paper. The first BOD bottle is used for the estimation of initial DO and the remaining white and dark bottles can be suspended in water filled with water without air bubbles. These bottles were attachment to the wire which is held in position by an anchored float. Kept for 3 to 4 hours and DO is calculated by standard methods prescribed by APHA (1995) and Trivedy and Goel (1986). The gross primary productivity (G.P.P.), net primary productivity (N.P.P.) and community respiration (C.R.) will be calculated by using these formulae

G.P.P. = D.O. of light bottle – D.O. of dark bottle
N.P.P. = D.O. of light bottle – initial D.O.
C.R. = Initial D.O. – D.O of dark bottle

Results and Discussion:

Water Quality:

Seasonal variations in the the physico-chemical parameters of the water in Ayyanakere lake have been analyzed and depicted in Table 1.

Primary Productivity:

Gross primary productivity is the rate of photosynthesis and includes the organic matter used in the respiration during the measurement period.Net primary productivity is the rate of storage of organic matter in plant tissues in excess of the respiratory utilization by the producers during the period of measurement.

Table 2 shows the primary productivity values of Ayyanakere lake. Gross primary production in Ayyanakere recorded as 4.572 $gC/m^3/day$, 9.1464 $gC/m^3/day$ and 6.4056 $gC/m^3/day$ (Table 2, Figure-3). In the present study, as per Table- 2 GPP, NPP and CR was maximum in monsoon season and lowest in pre-monsoon season. The lowest yield was observed in pre-monsoon season when it was 4.572 $gC/m^3/day$ it is due to the decrease in the water level in the tank. The higher production was observed in monsoon due to high phytoplankton content (Sreenivasan, 1967). Higher the

plankton diversity the increased fish yield observed by several researchers (Hepher, 1962; McConneli, 1936; Murphy, 1962). The gross primary production in Stanley reservoir Mettur dam ranged from 0.3937 gC/m^3/day to 4.1137 gC/m^3/day as studied by Sreenivasan (1967). Sharma and Kaushal (2004) studied ecology and fisheries of reservoirs in Southern Rajasthan. They recorded highest gross productivity in Khari reservoir (1375 $mgc/m^2/d$) and lowest in West Benas reservoir with 834 $mgc/m^2/d$.

Prabhakar et al (2009) reported that the primary productivity higher in winter and lower in monsoon season from Khadakwasla reservoir of Pune. Lower values are observed during monsoon might be due to increased turbidity and suspended slit content of water resulting from soil erosion from surrounding hills. Chattopadhyay and Banerjee (2008) recorded seasonal records of net production efficiency to be maximum in monsoon and minimum in winter season for Krishnasayar Lake at Burdwan. Community respiration is the rate of oxygen used by the organisms during the measuring period. According to Prabhakar et al.(2009) rate of respiration attain highest values in summer due to the effect of drainage water discharged from the different drains around the station. These effluents enhance the biological activities of bacteria, especially in summer due to the decomposition of organic matter (Gajanan K. Sontakke and Satish S. Mokashe, 2014).

Conclusion:

Primary production is important for fish diversity and high fish yield. In high productivity pond, the fish yield is more and in low productivity pond, the fish yield is low. So, the primary productivity of the lake is important parameter to judge whether the water body is suitable for fish culture or not. The observed primary production values of the lake is higher than the other studied fish tanks and water bodies. Therefore, the present water body is suitable for the fish culture.

References:

1. Ahmed S.H and Singh A.K. 1989. Correlation between antibiotic factors of Water and zooplanktonic communities of a tank in Patna, Bihar. In Proc Nat Sem on forty years of Freshwater Aquaculture in India. Central Institute of Freshwater Aquaculture, Bhubaneswar; 119-121.
2. APHA. 1995. Standard Methods for the Examination of Water and Wastewater. 19th ed., American Public Health Association, New York, 1143.
3. Chattopadhyay C and Banerjee T.C. Water Temperature and Primary Production in the Euphotic Zone of a Tropical Shallow Freshwater Lake Asian J Exp Sci 2008; 22(1):103-108.
4. Gajanan K. Sontakke and Satish S. Mokashe. 2014. Seasonal variation in primary productivity of two freshwater lakes of Aurangabad district, Maharashtra, India. International Journal of Fauna and Biological Studies 1 (6): 07-10
5. Gardner, T, Gran, H.H. 1927. Investigation of the production of plankton in the Oslo Fiord. Rapp. Et Proc-Verb. Cons Internat Explore Scient Mer Mediterr: 42:1-48.
6. Hepher, B. 1962. Primary production in fish ponds and its application to fertilization experiments. Limnol. Oceanog., 7 : 131-136.
7. McConnell, W.J. 1936. Primary productivity and fish harvest in a small desert impoundment. Trans. Am. Fisheries. Soc., 92: 1-12.
8. McConnell, W.J. 1965. Relationships of herbivore growth to rate of gross photosynthesis on microcosms. Limnol. Oceanogr., 19 :569-543.
9. Murphy, G.I. 1962. Effect of depth and turbidity on the productivity of freshwater impoundments. Trans. Am. Fisheries. Soc., 91: 69-76.

10. Odum E.P and Barrett G.W. Fundamentals of Ecology. Edn 5, Thomson Brooks Australia, 2008.
11. Prabhakar V.M, Vaidya S.P, Garud V.S and Swain K.K.2009. Trend in Primary Production in Khdakwasla Reservoir. 13th World Lake Conference, Wuhan, China.
12. Sharma, V.K and D.K.Kaushal.2004. Ecology and fisheries of selected reservoirs of Southern Rajasthan. CIFRI Bulletin No.138, West Bengal: 1-39.
13. Sreenivasan, A. 1967. Primary Production and fish yield in a tropical impoundment, Stanley reservoir, Mettur dam, Madras state, South India. 35(2): 125-130.
14. Trivedi, R.K. and P.K. Goel. 1986. Chemical and biological methods for water pollution studies. Environmental Publications, Aligarh.
15. Westlake D.F. 1963.Comparison of Plant Productivity. Botanical Research 25b 385-425.

Figure 1: Different views of Ayyanakere Lake

Figure 2: Location of Ayyanakere lake (Source: www.mapsofindia.com)

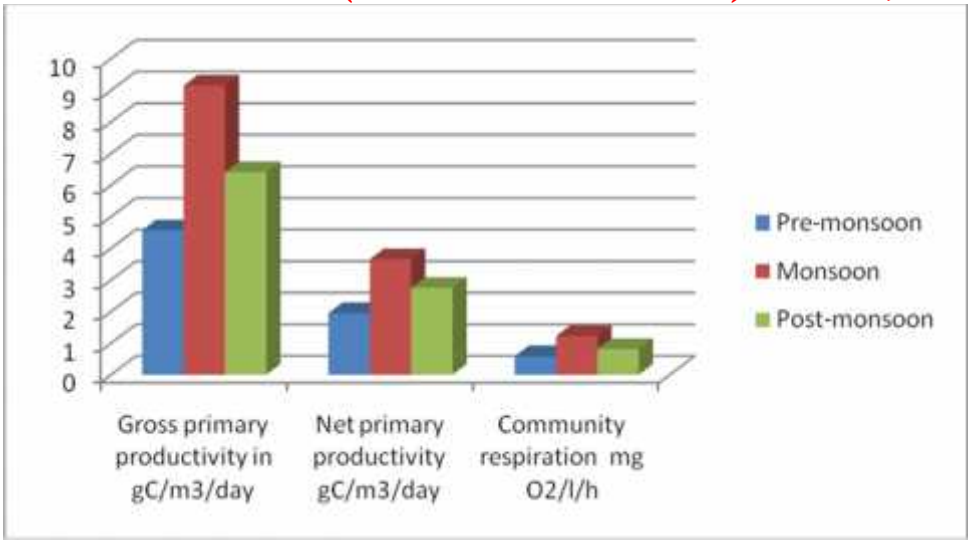

Figure 3: Primary production values in Ayyanakere Lake

Table 1: Physico-chemical parameters studies in Ayyanakare during study period 2008-2009

Parameters	**Pre-monsoon**	**Monsoon**	**Post-monsoon**
Air temp.	32	27	22
Water temp.	29.5	25	21
pH	7.5	7	7.2
DO	6.4	12.2	9.75
Free CO_2	6.83	5.06	7.05
Total hardness	92	96	108
Calcium	16.03	19.63	18.83
Magnesium	12.67	13.20	15.10
TDS	100.31	127.13	134.70
Chlorides	24	23.90	28.4
Total alkalinity	63.18	50.65	66.25
Phosphates	0.45	0.28	0.59

All the parameters are in mg/l except air and water temperature (°C), pH

Table 2: Primary production values in Ayyanakere Lake

	Gross primary productivity in $gC/m^3/day$	**Net primary productivity $gC/m^3/day$**	**Community respiration mg $O_2/l/h$**
Pre-monsoon	4.5720	1.9462	0.5837
Monsoon	9.1464	3.6526	1.2201
Post-monsoon	6.4056	2.7436	0.8140