Amte G. K, et.al. International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 11, Issue 5, (Series-II) May 2021, pp. 01-04

RESEARCH ARTICLE OPEN ACCESS

Studies on Seasonal Variation in Primary Productivity of Lake Kambe, Bhiwandi, Dist. Thane, Maharashtra.

Amte G. K., *Shinde P. P. and Ansari Gulista, R.
**(Department of Zoology, B.N.N. College, Bhiwandi, Thane-421305. Maharashtra, India.*

ABSTRACT
Primary productivity gives information related to the amount of energy available to support bioactivities of system. The present study has been carried out to study the seasonal variation in primary productivity of the Kambe Lake of Bhiwandi city, Maharashtra. The primary productivity was determined by using standard 'Light and Dark bottle' method of Gardener and Gran (1927) [1], in every month for a period of one year (February 2015 to January 2016). The GPP was 0.3115 gC/m3 /hr during Post-Monsoon season which was low, whereas GPP increased during Monsoon season. The NPP varied between 0.17928 gC/m3 /hr to 0.28315 gC/m3 /hr, the maximum value was observed during Pre-Monsoon season and the minimum value was observed during Post-Monsoon season of the study period. The respiration values varied between 0.22652 gC/m3 /hr to 0.45951 gC/m3 /hr with maximum value in Post-Monsoon season and minimum value in Pre-Monsoon season.
Keywords – CR, GPP, Kambe Lake, NPP, Primary productivity, Seasonal variation.

Date of Submission: 21-04-2021 Date of Acceptance: 06-05-2021

I. INTRODUCTION

The fixation of sunlight by plants and other autotrophic organisms initiates the flow of energy through an ecosystem. The rate at which this energy accumulates is called primary productivity. According to Odum and Barrett [2] 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 [3]. The chlorophyll bearing aquatic plants serve as primary producers in an aquatic food chain and thus act as keystone species in the ecosystem [4]. And plants being the producers, they use some of this energy themselves, however the total energy accumulated is gross primary production which is not available for the food web. Estimation of primary productivity is essential to understand food chain and food web [5], water quality [6] and pollution study [7][3]. Primary productivity has been used as potential index of productivity for many diverse ecosystems of the world (Wetzel, 1966). Primary productivity of a particular water body gives quantitative information about the amount of energy available to support bioactivity of the system [4].

It helps to understand the tropic status and to assess the fish production potential of aquatic ecosystem of a reservoir. It is necessary to determine the primary production to estimate the total biological activity of any water body. To understand both water quality and fisheries it is essential to study the primary production of lakes and reservoirs. Primary production is influenced by biotic as well as abiotic factors. Enrichment of nutrient and dry matter in the reservoir affects diversity of plankton and physico-chemical characters of water [8][9].

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 the controlling effects on the rate of multiplication and growth of the living organisms of the ecosystem [10][3].

Several environmental biologist and ecologists from across the globe have laid emphasis on the role and significance of the primary productivity as a vital functional attribute of the biosphere (Westlake, 1963). Studies on Primary productivity of many aquatic ecosystems have been reported by earlier workers from world Synudeen Sahib, S. (2002), Srivastava N, Agrawal M and Tyagi A (2003), Hujare, M.S. and Mule, M.B. (2007), Kudari V.A., R.D. Kanamadi and G.G. Kadadevaru (2004), Joseph K, Shanthi K (2010), Vasanthkumar B, Kumar KV (2011), Vandana.S. Yogesh.W.(2015), Odum et al., (1971), Roy *et al.* (2011), Koli and Ranga (2011), Patil (2012), Sontakke and Mokashe (2014), Rathod *et al.* (2016), Parmar Shashi and Vishal Sharma (2018), Ranjan and Prakash (2019), Ranjan and Kushwaha (2020) [12, 13, 14, 15, 16, 17, 18, 19, 3, 9, 20, 4, 21]. The present study has been undertaken to analyse the seasonal variations in

Primary productivity in freshwater lake Kambe, Bhiwandi, Dist. Thane, Maharashtra.

II. MATERIALS AND METHODS

2.1 Study area: - Kambe lake (latitude 19.313319'N and longitude 73.039003'E) is located in Kambe village of Bhiwandi city. The lake is used for irrigation and aquaculture purposes. The time of exposure (incubation period) in the present study was for the period of 2 hours. The dissolved oxygen is estimated by initial bottle and light and dark bottle method of Winkler [6][2]. Initial dissolved oxygen values were recorded from each site by Winkler method. Light and Dark Bottles were submerged for three hours, after which they were withdrawn and the final dissolved oxygen in each was measured on spot. The oxygen production values were converted into its carbon equivalents using a factor of 0.375 [4]. The observed Gross Primary Productivity (GPP), Net Primary Productivity (NPP) and Community Respiration (CR) in mg/l/hr were converted into gC/m3 /hr by multiplying these values with a factor of 0.375 as Studies suggested by Benton AH [11] et al. The Gross Primary Productivity (GPP), Net Primary Productivity (NPP) and Community Respiration (CR) were estimated by using following formulae of [10][3].

Net production efficiency (NPE): (%) = NPP/GPP × 100

GPP Respiration (% of GPP): % = CR/GPP × 100

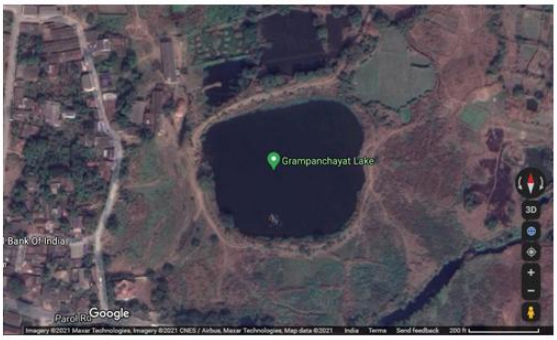

Fig. 1: Satellite location of Kambe Lake, Bhiwandi, Dist. Thane, Maharashtra, India.

III. RESULT

In the present study, primary productivity of Kambe Lake has been calculated. Seasonal record of primary productivity recorded as Gross primary productivity, Net primary productivity, Community respiration, from Kambe Lake during February 2015 to January 2016 is depicted in Table 1.

Table 1: Seasonal record of Primary Productivity of Kambe Lake during February 2015 to January 2016.

Parameters	Pre-Monsoon	Monsoon	Post-Monsoon
GPP	0.50967	0.52807	0.3115
NPP	0.28315	0.24541	0.17928
CR	0.22652	0.28313	0.45951

Abbreviation: GPP = Gross Primary Productivity, NPP= Net Primary Productivity, CR= Community Respiration

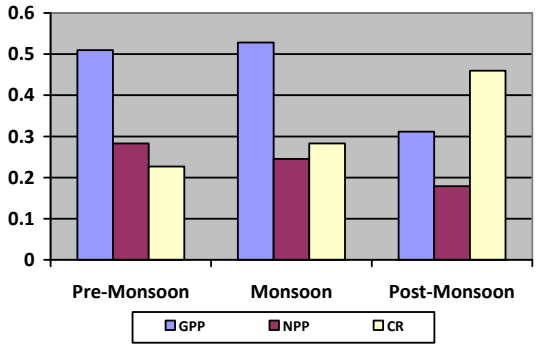

Fig. 2: Seasonal variation in GPP, NPP and CR in Kambe Lake.

3.1 Gross Primary Productivity (gC/m3 /hr):
Seasonal record of GPP in Kambe Lake showed lower value in Post-Monsoon season (0.3115 gC/m3 /hr) and higher value in Monsoon season (0.52807 gC/m3 /hr).

3.2 Net Primary Productivity (gC/m3 /hr):
Seasonal record at Kambe Lake was minimum in Post-Monsoon season (0.17928 gC/m3 /hr) and higher in Pre-Monsoon season (0.28315 gC/m3 /hr).

3.3 Community Respiration (gC/m3 /hr):
Seasonal record at Kambe Lake showed minimum CR value in Pre-Monsoon season (0.22652 gC/m3 /hr) and maximum value in Post-Monsoon season (0.45951 gC/m3 /hr).

IV. DISCUSSION

Seasonal study of GPP indicated that there is a decline from Monsoon to Post-Monsoon season. Primary productivity of any aquatic ecosystem mostly depends upon nutrient input, algae, macrophytes, green bacteria and temperature [22]. Seasonal record of GPP in Kambe Lake showed lower in Post-Monsoon season (0.3115 gC/m3 /hr) and higher in Monsoon season (0.52807 gC/m3 /hr). Minimum average temperature of 25.6°C was reported during Post-Monsoon season and comparatively GPP (0.3115 gC/m3 /hr) was also recorded during Post-Monsoon season. The highest rate of Primary productivity (0.52807 gC/m3 /hr)

was observed in Monsoon season along with the temperature (26.75°C) which may be due to phytoplankton diversity as rain helped in accumulation of organic matter from decomposed macrophyte vegetation and also due to high velocity of wind there is a continuous mixing of bottom and surface water, the sediments brought up and mix with the photic zone which ultimately increases the production [23]. Whereas low Primary productivity in Post-Monsoon season may be due to low light intensity, temperature and reduced phytoplankton [24, 25, 3].

Seasonal record of NPP of Kambe Lake was minimum in Post-Monsoon season (0.17928 gC/m3 /hr) and higher in Pre-Monsoon season (0.28315 gC/m3 /hr). NPP value of 0.23 gC/m3/hr during summer season of 2009-10 reported in the Nagaram tank of Warangal district of Andhra Pradesh [26] and also in Morawane dam the NPP value 0.042 gC/m3 of Vashishthi river in the year 2015 [22] were observed. Ugeshkumari (2017) [27] reported the NPP of Lake Chole and Lake Bhoirwadi, maximum during summer i.e., Pre-Monsoon and minimum during winter i.e., Post-Monsoon. Paul *et al*. (2006) [28] also reported the same trend for NPP. Similar thought was earlier resonated by Maheshwari et al. (2015) [29]. The maximum productivity during Pre-Monsoon season may be due to bright sunshine, high temperature, high phytoplankton density and algal bloom as per the opinion of Mitsch *et al.* (1993) [24]. The winter minima primary productivity may be attributed to dull sunlight, low phytoplankton density, decreased DO, and chlorophyll a [22].

The CR in the present study was found to be maximum during Post-Monsoon season, this is in accordance with Ugeshkumari (2017) [27]. The CR maxima during winter in both lakes probably indicates that the amount of food or organic matter consumed for respiration was high.

V. CONCLUSION

The productivity of any water body mainly depends on the presence of nutrients. Based on the result it can be concluded that the lake Kambe is mesotrophic in nature and can be used for aquaculture.

ACKNOWLEDGEMENT

The authors are thankful to Hon. Shri. Vijay Jadhav, President, Hon. Shri B.D. Kale, Executive President P.A.J.B.S.U. Mandal, Bhiwandi, Dr. Ashok D. Wagh, Principal, and Dr. R. S. Lendhe, HOD of Zoology Department of B.N.N. College, Bhiwandi for providing necessary laboratory facilities and support.

REFERENCES

[1]. Gardner T, Gran HH. Investigation of the production of plankton in the Oslo Fiord. Rapp. Et Proc-Verb. Cons Internat. Explore Scient Mer Mediterr. 1927; 42:1-48.

[2]. Odum EP, Barrett GW. Fundamentals of Ecology. Edn 5, Thomson Brooks Australia, 2008.

[3]. Sontakke, G. K., Mokashe, S. S., Seasonal variation in primary productivity of two freshwater lakes of Aurangabad district, Maharashtra, India. International Journal of Fauna and Biological Studies, 1(6): 7-10(2014).

[4]. Ranjan, R. A. J. I. V., & Prakash, S. A. D. G. U. R. U. (2019). Seasonal Variation in Primary Productivity and Macrophytes of Baghel Taal. Iconic Research and Engineering Journal, 3(6), 210-215.

[5]. Chinnaiah B, Madhu V. Primary Productivity of Darmasagar Lake in Adilabad, Andhra Pradesh, India. International Journal of Pharmacy and Life Sciences 2010; 1(8):437-439.

[6]. Wetzel RD, Linkens GE. Limnological Analysis. Edn 3, Springer, NewyorkXv, 2000, 429.

[7]. Prabhakar VM, Vaidya SP, Garud VS, Swain KK. Trend in Primary Production in Khdakwasla Reservoir. 13th World Lake Conference, Wuhan, China, 2009.

[8]. Patil, S. R., Patil, S. S., and Sathe, T. V., Seasonal changes in primary productivity at water reservoir of Ajara tahsil from Kolhapur district, Maharashtra, India. European Academic Research, 2 (12): 15824-15830 (2015).

[9]. Rathod, R.P; Chavan, B.R. and Pai, R.K. (2016). Variation in primary production in relation to physic-chemical parameters of Kadwai reservoir, Ratnagiri. Maharashtra, India. Current World Environment.Vol. 11(1):228-232. http://dx.doi.org/10.12944/CWE.11.1.28.

10. Westlake DF. Comparison of Plant Productivity. Botanical Research 1963; 25b 385-425.

[10]. Benton AH, Werner WE. Manual of Field Biology and Ecology. Edn 5, Burgess Publishing Company, Minniapolis, Minnesota 1972.

[11]. Synudeen Sahib, S. (2002). Primary productivity studies in some aquatic bodies of Kollam district, Kerala. Uttar Pradesh J. Zool., 22(3):247-250.

[12]. Srivastava, N; Agrawal, M; and Tyagi, A. (2003). Study of physico-chemical

characteristics of water bodies around Jaipur. J. Environ. Biol.24(2):177-80.
[13]. Kudari, V.A; Kanamadi, R.D; and Kadadevaru, G.G. (2004). Present status of Naregal tank (Haveri, Karnataka) with reference to water quality, Plankton and wetland birds. Environment and Ecology. 22 (1):182-187.
[14]. Joseph, K; Shanthi, K. (2010). Assessment of the Primary Productivity of Muvattupuzha River, Kottayam, Kerala. J Ecotoxicol Environ Monit.20(4):355-355.
[15]. Vasanthkumar, B; Kumar, K.V. (2011). Diurnal Variation of Physicochemical Properties and Primary Productivity of Phytoplankton in Bheema River, Gulberga. Recent Research in Science and Technology. 3(4):39-42.
[16]. Vandana, S; Yogesh, W. (2015). Studies on primary production in Gobindsagar reservoir, Himachal Pradesh. J. Environ. Biol., Lucknow.19(2): 167-170.
[17]. Roy, Utpal Singha; Goswami, Abhishek Roy; Aich, Anulipi and Mukhopadhyay, Subhra Kumar. (2011). Changes in Densities of Waterbird Species in Santragachi Lake, India. Potential Effects on Limnochemical Variables. Zoological studies.Vol. 50:76-84.
[18]. Patil, A.M., Raipure, D.M., Paunikar, M.W., and Shukla, S. K. (2012): Analysis of water quality aspects of Wainganga river Maharashtra. India Water Week, Water, Energy and Food Security.
[19]. Parmar, Shashi, and Vimal Sharma (2018). "Seasonal variation in primary productivity of SomKamla Amba reservoir of Dungarpur district, Rajasthan, India."
[20]. Ranjan, R., & Kushwaha, A. (2020). Seasonal variation in primary productivity and macrophytes of Guthia taal, Bahraich (UP).
[21]. Babar, H.T. and G.B.Raje. (2015). Primary productivity study of Morawane Dam in Ratnagiri district of Maharashtra, India. Journal of global Biosciences Vol. 4 No.2, pp. 1430-1438.
[22]. Kakavipure, D. K. (2005). Environmental studies in relation to Aquaculture of Khativali-Vehloli lake., PhD Thesis, University of Mumbai.
[23]. Mitsch WJ, Gosselink JG. Wetlands Edn 2, Van Nostrand Reinhold, Newyork, USA, 1993, 722.
[24]. Chattopadhyay, C., and Banerjee, T.C. (2008). Water temperature and primary production in the euphotic zone of a tropical shallow fresh water lake. Asian J. Exp. Sci. Vol. 22(1):103-108.
[25]. Narasimha, R.K. and G. Banarjee. (2014). Primary productivity studies in Nagaram Tank of Warangal District, Andhra. International Journal of Scientific Research Vol.3 (7):18-22
[26]. Ugeshkumari, R.S. (2017). Study of some ecological aspects and biodiversity of Chole and Bhoirwadi lakes, Dombivli. Ph.D. Thesis submitted to the University of Mumbai.
[27]. Paul, A., Das, B. K. and Sharma, R. (2006). Seasonal fluctuations in primary production in relation to the Physicochemical parameters of two weed-infested ponds of Kalyani, West Bengal. J. Indian Fish Assoc., Vol. 33, pp 83-93.
[28]. Maheshwari, K., Vashistha, J., Paulose, P. V. and Agarwal, A. (2015). Seasonal Changes in Phytoplankton Community of Lake Ramgarh, India. Int. J. Curr. Microbiol. App. Sci, Vol. 4(11). ISSN: 2319-7706.