

# SEASONAL VARIATION IN PRIMARY PRODUCTIVITY OF A FRESHWATER FISH TANK AT VARANASI, U.P.

Vinod Kumar Chaudhary

Assistant Professor, Department of Environmental Sciences, Dr. R. M. L. Avadh University, Faizabad, India

**Abstract:** Seasonal variation in primary productivity of a tropical freshwater fish tank in Bachhawon village at Varanasi have been studied. The trophic status of the tank was determined on the basis of primary production. Primary production was taken in to account to obtain the degree of water pollution in the present water body. Temperature and transparency play an important role in determining pond productivity. The net primary productivity value was in the range of 0.26 to 0.69 g g cal/m<sup>2</sup>/day. The rate of productivity was higher during the warmer months than in other months of the year.

**Index Terms – Productivity, Temperature, Respiration, Photosynthesis.**

## 1. Introduction

Studies on primary productivity of fresh water bodies in India have been made to a limited extent (Sreenivasan, 1964; Vijayaraghavan, 1971; Siddiqui et al., 1980). But practically no work on the primary productivity of fresh water bodies of Bachhawon, Varanasi has been done so far. Hence a perennial freshwater fish tank was selected for studying the seasonal variations and primary productivity for the selected Sagara tank situated 11 Km South of Varanasi. The area of the tank is 8 hectare and the depth of water varies from 0.5 to 5 meter.

## 2. Materials and Methods

Primary production was measured by using the light and dark bottle suspended in the tank at 0.5 m from the surface for a 4 ha duration. Photosynthesis quotient of 0.375 was used to convert oxygen values to carbon values. The photosynthetic rate was calculated in g.cal/m<sup>2</sup>/day (Odum, 1963). The physico-chemical factors (pH, CO<sub>2</sub>, DO, Alkalinity) estimated as per standard methods given in APHA (1985).

## 3. Result

Annual fluctuation in the temperature was in the range of 19.4°C, the lowest recorded was in January. The pH of water was always above 7.1 to 8.6. Free carbon dioxide was detected throughout the year and it was always found above 3 mg/L. Alkalinity was due to bicarbonates and it range from 52 to 115 mg/L. Dissolved oxygen in the water was in the range of 5.2 to 8.1 mg/L. The chloride content was ranged from 55 to 80 mg/L was recorded. The net primary productivity value was in the range of 0.25 g.cal/m<sup>2</sup>/day to 0.59 g.cal/m<sup>2</sup>/day. The lowest value was recorded in month of September and highest in the month of May.

**Table 1:** Seasonal variation in primary productivity during March to February (2013-2014) Sagara tank, Bachawon, Varanasi.

Month	Water Temp. (°C)	pH	Transparency (cm)	Alkalinity (mg/L)	DO (mg/L)	Chloride (mg/L)	Net Production (g.cal/m <sup>2</sup> /day)	Respiration (g.cal/m <sup>2</sup> /day)	Gross Production (g.cal/m <sup>2</sup> /day)
March	23.5	7.5	98	101	3.8	75	0.45	0.20	0.65
April	26.0	8.1	105	104	4.3	77	0.51	0.25	0.76
May	32.0	8.5	110	115	4.4	80	0.69	0.29	0.88
June	34.0	8.6	120	109	4.4	72	0.68	0.21	0.69
July	30.0	8.1	87	98	4.2	61	0.57	0.15	0.55
August	30.2	7.8	60	86	3.9	59	0.39	0.12	0.41
September	28.0	7.4	50	79	3.5	55	0.25	0.17	0.42
October	26.0	7.1	51	60	3.4	57	0.27	0.21	0.48
November	21.0	7.3	62	52	3.1	64	0.39	0.35	0.74
December	19.7	7.5	73	68	3.4	64	0.35	0.19	0.54
January	19.4	7.3	93.5	81	3.6	68	0.31	0.25	0.56
February	20.0	7.5	95	95	3.4	72	0.26	0.32	0.58

## Discussion

In the present study the net production of tank was recorded highest (0.59 g.cal/m<sup>2</sup>/day) in the month of May and the minimum 0.25 g.cal/m<sup>2</sup>/day was found during the post monsoon in September. Sreenivasan (1964) reported that the maximum net production was in June and the lowest in December in a tank of South India. Nasar and Dutta Munshi (1975) have pointed out that the maximum value of net production was in April and minimum in November. Siddiqui et al (1980) have given the maximum net production in May and minimum in September in the tank at Barauni, Bihar. In the present study the maximum and minimum production in the tank coincides in time with findings of Siddiqui et al (1980) but little differ to other workers. According to Vijayaraghavan (1971) the maximum value of net production was ten times that of the minimum value in Othakodia pond. In the present study, the range is much narrower almost three times greater than the minimum which is of the same order as was reported by Siddiqui et al (1980). The relationship of Secchi disc transparency of water primary productivity was previously observed by Hickman (1973), Nasar and Dun Munshi (1975) and Siddiqui et al. (1980). In the present study there was also observed a definite relation between transparency and primary productivity. Findenegg (1965) has stated that primary production in a water body is controlled by the interaction of many factors and temperature is probably important. Goldman and Wetzel (1963) have concluded that temperature is important in determining the primary productivity. In the present investigation it was noticed that an increase in temperature enhances production and the production decreases when the temperature was low. The maximum production was in May and June when the temperature was 32 and 34°C respectively. Ananthkrishnan and Viswanathan (1976) have stated that when the value of gross production is greater than respiration then there is an accumulation of biomass. They further pointed out that biomass is total stored energy at any time. Whereas net production is an increase of stored energy with time. In the present study it has been observed that the gross production was always greater than respiration throughout the year of investigation. The present tank having a productivity of 0.35 g cal/m<sup>2</sup>/day to 0.69 g cal/m<sup>2</sup>/day can be classified as one of the oligotrophic water system. The data on physico-chemical parameters and primary productivity suggest that the present tank is gradually attaining mesotrophic state but it cannot be viewed as such though some limnological features points towards mesotrophic state, as stated by Patil et al (1985). They further point out that the present tank is oligotrophic and is well is advanced stage of eutrophication process Zutshi (1976), Cheng and Tyler (1976) have classified the trophic status of the water bodies on the basis of primary productivity.

## Acknowledgement

The authors are thankful to Shri Indrasan Singh, Principal, S.B P.G. College, Baragaon, Varanasi and various faculties from Dr. Rammanohar Lohia Avadh University, Faizabad for providing necessary facilities to do the works.

## REFERENCES

- APHA (1985). Standard Method for the Examination of water and waste waters, Amer. Publ. Health Assoc. Inc., New York (1985).
- Ananthkrishnan, T.N. and Viswanathan T.R. (1976). General Animal Ecology. Macmillan, India Ltd.
- Cherw, D.M.N. and Tylar, P.A. (1976). Primary productivity and trophic status of lakes Sorell and Crescent, Tasmania, Hydrobiologia, 43, 59-64.
- Findenegg, I. (1965). Factors controlling primary productivity especially with regard to water replenishment, stratification and mixing. Memoire Inst. Ital. Idrobiol. Suppl., 18, 105-119.
- Goldman, C.R. and Wetzel, R.G. (1963). A study of primary productivity of clear lake, California. Ecology, 44, 283-294. Hickman, M. (1973). The standing crop and primary productivity of the phytoplankton of Abbot's pond, North Somerset. J. Ecol. 61, 269-287
- Nasar, S.A.K. and Dana Munshi, (1975). Studies on primary prodhction in freshwater pond. Jap. Jour. Ecol., 25, 21-23.
- Odum, E P. (1963). Ecology. Modern Biology Series Holt. Rinehart and Winston, New York .
- Patil, S.G., Harshey, D.K. and Singh, D.F. (1985). Limnological studies on seasonal variations in physico-chemical factors and plankton in surface layers of a tropical freshwater fish tank of Jabalpur (M.P.) Geobios new reports, 4, 125-129.
- Siddiqui, E N., Singh, N.K. Afsar, M.R. (1992). Primary production studies in a fresh water pond at Barauni, Bihar. Comp. Physiol. Ecol. 5, 258-265.
- Sreenivasan, A. (1964). The limnology primary production in a tropical pond. Limnol. Oceanogr. 9, 391-396.
- Vijayaraghavan, S. (1991). Seasonal variations, in primary production in three tropical ponds. Hydrobiol., 38, 395-408.
- Zutshi, D P. (1976). Phytoplankton productivity, algal dynamics and trophic status of lake Mergozze (Northern Italy). Mem. 1st. Indobiol., 33, 221-256.