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Status of Phytoplanktonic Biomass, Chlorophyll and Energy Content of Kolayat Lake, Bikaner (Rajasthan), India

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Key words: Kolayat Lake, Phytoplanktons, Biomass, Chlorophyll, Energy content

Abstract

The biomass, chlorophyll and energy content of phytoplanktons of Kolayat Lake, Bikaner has been assessed for a period of 12 months from July, 2006 to June, 2007. The monthly production potential in the lake revealed a seasonal cycle in the values for biomass, chlorophyll and energy content. In the present study, biomass production showed a close parallelism with chlorophyll content. Both the parameter showed their maximum amount during winter season followed in a decreasing order by summer and rainy season. Energy content also showed similar trend of variation during different season.

Introduction

Phytoplanktons are of great significance since they comprise the major portion of primary producers in the aquatic environment. Studies on productivity of an aquatic environment are not only important for the comparison of productive capacity of water belonging to different geographical region but also for their practical value in fish culture programmes. High rates of production in natural and cultural ecosystems occur when nutrient conditions are favorable (Sultan *et al.*, 2003). The use of photosynthetic pigment as predictors of algal biomass is widely known (Fogg, 1975) and mainly because the pigments are specific to plants and their determination is relatively simple and straightforward (Moses, 1979). Chlorophyll is used to measure algal biomass that is relatively unaffected by non-algal substances. It provides an estimate for measuring algal weight and volume, and act as an empirical link between nutrient concentration and other biological phenomenon in aquatic ecosystem. Acquiring carbon is a prerequisite for the photosynthetic activity of the phytoplankton that supplement energy for growth, reproduction and physiological processes.

The Bikaner district has an appreciable number of temporary and permanent ponds, open tanks and lakes. Kolayat Lake is one of the important fresh water lake and situated about 55 km at Kolayat in the south-west of Bikaner city. It lies at located 27°50' N latitude and 73°57' E longitude. The depth of lake varies from 3 feet (shallow water zone) to 20 feet (deep water zone) with maximum towards south, and it has a capacity of 100 mcft. of water. It is a holy place of great significance not only in this part of the country but also throughout India. The catchment area of lake is sandy plane and some clay mines are also in the area. In the present study, an attempt has been made to assess the seasonal variation in the biomass, chlorophyll concentration and energy content of phytoplanktons of Kolayat Lake, Bikaner (Rajasthan).

Materials and Methods

The production potential was determined at monthly intervals for the period of one year (July, 2006 to June, 2007). Phytoplanktonic biomass was estimated by filtering one litre of lake water through phytoplanktonic net and the sample were collected on filter paper of known weight and then the filter paper was kept in oven at 60 ^{o}C for 24 hours. Weight of paper with phytoplanktons taken and difference, was recovered as the phytoplanktonic biomass per litre. Determination of chlorophyll content was made according to the method of Arnon (1949). The samples were dried at 60 ^{o}C for 48 hours in oven and subsequently powdered. In each experiment, 0.25 gm of powdered sample was extracted with 80% acetone containing 0.02% sodium carbonate and then centrifuge at 3000 rpm for 10 minutes. The supernatant liquid was made to 50 ml by adding 80% acetone. Optical density was then measured with Systronic Spectrophotometer (model 105) at wavelength 652 nm and total chlorophyll (mg/g dw material) was calculated. The measurement of calorific value of the planktonic material was done with the help of Oxygen Bomb Calorimeter. The energy in calories was determined by the formula suggested by Lieth (1968).

Results

Quantification of phytoplankton biomass and community composition is important for understanding the structure and dynamics of fresh water ecosystems. In order to understand the production potential of the lake studied, biomass of plankton population was recorded monthly and analysed the seasonal variations (Table - 1). In shallow water zone, maximum (32 mg lit^{-1}) biomass value was recorded to be in December and minimum (13 mg lit^{-1}) to be in October. In deep water zone, biomass value varied between 10 mg lit^{-1} to 25 mg lit^{-1} with minimum in October and maximum in December. In respect of season, both the zone exhibited maximum values during winter month while minimum values during rainy season (Fig. - 1).

Table-1. Monthly Variation in Biomass, Chlorophyll concentration and Energy content of Phytoplankton Community in Kolayat Lake, Bikaner, during 2006-07

Months	Biomass on dry weight basis (mg lit^{-1})		Chlorophyll concentration (mg/g)		Energy content (Kcal/gm)	
	Shallow Water Zone	Deep Water Zone	Shallow Water Zone	Deep Water Zone	Shallow Water Zone	Deep Water Zone
Jul	16	12	2.522	2.383	3.372	3.221
Aug	17	15	2.681	2.592	3.421	3.233
Sep	19	15	2.923	2.881	3.883	3.424
Oct	13	10	2.653	2.627	4.184	3.942
Nov	20	13	3.582	3.343	5.001	4.724
Dec	32	25	4.184	3.852	5.822	5.485
Jan	30	22	4.521	4.221	6.583	6.294
Feb	26	21	4.123	4.014	6.121	5.921
Mar	23	15	3.582	3.423	5.424	5.123
Apr	21	13	3.401	2.981	5.120	4.722
May	19	15	3.008	2.820	3.973	3.581
Jun	17	14	2.623	2.472	3.641	3.523

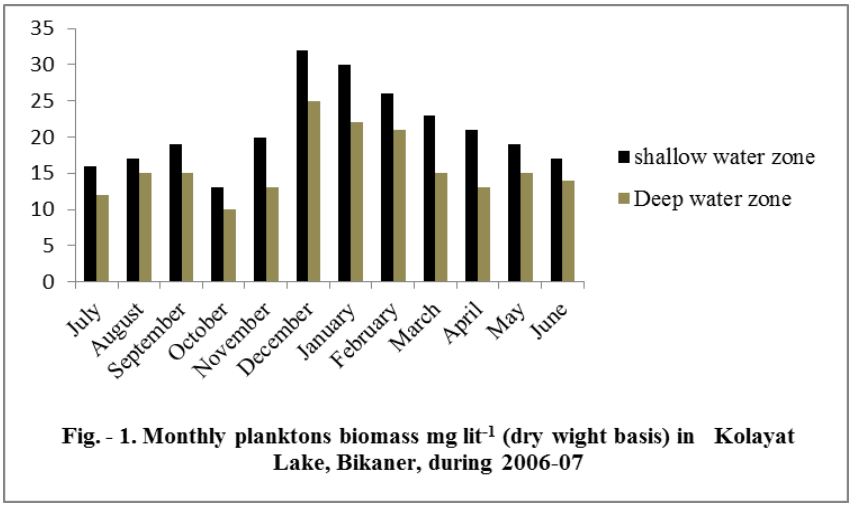

Fig. - 1. Monthly planktons biomass mg lit^{-1} (dry wight basis) in Kolayat Lake, Bikaner, during 2006-07

The chlorophyll content in phytoplankton population of the lake was estimated to confirm the production data observed as primary productivity and biomass. A close parallelism was observed between chlorophyll concentration and the amount of biomass. Surface water production was observed to be higher than that of deep water. The observed higher production in the surface water could be on account of the prevalent high light intensity and large phytoplankton population. Moreover, the nutrients were also more in surface water than the deep water. In shallow water zone, maximum chlorophyll concentration (4.521 mg/g) was recorded in January and minimum (2.522 mg/g) in July while in deep water zone maximum (4.221 mg/g) value of chlorophyll concentration was observed in January and minimum (2.383 mg/g) in July. In both the zone maximum chlorophyll concentration was recorded during winter and minimum during rainy season (Fig.- 2).

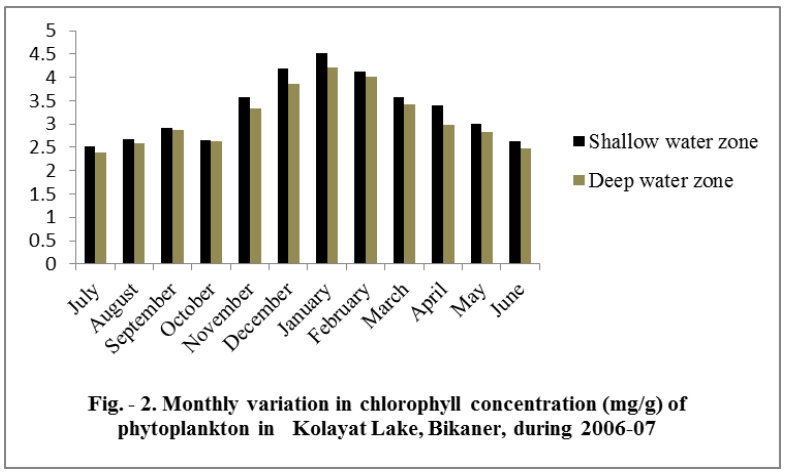

Fig. - 2. Monthly variation in chlorophyll concentration (mg/g) of phytoplankton in Kolayat Lake, Bikaner, during 2006-07

In present investigation, energy status of the phytoplankton was also assessed in respect of different months and seasons. The calorific values varied between 3.372 Kcal gm^{-1} to 6.583 Kcal gm^{-1} in shallow water zone and 3.221 Kcal gm^{-1} to 6.294 Kcal gm^{-1} in deep water zone. In respect of season, maximum calorific value was observed during winter and minimum during rainy season in both the zone (Fig. - 3).

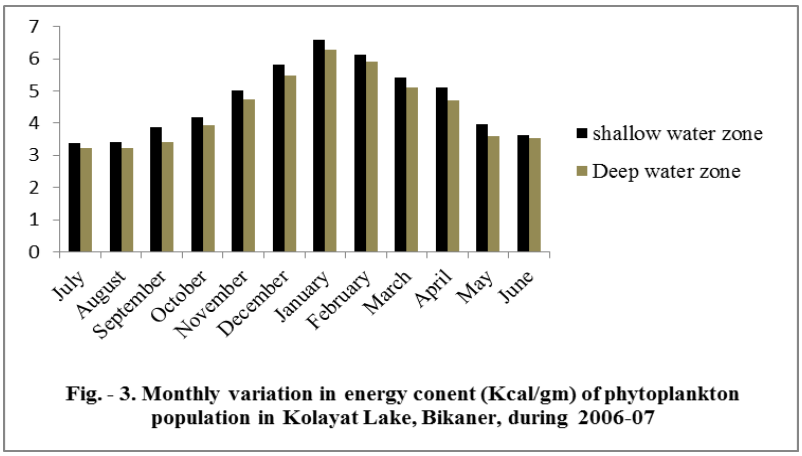

Fig. - 3. Monthly variation in energy conent (Kcal/gm) of phytoplankton population in Kolayat Lake, Bikaner, during 2006-07

Discussion

The measurement of phytoplankton productivity helps to understand conservation ratio at various trophic level and resources as an essential input for proper management of water reservoir. In both the zone studied maximum value of biomass was recorded during the winter and minimum during rainy season. Comparatively, higher biomass production was observed in shallow water zone (253 mg lit^{-1} yr^{-1}) than deep water zone (190 mg lit^{-1} yr^{-1}) during the study period. Shekhawat (1983) and Shukla (1986) observed 202 mg lit^{-1} yr^{-1} and 225 mg lit^{-1} yr^{-1} biomass production from Swaroop Sagar Lake, Udaipur and Rang Sagar Lake, Udaipur, respectively.

Fertility and production potential of any aquatic ecosystem is depend on the primary production and phytoplankton pigment. The high value of Chlorophyll a were recorded during winter season in both the zone and observed to be higher in shallow water zone than deep water zone. Shobha *et al*., (2006) observed maximum value of chlorophyll a during pre monsoon and minimum value during post monsoon. Zhang *et al*., (2004) found a significant positive correlation between

Chlorophyll a content and primary productivity. In present study also a positive correlation was to be found in both the zone. Biomass production and chlorophyll concentration showed direct correlation. Shekhawat (1983) also observed similar trend.

In the present study, a very close parallelism between energy content and pigment concentration was observed. This is conformity with the observation made by Vyas (1973). Thus, the present study suggested that the Chlorophyll concentration and energy status are acting as an interdependent system in aquatic environment.

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