

Ecology of *Diaphanosoma brachyurum* Lieven (Cladocera : Crustacea) in Lake Manasbal, Kashmir

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Received on February 18, 1981.

Abstract

The paper describes the seasonal distribution and abundance of *Diaphanosoma brachyurum* Lieven (Cladocera: Crustacea) in Lake Manasbal, Kashmir. The lake is alkaline and conforms to the warm monomictic type. *D. brachyurum* remains mainly confined to the limnetic zone of the lake and forms an aestival species. It prefers water with temperature above 20.0° C and pH > 8.0.

Key words : Warm monomictic lake, Cladocera, limnetic, aestival.

1. Introduction

In an aquatic ecosystem, the seasonal changes in the plankton composition are closely dependent on physical, chemical and biological characteristics of water, each of which directly and indirectly acting as a controlling factor¹⁻⁴. From May 1976 to April 1978, a detailed investigation was carried out on the seasonal fluctuations in the abundance and vertical distribution of zooplankton in Lake Manasbal (34° 15' N and 74° 40' E) Kashmir, in relation to its physical and chemical limnology. In the present communication, influence of some physico-chemical characteristics on the seasonal abundance and vertical distribution of *Diaphanosoma brachyurum* Lieven (Cladocera: Crustacea) is described.

2. Methods of study

Collections were made at five stations, three located in the outer shallow (littoral zone) and two in the inner deeper (limnetic zone) region of the lake. Location of the stations and methods of collection of water samples are described elsewhere⁵. pH was measured

by Toshniwal digital pH meter CL 46 and transparency by a 20 cm black-and-white Secchi disc. Water was chemically analysed using the methods of Welch⁶.

3. Results

Data were collected for a period of two years, from May 1976 to April 1978, and the mean values of the two years are presented in Figs. 1-3. The physical and chemical factors showed only small variations from station to station in both littoral and limnetic zones. However, the values of the two zones revealed appreciable differences from each other (Fig. 1) except for atmospheric temperature which was nearly the same in the two zones. The latter varied from 4.4°C in January to 32.1°C in July. Surface water temperature fluctuated in close relation with that of the atmosphere. The deeper layers were not affected by the atmospheric temperature to any appreciable extent and the lake stratified for a period of 8-9 months (March/April-November). Transparency showed irregular fluctuations in the littoral zone, where it ranged from 0.85 m (July) to 1.54 m (April). In the limnetic zone the fluctuations in the transparency (2.95 m in December to 4.88 m in January) were regular and followed the thermal structure of the lake. It decreased with the advancement of the stagnation period and the lowest values were recorded in December at the start of circulation as a result of upswelling. The water was always alkaline (pH 7.3-9.5) which was mainly due to bicarbonates, ranging from 57.0 mg/l to 169.0 mg/l. Alkalinity decreased gradually with depth and carbonates appeared in the surface layers from May to October in the littoral and from May to August in the limnetic zone. Free CO₂ was present throughout the year in the deeper layers. In the surface layers it disappeared during the period when carbonates were present in these layers. Dissolved O₂ showed a clinograde depth distribution with the hypolimnion getting depleted of this gas during late stagnation period.

Diaphanosoma brachyurum Lieven was found to be the most dominant species among Cladocera in the lake (Fig. 2), being mainly confined to the limnetic zone, where it preferred the upper layers of the water column and concentrated generally at a depth of 3 m. Its population decreased downwards and at 9 m depth showed very low concentration, almost throughout its period of occurrence (Fig. 3). In the littoral zone, the species were very few and showed no regular fluctuations. It made its appearance in early spring (March) in the upper layers of the limnetic zone and the population increased throughout spring with the result that the first peak was recorded in July (mean population = 22.1 individuals/litre). There was a quick decline in the population in August which was followed by a second peak (31.45 individuals/litre) in September. From October onwards the population decreased and the species disappeared completely in February.

4. Discussion

Distribution of zooplankton has been correlated with several environmental factors such as temperature, light intensity, pH, food availability, etc.⁷⁻⁹. *Diaphanosoma brachyurum*

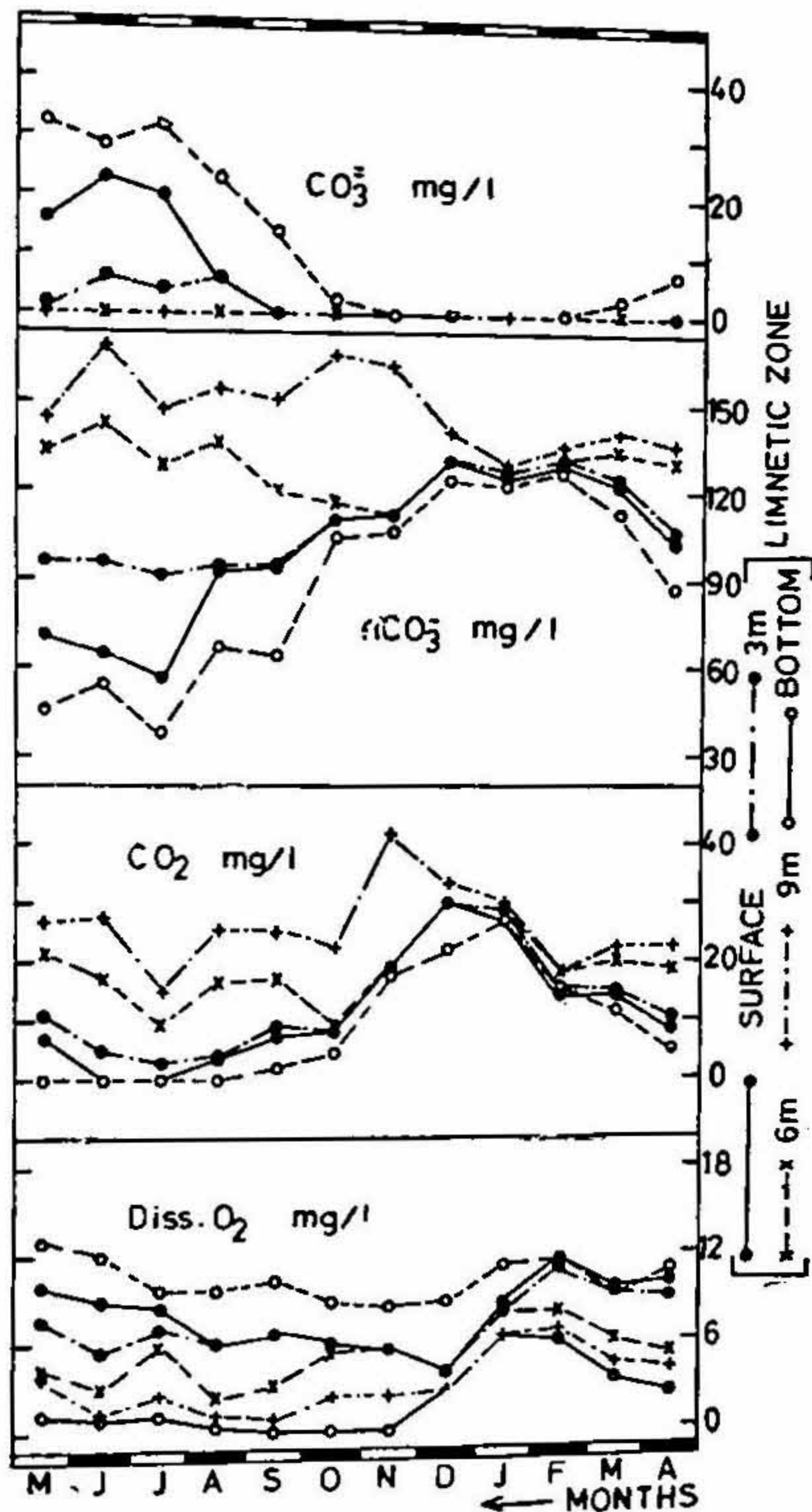
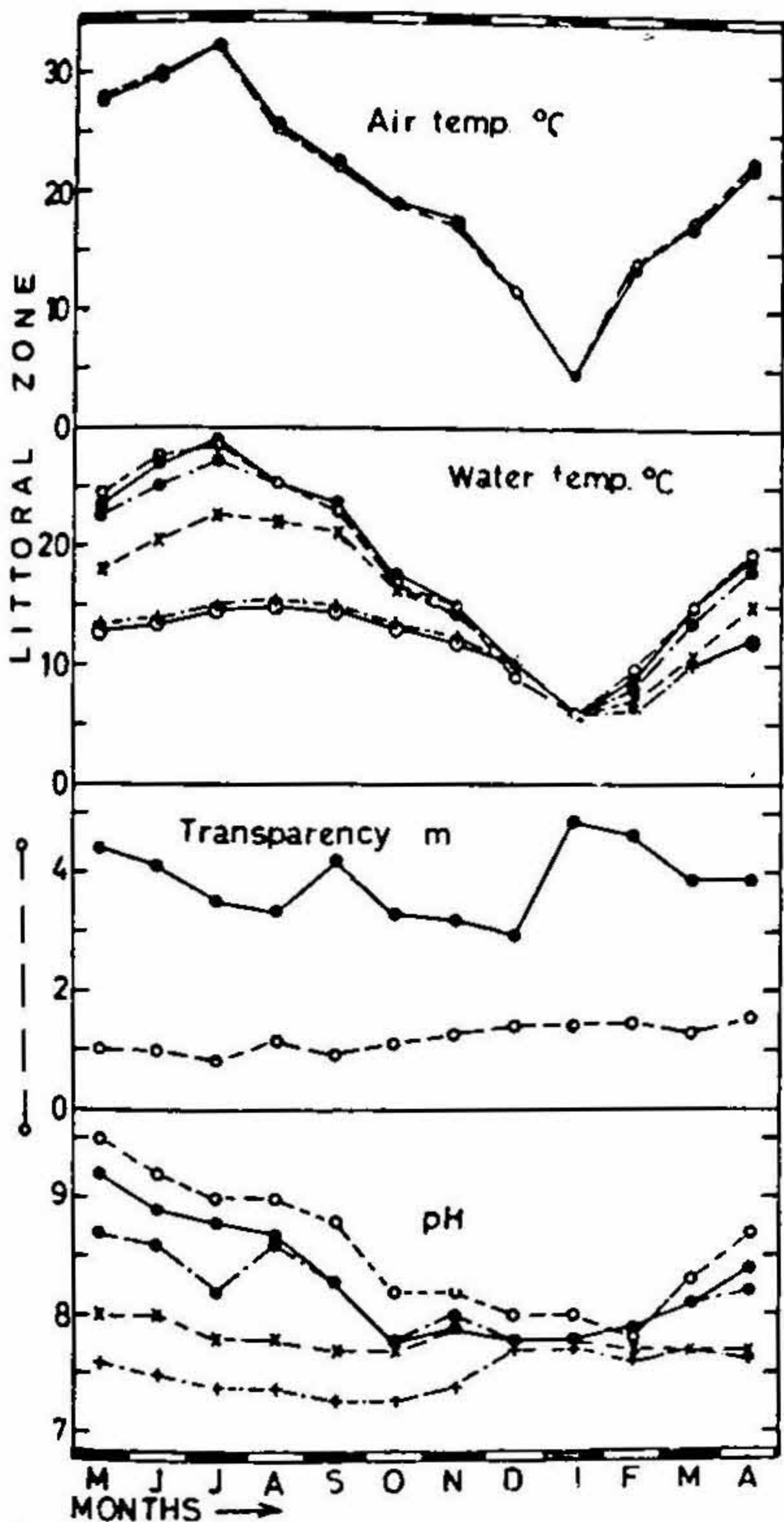


FIG. 1. Variation in the physical and chemical factors in Lake Manasbal.

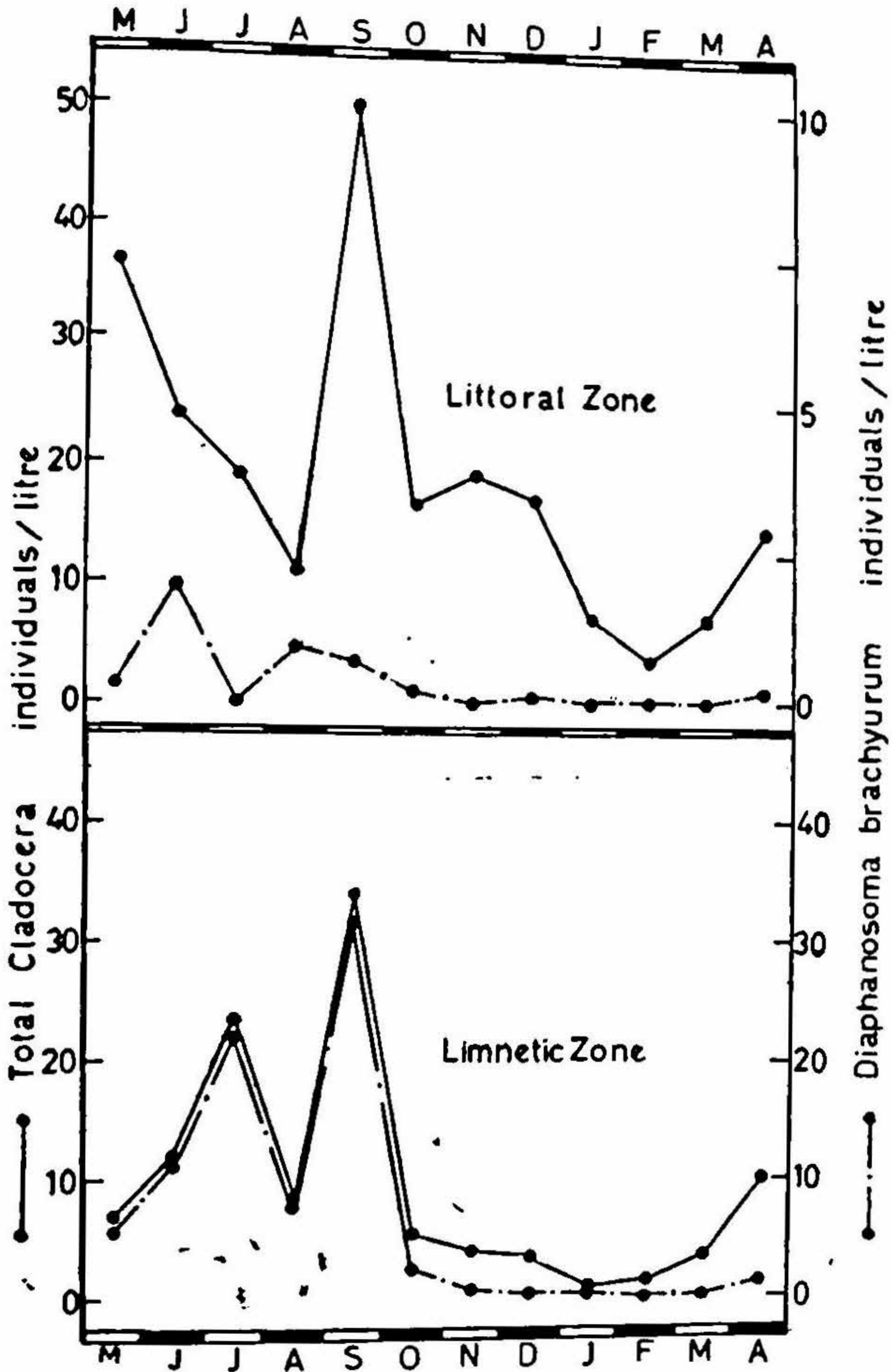


FIG. 2. Monthly changes in the population of total cladocera and *Diaphanosoma brachyurum* in Lake Manasbal. Values in the limnetic zone are mean of four d.pths.

is the most dominant species among the cladoceran populations in the limnetic zone of Lake Manasbal, contributing generally to more than 80% of the total biomass (mean annual density of *D. brachyurum* being 6.84 ind/l and that of total Cladocera, 9.45

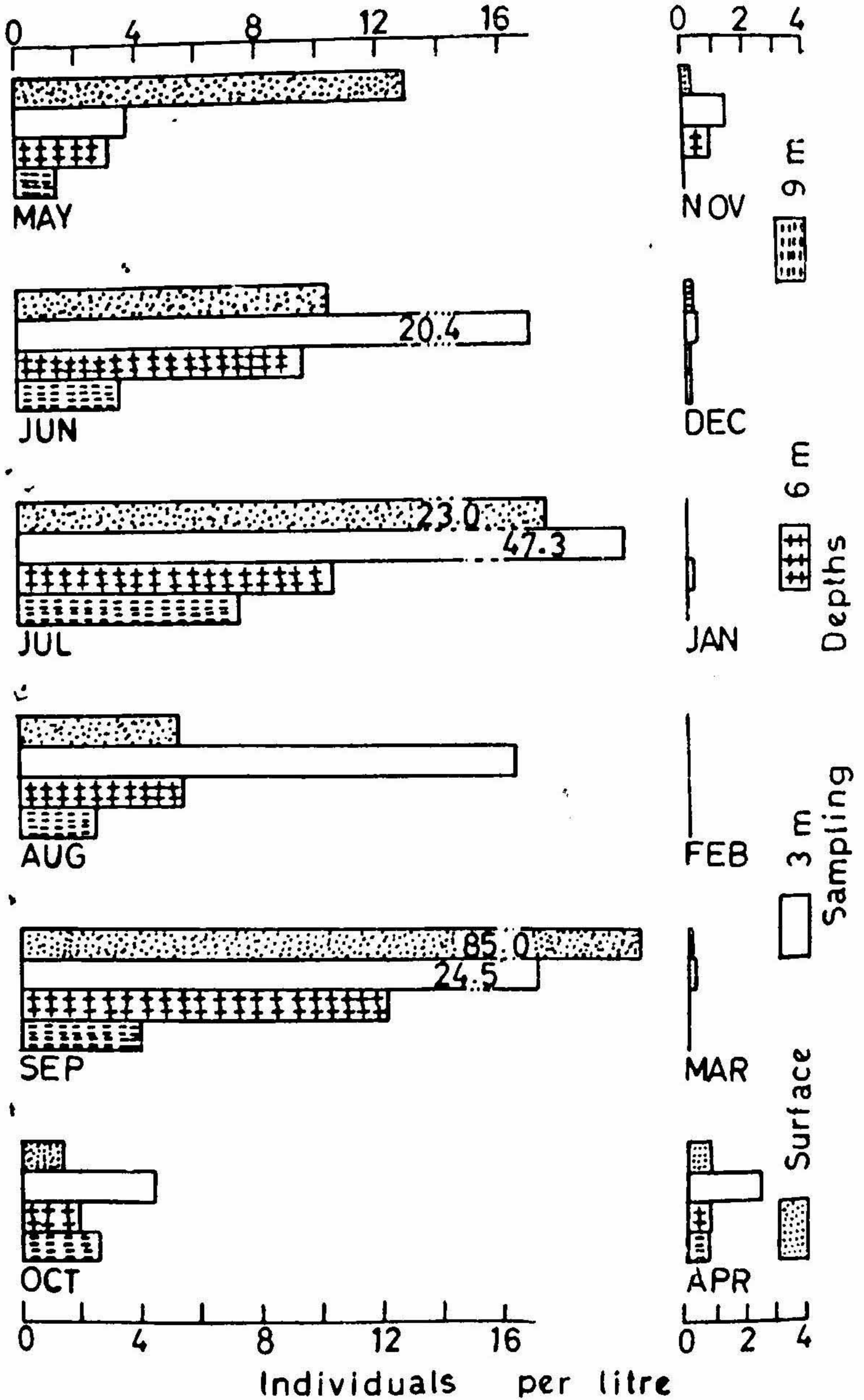


FIG. 3. Vertical distribution of *Diaphanosoma brachyurum* in Lake Manasbal.

ind/l). In the littoral zone the species is rare and contributes less than 2% of the population (mean annual density of *D. brachyurum* being 0.35 ind/l and that of total Cladocera, 18.8 ind/l). The species has been reported to be an aestival form throughout the temperate Holarctic region of the world⁸. Kashmir valley experiences a temperate-cum-Mediterranean type of climate. The present data also reveal that this species appears in spring when the temperature begins to increase, CO₂ disappears from the upper layers due to its uptake in photosynthesis, the concentration of bicarbonates decreases, due to their conversion into carbonates, and the pH increases. The population reaches maximum level during the warmest period of the year (July-September). The species prefer upper warmer, more alkaline, waters which contain lower concentrations of bicarbonates and larger quantities of dissolved oxygen. Only small numbers are found in the deeper oxygen-deficient layers which are less alkaline and contain large quantities of carbon dioxide.

The population of *D. brachyurum* records two maxima in Lake Manasbal, first in July and the second in September. The two peaks are separated by a well-marked minimum in August. Such a seasonal pattern has also been reported by Patalas¹⁰ in Lake Charzykowo (Poland). The data reveal that soon after the maxima are recorded the population declines quickly. As the physico-chemical factors do not show any abrupt change at this time this phenomenon seems to be related to the starvation due to decrease in the phytoplankton population which is the main food of this cladoceran¹¹. The gradual decrease in the population density from October onwards seems to be influenced by the destratification process which involves a decrease in temperature, transparency, pH and dissolved O₂ and an increase in the free CO₂ and bicarbonate content due to the mixing of the hypolimnetic waters with the upper layers.

It may be concluded that *D. brachyurum* is an aestival species in the lake and prefers warm water (temperature > 20° C) having pH > 8.0 with low quantities of free CO₂ and bicarbonates.

Acknowledgements

Thanks are due to Dr. D. N. Fotedar of the University of Kashmir for providing the laboratory facilities and to Dr. R. G. Michael of the North-Eastern Hill University for identifying the species. This study was made possible by a doctoral research fellowship to the first author by the C.S.I.R., New Delhi.

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* Not seen in original.