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EFFECT OF BIRD GUANA IN THE PLANKTON POPULATION OF FRESH WATER TANKS

M. MARY BAI and ARUN KUMAR*
Zoological Survey of India, Southern Regional Station, Madras

INTRODUCTION

The Indian countryside abounds with a large number of seasonal and perennial tanks which are differently used for irrigation, drinking and washing purposes. Most of the seasonal tanks retain water for a period of 3 to 10 months and harbour wild and uneconomic varieties of fishes.These waterbodies offer vast scope for fish culture and fishery development. A comprehesnsive knowledge of the fauna and flora of such freshwater systems is a prerequisite for any scientific fish culture programme.

Literature on the physico-chemical properties of fresh water systems is rather abundant. Michael (1962, 66, 68, 69 and 1970) studied the physico-chemical factors and zooplankton of certain freshwater fish ponds in Delhi and west Bengal. Sumithra (1969); Sreenivasan, (1964, 1966, 1972 and 1974), Prabhavathy and Sreenivasan (1977) studied the physico-chemical aspects of freshwater tanks in Tamil Nadu. David et. al. (1974) gave an account of the tanks in Karnataka.

The Vedanthangal bird sanctuary, established in 1790, is the oldest sanctuary in India (Fig. No. 1). Located at a distance of 80 Km. from Madras (Tamil Nadu) (12 N; 79E; 120 mt mal), this is the temporary abode of more than 25,000 breeding and non-breeding migratory water birds, (Paulraj 1984, Annamalai 1985). Daily deposition of large amounts of droppings by these birds in this compact tank area of 30 ha makes the tank water turbid and the tank water is converted into a liquid guano in due course. When this guano-rich tank water is used for irrigating the fields, it enriches the soil with phosphates and nitrates. Much work has been done on the fertilizer property of this tank (Thangam 1956, Spillet 1966, Santharam 1984, Paulraj, 1988 and Arun Kumar and Mary Bai Krishnan 1991). The object of the present study is to find the impact of guano on the plankton population of this tank. Another fresh water tank, Chenglepat tank situated at about 20 Km North East of Vedanthangal, which is not a bird sanctuary, was selected for comparative studies.

MATERIAL AND METHODS

For a period of one year, composite water samples were collected every month from both the tanks (between 9-11 AM) with a water sampler. The physico-chemical parameters were analysed with the help of DREL-5 water analysis kit supplied by HACH & Co.,

* Northern Regional Station, Zoological Survey of India, Dehra Dun-248195, U.P.

Belgium. Plankton samples were collected by filtering 10 liters of water through a conical net made of a bolting silk (No. 25) and the resulting filtered concentrate was preserved in 4% formaldehyde. The planktons were identified upto genus level and a quantitative count was made using a Hydrobios inverted plankton microscope.

RESULTS

The physiography and physico-chemical parameters of Vedanthangal and Chenglepat tanks were published in an earlier paper by Arun Kumar and Mary Bai Krishnan (1991).

Plankton of Vedanthangal Tank

The phytoplankton growth in Vedanthangal tank was dense althrough the year than in Chenglepat tank. The phyto-and zooplankton compositions were 24% and 76% respectively. The seasonal variation in phyto-and zooplankton is shown in Fig. 2. The Cyanophyceae dominates the phytoplankton. The phytoplankton concentration ranged from 200 u/l in August to 12499 u/l in May with an average of 6300 u/l. The annual maximum was during May in summer and December in winter. The groups represented were Cyanophyceae, Chlorophyceae and Bacillariophyceae.

Zooplankton Of the groups represented chief Protozoa, Rotifera, Copepoda and Cladocera which have been dealt here. The seasonal trends in the density of these groups are shown in Fig. 3.

Protozoa The concentration of protozoa varied from 260 units/l in January to 1840 units/l in July (average 1050 units/l). It was abundant during June, July and December. *Euglena, Volvox, Aulonia* and *Tintinnid* were the four genera encountered in this group.

Rotifera The concentration varied from 400 u/l in January to 9400 u/l in March (average 4900 u/l). The months of abundance were March (Summer) and December (winter). A feeble pulse (6200 u/l) was observed during October. Very few Rotifers were represented by the genera *Asplanchna, Filinia* and *Branchionus*.

Copepods The density of this group ranged from 200 u/l in January to 7800 u/l in May (average 4000 u/l). Copepods were abundant in summer and winter with a primary peak in May and secondary peak in December. January and February were lean months for Copepode population. This group was represented by *Diaptomus, Mesocyclops* and their nauplii stages.

Cladocera This group was dominant in Zooplankton with density varying from 200 u/l in February to 37,400 u/l in November with an average of 18,710 u/l. Cladocerans were abundant during summer months from March to June. A secondary peak was observed in November. *Ceriodaphnia, Moina* and *Cypris* represented this group.

Plankton of Chenglepat tank

The phytoplankton population was represented by 5 species of Cyanophycea Viz *Microcystis, Oscillatoria, Merismopodia* and *Aphanizomenon*, 2 species of Chlorophyceae Viz, *Mougeotia* and *Zygnemia* and one species of *Bacillariophycea* by *Navicula*. Cyanophyceae dominates the phytoplankton community in general. The phytoplankton concentration ranged from 380 to 4200 u/l from January to December (average 2240 u/l). The maxium number was recorded during May (summer) and December (winter). The seasonal variation of phyto-and zooplankton is shown in Figs. 4 & 5.

Of the zooplankton represented, Protozoa, Rotifera, Cladocera and Copepoda the chief groups that have been dealt. During the present studies 40% of the plankton population was represented by phyto and 60% by zooplanktons.

Protozoa The protozoans recorded were *Euglena, Volvox, Aulonia* and *Tintinnid*. They ranged from 200 u/l to 520 u/l with an average of 360 u/l. They were abundant during summer (June-July) and winter.

Rotifera This group was represented by a large variety of forms belonging to the genera *Asplanchna, Filinia* and *Branchionus*. The concentration varied from 280 u/l to 1400 u/l with an average of 840 u/l. Rotifers were abundant in summer and winter with primary peak in May and secondary peak in December. February and August were lean months for Rotifer populations.

Copepoda The copepods recorded were *Diaptomus, Mesocyclops* and their nauplii stages. The density of this group ranged from 150 u/l in January to 6800 u/l in June with an average of 3452 u/l. A primary peak was noticed in May and a secondary one in November. The group was poorly represented in January, February, July and September.

Cladocera *Ceriodaphnia, Moina* and *Cypris* were encountered in this group. Cladocera formed the dominant group in zooplankton with concentration ranging from 200 u/l in January to 11600 u/l in August. They were abundant in summer months, May to July after which the number decreased. A secondary peak was observed in November. Abundance of Cladocera was found to be responsible for the zooplankton peak in summer and winter.

DISCUSSION

Vedanthangal and Chenglepat tanks are two water bodies of eutrophic nature as revealed by permanent phytoplankton blooms (Prasadam 1977). Both phytoplankton and zooplankton were abundant in Vedanthangal tank than in the Chenglepat tank. This might be due to higher nutrient content because of the bird droppings as stated by Paulraj 1988. The zooplankton was found to be more than the phytoplankton during major part of the year. The zooplankton was observed to be abundant during summer and winter seasons in both

Plate-1

Fig. 1 Photograph of Vedanthangal tank with migratory birds.

the tanks. The seasonal abundance is identical in general in both the tanks but for the slightly decrease in Chenglepat tank.

Numerical abundance of Phytoplankton.

In both the tanks the dominant group is blue green algae (Cyanophyceae). The dominance of blue green algae in both the tanks agrees with the observations of Palmer 1980 who also found the abundance of blue green algae in the fresh water systems containing more organic matter. According to Schindler (1971) blue green algae are assimiliated by zooplankton with low efficiency. Keating (1977) has suggested that the excretory products from blue green algae would inhibit other algae. Welsh (1980) is of opinion that the enrichment of Nitrogen and phosphate depletes silica which is slow to regenerate and which in turn would limit Diatom growth leaving more nutrients for blue green algae.

The increase of phosphate and nitrate in Vedanthangal tank might be due to the droppings of birds which ultimately would have limited the phytoplankton population. Depletion of phytoplankton during August, September and October might be due to the dilution of water by rains in both the tanks. The occurrance of lesser amount of phytoplankton compared to zooplankton may be due to the rapid grazing behaviour of zooplankton such as cladocerans and copepods.

Numerical abundance of zooplankton

12 species of zooplankton were recorded in Vedanthangal and Chenglepat tanks.

Protozoa was found to be abundant in Vedanthangal tank than in Chengalpat tank with peaks during summer (July) and winter, (December and January). Abundance of Protozoa in this tank, where Blue green algae is dense suggests that, besides other factors, the latter form the pasture for Protozoans. A similar correlation was drawn by Michael (1969) in the case of ciliate protozoans.

Rotifers represented by *Asplanchna, Filinia* and *Branchionus* were found in both the tanks, though less abundant in Chengalpat tank. They were abundant during summer (May-June) and winter (November-December) as in a tropical pond reported by Michael (1969). Gray 1953 and Byars (1960) have also reported the abundance of rotifers during summer and winter months in Cambridgeshire and New Zealand respectively.

Copepoda represented by *Diaptomus* and *Mesocyclops* were abundant both during summer (May-June) and winter (November-December). Similar observations were recorded by Michael (1968) in Delhi. Nauplii were encountered throughout the year indicating that the reproduction of copepods takes place during all the seasons (Prasadam, 1977).

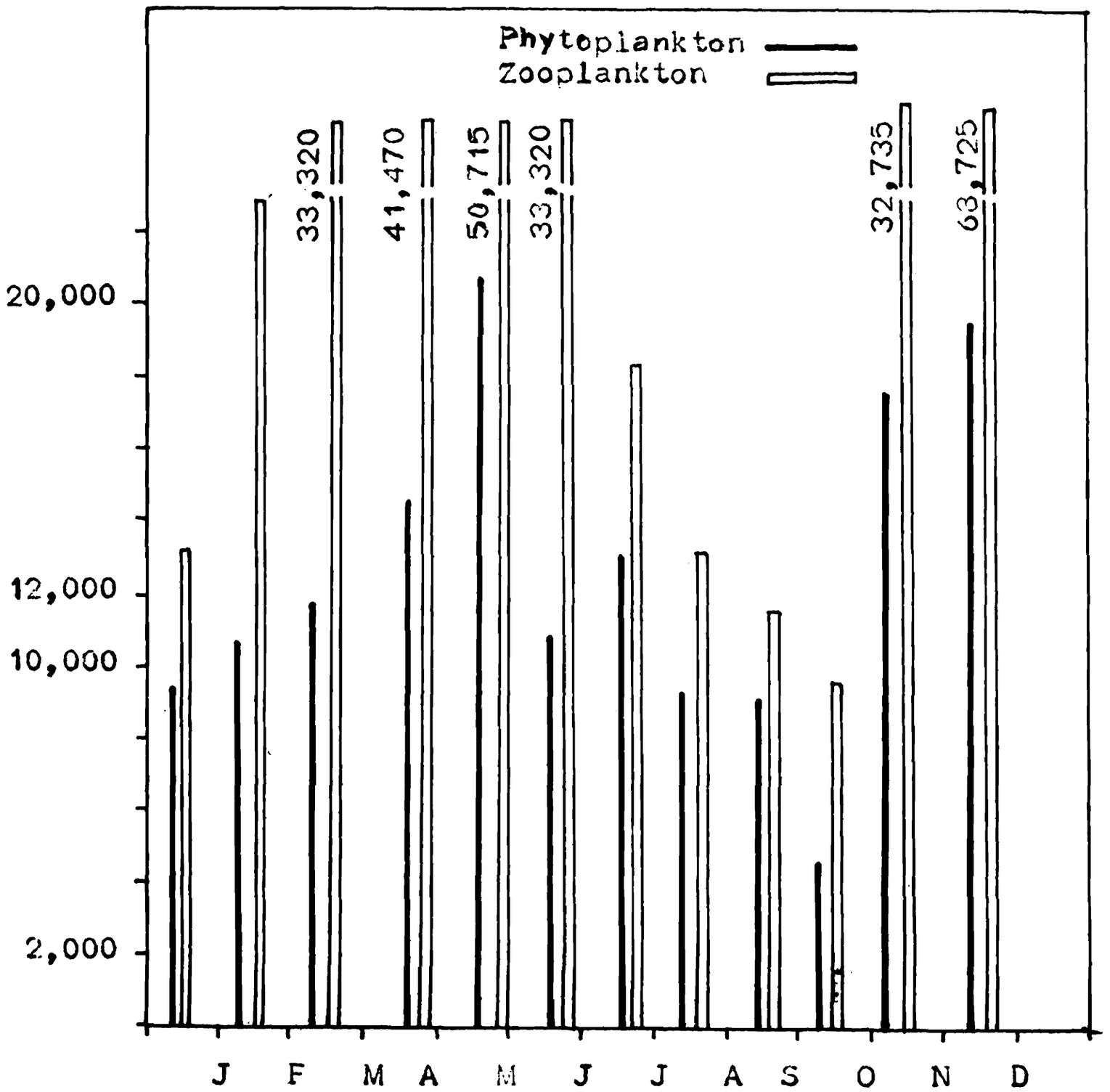

Fig. 2. Seasonal fluctuations in the density of Phyto and Zooplankton of Vedanthangal tank

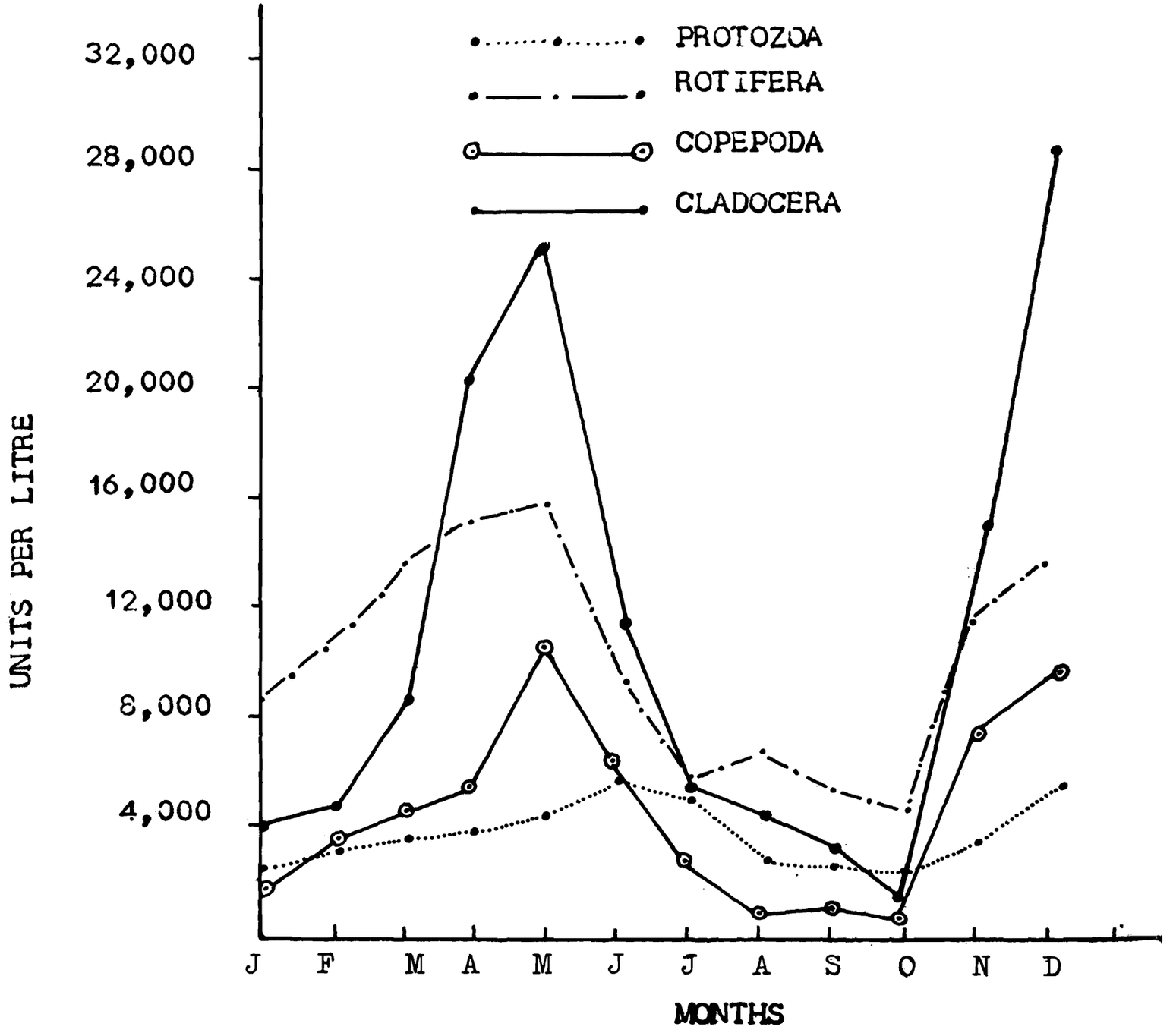

Fig. 3. Seasonal trends in the density of Protozoa, Rotifera, Copepoda and Cladocera in Vedanthangal tank

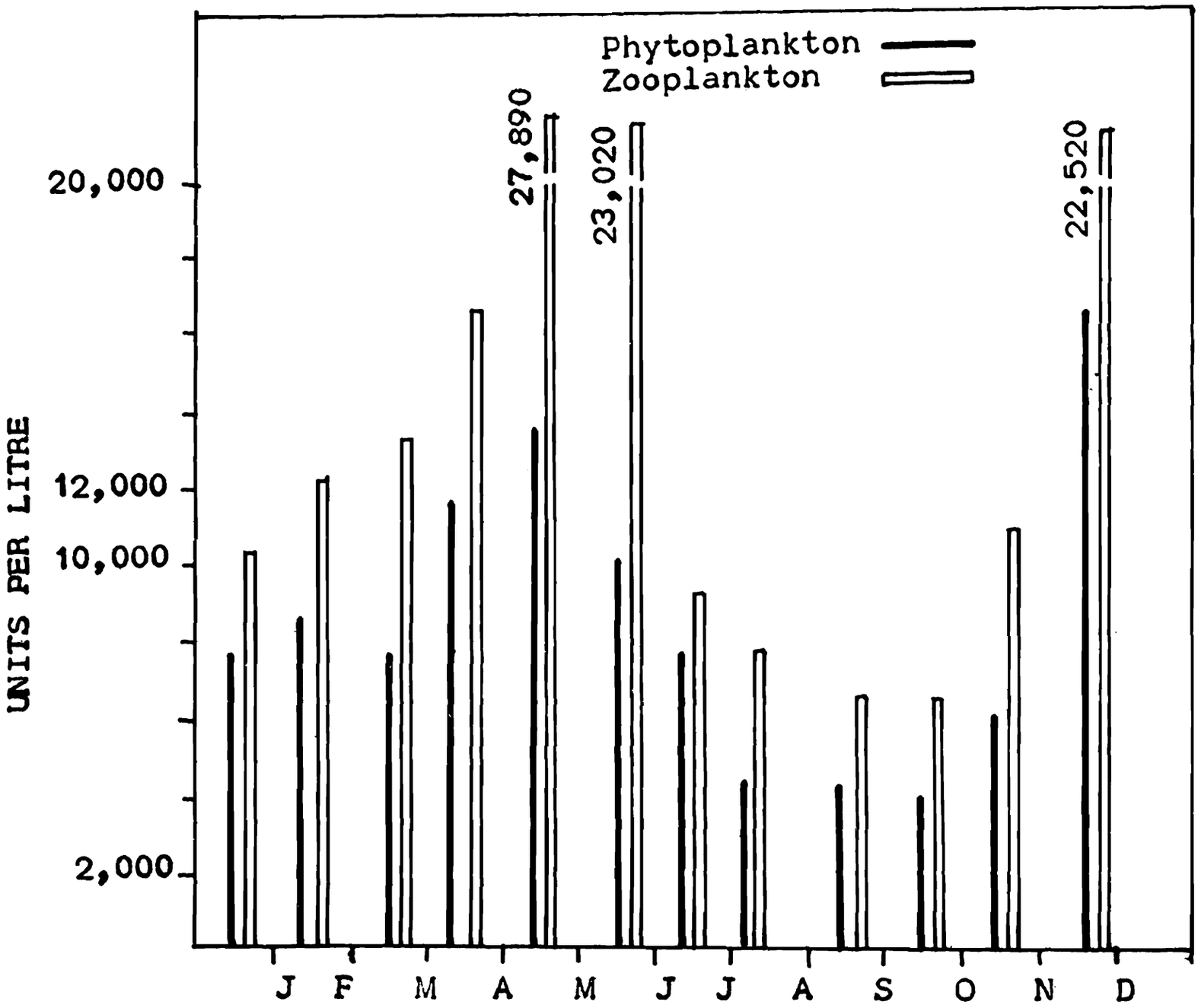

Fig. 4. Seasonal fluctuations in the density of Phyto and Zooplankton of Chenglepat tank.

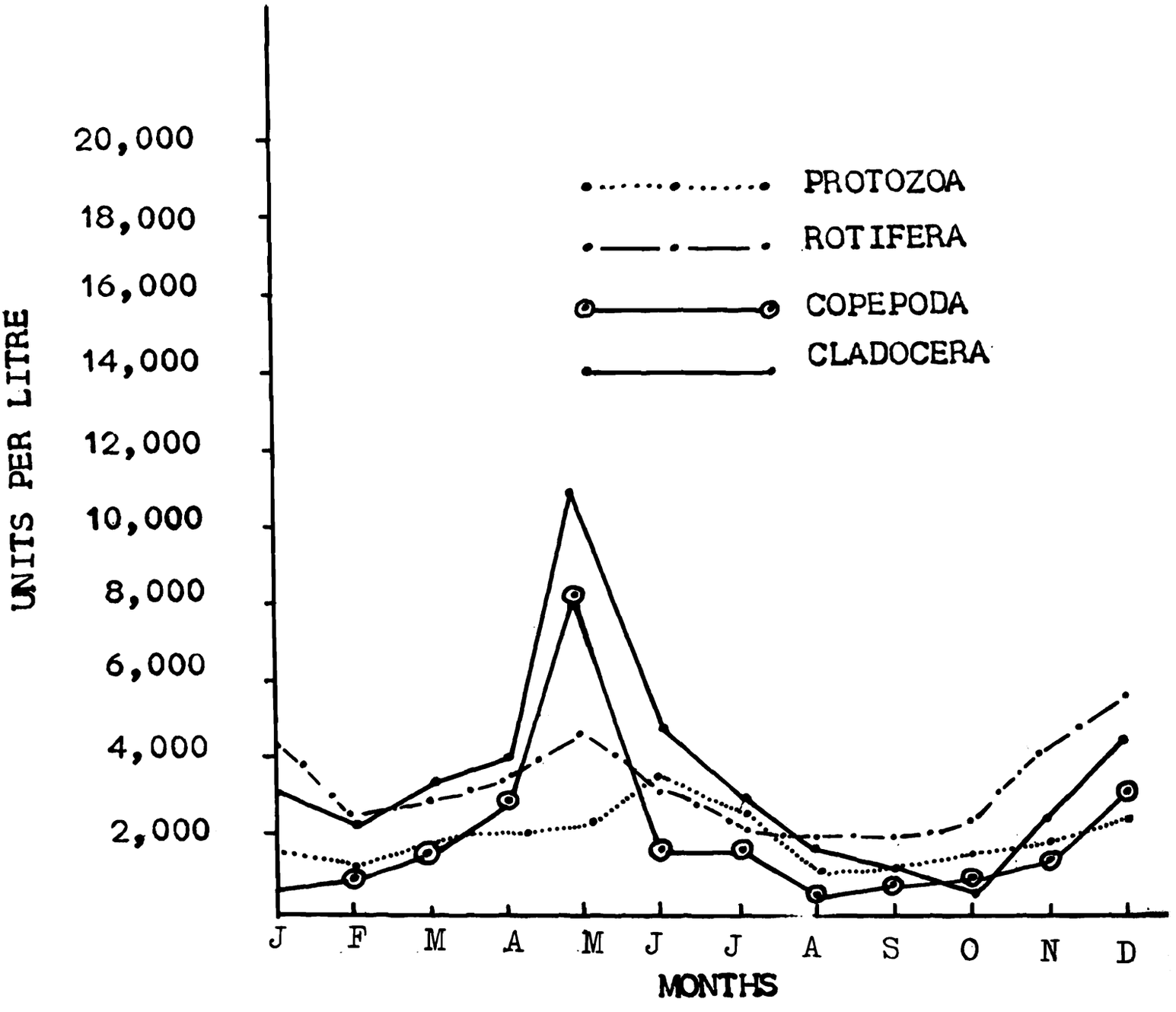

Fig. 5. Seasonal trends in the density of Protozoa, Rotifera, Copepoda and Cladocera in Chenglepat tank.

The Cladocera is represented by *Ceriodaphnia, Moina* and *Cypris*. These organisms also occurred in large numbers in summer (March-May) and winter (November-December). They were, however more in Vedanthangal tank which is rich in nutrients (Arnemo 1965).

The plankton in general, forms an important link in the food chain and any seasonal changes in its qualitative and quantitative composition is reflected in the growth and production of fish. The present study revealed that the phyto-and zooplankton densities in Vedanthangal and Chenglepat tanks indicate that the Vedanthangal tank has rich plankton populations attributed by the high nutrient content due to the bird droppings. The lesser plankton density in Chenglepat tank is mainly due to the presence of lesser amount of nutrients. The results of the present study,therefore suggest that both the tanks can be utilized for aquaculture and Vedanthangal tank may yield more fish than the Chenglepat tank.

SUMMARY

The phyto-and zooplankton populations of two freshwater tanks, viz, Vedanthangal tank which is used as a sanctuary by migratory birds and Chenglepat tank which is not so used is described. The higher content of nutrients in Vedanthangal tank due to the droppings of migratory birds increases the plankton population in it than in Chenglepat tank. The zooplankton was observed to be abundant during summer and winter seasons. Both the tanks can be utilized for aquaculture.

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