

# HYDROBIOLOGICAL FEATURES OF THE KERALA BACKWATERS DURING PREMONSOON AND MONSOON MONTHS

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The hydrobiological features like temperature, salinity, phytoplankton, zooplankton and bottom fauna at twelve stations in the Vembanad lake during pre-monsoon and monsoon months were studied and the results communicated in this paper.

## INTRODUCTION

In recent years the backwaters of Kerala have been a centre of intensive study on hydrography and primary productivity Santhakumari, 1966; Desai and Krishnakutty, 1967; Qasim *et al*, 1968, 1969, (Sankaranarayanan and Qasim, 1969, Qasim and Gopinathan, 1969). But these studies have been largely confined to typically estuarine areas around Willingdon Island, as far as Aroor, which have been termed as Cochin Backwater(s). The backwaters, as has been pointed out recently (Sankaranarayanan and Qasim, *loc cit.*), include a complex system of interconnected lagoons, sawmps and a network of canals which finally terminate into a large lake called the Vembanad Lake (Fig 1). Even earlier studies such as those on temperature and salinity (Ramamritham and Jayaraman, 1963 and George and Kartha, 1963) and on zooplankton (George, 1958) have been restricted to the same area around Willingdon Island. Some observations,

however, on the salinity conditions of the backwaters extending as far as Vembanad Lake were made by Murthy (1965). Since the conditions in the backwaters are highly variable from one region to the other in the same season, it was thought important to extend the investigations as far as Vembanad Lake. Two surveys were therefore made: one in March 1967 and the other in August 1967, for it was thought that these two months depict typical conditions of premonsoon and monsoon seasons and thus a comparison of the two seasons would make the changes very striking.

## MATERIALS AND METHODS

During each survey 12 stations were worked. These have been shown in Fig I. Observations on the hydrographical features included the measurements of air and water temperatures, transparency of water by a Secchi disc, salinity and dissolved oxygen. Five minute zooplankton tows

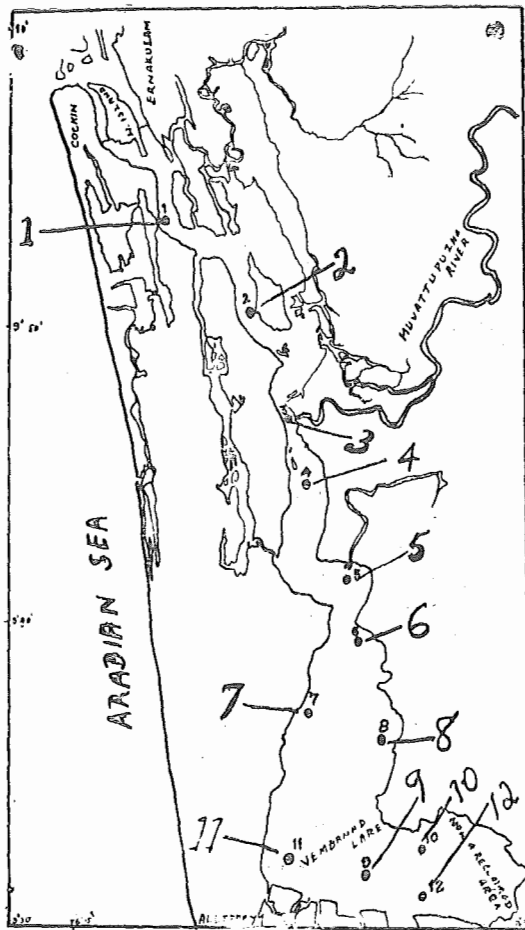


Fig 1

were made by a nylon net of 0.33 mm mesh width which were fixed in 4% formaldehyde. For obtaining phytoplankton samples, 100 litres of water were filtered through a nylon net of 0.065 mm mesh width and the contents were fixed in 2% formaldehyde. Zooplankton volume was estimated by displacement method, while the phytoplankton was expressed in counts/litre. A 'Van Veen Grab', which sampled 0.048 m<sup>2</sup>, was used for the collection of bottom fauna which were passed through 0.5 mm and 0.062 mm mesh sieve and macro- and meio fauna thus obtained were fixed in 4% formaldehyde, identified and counted. After removing the shells and other hard portions they were dried and weighed.

#### General description of the area

The backwater system extends between Cranganor on the north and Alleppey on

the south in the Kerala State. It runs almost parallel to the mainland and maintains permanent connections with the Arabian sea at Cranganor and Cochin. The stations 1-12 were spread over a distance of about 64 km. This region receives 3 major rivers namely, the Pamba, the Achankoil and the Muvattupuzha. The southern end of the lake attains a maximum width of about 13 km. The stations located in the lake had a depth of about 3 m, while the other stations were deeper with depth ranging from 4-6 m. Station 1, situated in the northern part of the backwater, was the deepest (7 m).

#### RESULTS AND DISCUSSION

In March, surface water temperature in between the stations ranged from 28.4 to 31.1°C but in August, there was a decrease in temperature with a range 26.7 to 29.1°C (Fig 2 a and b). The attenuation coefficient ( $k$ ), calculated by the formula  $k = \frac{1.5}{D}$  (Qasim *et al*, 1968), showed that the intensity of light penetration was greater in March than in August (Fig 2 c and d); in the latter season, due to rainfall, turbidity of the water became very high. In March, a progressive decline in the salinity was observed from station 1-12, except at station 5 where the values were a little higher than at station 4 or 6 (Fig 2 e). During this season, the intrusion of sea-water seems to extend throughout the backwater system, as far as Vembanad Lake. Maximum salinity values 31.49‰ at the surface and 31.94‰ at the bottom were recorded at station 1. From this station onwards the salinity progressively decreased until lowest values of 6.13‰ and 7.16‰ at the surface and bottom respectively were recorded at station 12.

In August, the range in salinity at the surface and bottom was much greater. At Stations 1, 2 and 3, surface salinities were

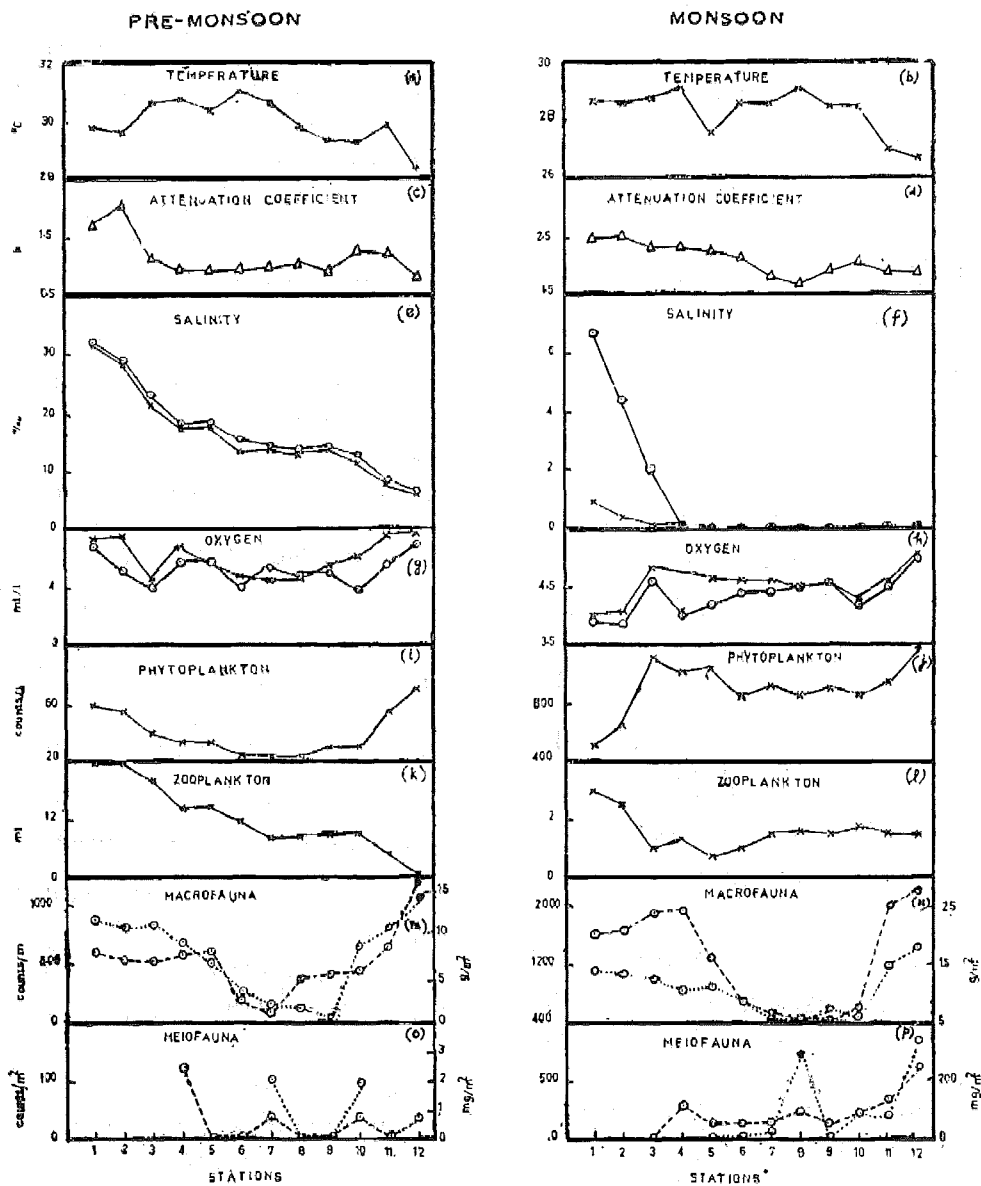


Fig 2

0.93‰, 0.39‰ and 0.14‰ and at the bottom the values were 6.71‰, 4.36‰ and 1.95‰ respectively. From station 4 onwards freshwater occupied the entire region of observation and hence the salinity values were nil (Fig 2 f). Murthy (1965) observed similar decreasing trend in salinity towards the southern extension of the backwater in the premonsoon months. Similarly during the monsoon period, except for the first few stations near the Cochin Harbour, the portions of the backwaters including the lake had

freshwater only.

In March, the *in situ* oxygen values at the surface ranged from 4.50 to 5.00 ml/l and from 3.37 to 4.76 ml/l at the bottom. In August, the range in oxygen at the surface was from 4.00 to 5.05 ml/l and at the bottom 3.85–5.00 ml/l; the highest value being at station 12 (Fig. 2 g and h).

#### Phytoplankton:

Phytoplankton population was relatively poor in March and showed a gradual

decline from stations 1 to 10. At stations 11 and 12, a marked increase in the biomass was noticed, which was mainly because of the freshwater algae, *Spirogyra* (70 counts/litre). Stations 6 to 8 were poorer in phytoplankton abundance, while diatoms such as *Coscinodiscus*, *Chaetoceros*, *Surirella*, *Triceratium*, *Stigeocolonium*, *Pleurosigma*, *Biddulphia*, *Navicula*, *Planktoniella* and *Gyrosigma* were abundant from stations 1 to 6. Their numbers went on decreasing from stations 6 to 8. At the last few stations, *Spirogyra* was the only freshwater green algae present. The blue green algae, *Oscillatoria* and *Spirulina* were fairly abundant at all the stations and *Ceratium sp.* was recorded only from stations 1 and 2 in small numbers (5 counts/litre).

During the August survey, some of the organisms were seen to be very abundant. At stations 1 and 2 the crop was relatively low (500 and 650 counts/litre respectively) but station 3 showed a high count of phytoplankton organisms (1110 counts/litre). This station being near the confluence of the Muvattupuzha river, was predominated by several freshwater organisms. At the other stations also many freshwater organisms were abundant, the highest counts were obtained at station 12 (1200 counts/litre) (Fig 2 i and j). In this survey the abundance of diatom gradually decreased from stations 1 to 11, but the green algae became predominant in the lake, especially at station 12. The latter were represented by *Spirogyra*, *Pediastrum*, *Mougeotia*, *Chlorella*, *Coelopharium*, *Cladophora*, *Closterium*, *Staurastrum*, *Xanthidium*, *Pleurotaenium*, *Kirchnerella* and *Ulothrix*. The blue-green algae namely, *Microcystis*, *Oscillatoria*, *Lyngbia* and *Phormidium* were also abundant.

#### Zooplankton:

In March, the zooplankton biomass was many times greater than that of the August survey (Fig 2 k and l). During this month, a gradual decline in zooplankton volume was noticed from stations 1 to 12. The nature of curve was almost

similar to that of salinity. Stations 1 and 2 showed the maximum volume, whereas station 12 recorded the lowest. Forms such as copepods, lucifers, decapod larvae, medusae, ctenophores, chaetognaths, fish eggs and larvae, *Squilla* and zoea were present in the premonsoon samples. Only fish eggs were noticed at station 12. Most of these forms appeared from stations 1 to 9.

In March, prawn (decapod) larvae constituted a major group of zooplankton. Panikkar and Menon (1955) and Menon (1965) have pointed out that post-larvae of many Penaeid prawns migrate into brackish waters of coastal lakes and estuaries and this migration is attributed to favourable ecological factors such as low salinity conditions and a greater availability of food. The abundance of prawn larvae in zooplankton during the present observation confirms the above findings. The zooplankton biomass was poor in August. Highest volume recorded was only 3 ml at station 1 and the lowest (0.75 ml) at station 5. While station 1 still showed the presence of many organisms such as lucifers, copepods and fish larvae, the other stations were devoid of marine forms; and besides decapod larvae and some copepods, no other marine forms were seen. The small biomass present at these stations included the common freshwater rotifers (*Keratella* and *Trichocera*), cladocerans (*Bosminopsis* and *Ceriodaphnia*) and *Chironomus* larvae.

#### Bottom fauna:

Next to polychaetes, bivalves formed the most dominant group at all the stations during both the surveys; but the latter contributed towards a greater value of biomass, being heavier in weight. Macrofauna occurred in larger quantities during the August survey and maximum number was recorded from station 12 (2229 counts/m<sup>2</sup>), and minimum from station 7 (84 counts/m<sup>2</sup>). Polychaetes were most abundant and these alone gave 1625 counts/m<sup>2</sup> at station 12 (Fig 2 m and n). The highest

biomass was recorded from station 12 during both the surveys. At this station, in March, the value was 14.32 and in August it was 18.71 g/m<sup>2</sup>. These values were largely contributed by bivalves and polychaetes. In March, the density of the meiofauna consisting of nematodes, insect larvae and amphipods, was low (the highest quantity being 125 counts/m<sup>2</sup>), but in August, the meiofauna was more abundant at station 12 which once again gave the highest value (667 counts/m<sup>2</sup> - Fig 2 o and p).

Desai and Krishnankutty (1967) found that bivalves, gastropods and polychaetes were the most abundant benthic forms in the Cochin Backwater. They also observed that the benthic biomass was greater in the regions near the sea and that the abundance of organisms decreased progressively towards the more estuarine zone. This may be true when a small area of backwater is taken into consideration where the fluctuations in the hydrographic features are intense. But when a large area is studied in which the transition from marine to freshwater disappears, more benthic forms become abundant, which are possibly of either entirely freshwater origin or are adapted to extremely low salinity conditions. This possibly explains a gradual increase in the benthic biomass from marine to freshwater zone, especially during the monsoon survey.

#### SUMMARY

Two surveys, one in March and the other in August, were made in the Kerala backwaters. The former depicts hydro-biological conditions of the premonsoon season and the latter those of the monsoon season. In March, the temperature was higher than in August and the salinity over a stretch of 64 km, showed that the intrusion of seawater occurs deep down into the backwater. In August, on the other hand, the sea water influence is felt

only upto a distance of about 15 km and the rest of the area remains freshwater dominated. The phytoplankton crop was poor in March and rich in August, while the zooplankton biomass showed a reverse trend. In March both macro and meiobenthos were low, but in August, they were relatively high.

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#### REFERENCES

- Desai, B. N. and Krishnankutty, M. 1967. *Proc. Indian Acad. Sci.*, 66 (4) 123-142.
- George, M. J. 1958. *Indian J. Fish.*, 5 (2), 375-401.
- George, M. J. and Kartha, K. N. K. 1963. *J. Mar. Biol. Assoc. India*, 5, 178-84.
- Menon, M. K. 1965. *Fish. Technol.*, 2 (1), 12-18.
- Murthy, P. S. N. 1965. *J. Indian G. Union*, 2 (4), 221-223.
- Panikkar, N. K. and Menon, M. K. 1955. *Proc. Indo-Pacific Fish. Coun.* 6 (1), 328-344.
- Qasim, S. Z., Battathiri, P. M. A. and Abidi, S. A. H. 1968 *J. Exp. Mar. Biol. Ecol.* 2, 87-103.
- Qasim, S. Z., Wellershaus, S., Bhattathiri, P. M. A. and Abidi, S. A. H. 1969. *Proc. Indian Acad. Sci.* 69B (2), 51-94.
- Qasim S. Z. and Gopinathan, C. K. 1969. *Ibid.* (6), 336-348.
- Ramamritham, C. P. and Jayaraman, R. 1963. *J. Mar. Biol. Assoc. India*, 5 (2), 170-177.
- Santhakumari, N. 1966. *Curr. Sci.*, 35, 310-311.
- Sankaranarayanan, V. N. and Qasim, S. Z. 1969. *Marine Biol.* 2, 236-247.