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Carbohydrates in the Waters of Ponds of Ramanthuruthu Island, Cochin

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Particulate and dissolved carbohydrates in 4 ponds of the Ramanthuruthu Island (9°58.5'N lat. and 76°15.4'E long.) were studied for 1 yr (1978-79). Particulate carbohydrate concentration varied from 0.2 to 2 mg/l. Dissolved carbohydrate showed high variability and the concentration varied from 0.2 to 11 mg/l. High concentration of particulate carbohydrate observed during monsoon months is believed to be due to high phytoplankton population and also to the large amount of organic matter brought into the estuary by the freshwater discharge. No definite relationship was observed between the chlorophyll *a* concentration and dissolved carbohydrate.

Distribution of dissolved and particulate carbohydrates in the ecosystem is very important as they serve as energy source for plants and bacteria. Moreover the dissolved carbohydrate content also serves as a general indicator of the total primary productivity. Very little is known on the distribution of carbohydrate in the estuarine and nearshore waters except for the works of Kamat[1] and Sumitra *et al.*[2].

Physico-chemical characteristics of tidal ponds in the Ramanthuruthu Island (lat. 9°58.5'N and long. 76°15.4'E) have been studied during 1978-79 to assess their suitability for prawn culture. The environmental conditions of these ponds are reported elsewhere[3]. Distribution of particulate and dissolved carbohydrates in 4 different ponds of the Ramanthuruthu Island is presented here.

Samples were collected from the ponds at fortnightly intervals for 1 yr. In the laboratory 50 ml of the sample were filtered for particulate carbohydrate and duplicate estimations were made on the residue by phenol sulphuric method[4]. Dissolved carbohydrates were estimated in the filtrate in duplicates[4]. GF/C pads were used for the filtration of the samples. Blanks were estimated with the blank filter papers. Chlorophyll *a* extracted in 90% acetone was measured by spectrophotometric method[5]. For phytoplankton counts, water sample (500 ml) was collected and fixed in Lugol's iodine and preserved in 3% formalin. Fortnighly data collected were averaged for the month and plotted.

Particulate carbohydrate—Distribution of particulate carbohydrate in the ponds during different months is given in Fig.1. In all ponds maximum concentration was observed during SW monsoon period (June to September) except in pond 4 where maximum was observed in March and minimum values were observed during December to February. Particulate carbohydrate concentration ranged from 0.2 to 2 mg glucose/l. Monthly variation in the particulate carbohydrate content in all the ponds showed a more or less similar pattern.

High concentration of particulate carbohydrate during the SW monsoon period is mainly due to the large phytoplankton population in all the ponds and also to the particulate organic matter brought into the estuary by the river discharge. Kamat[1] also observed high concentration of particulate carbohydrate in the nearshore waters of Goa during SW monsoon season. Higher concentration of particulate carbohydrate in

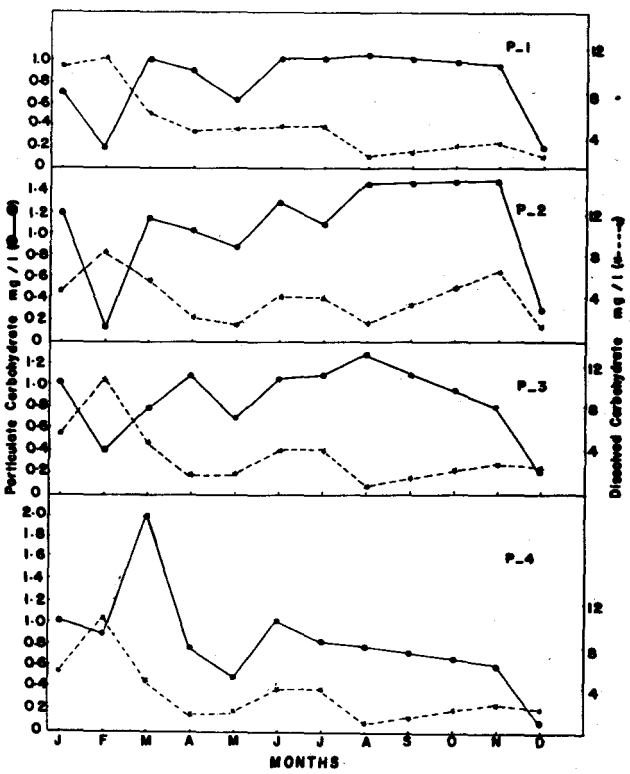

Fig. 1—Distribution of particulate and dissolved carbohydrates in various ponds during different months

pond 2 is due to relatively dense phytoplankton population (Fig.2). Marshall and Orr[6] observed an increase in the concentration of particulate carbohydrate associated with an increase in the diatom number. The lower particulate carbohydrate content during the period December-February could be attributed to the lesser phytoplankton counts (Fig.2).

Particulate carbohydrate content and chlorophyll *a* concentrations are plotted against each other and there is no significant correlation between them in all the ponds, indicating clearly the contribution of particulate carbohydrate from other sources also.

Bordovsky[7] has observed a decrease in particulate carbohydrate concentration due to the utilisation by the filter feeders. The zooplankton population in all the ponds is poor throughout the year[8]. In the absence of zooplankton and other filter feeders the utilisation of phytoplankton could be minimal in all the ponds. Living zooplankton also does not seem to contribute to the particulate carbohydrate since no zooplankters were observed on the filters. It is likely that much of the detrital material formed during the productive season sinks and collects on or near the bottom of ponds. This supports high levels of benthic population and in turn the growth of prawns in these ponds. Fast growth rate of prawn in cages have been reported by Paulinose *et al.*[9].

Dissolved carbohydrate—Dissolved carbohydrate levels showed high concentration in all the ponds during January to March (Fig.1). There are 2 peaks, a larger one during January to March and a small peak during SW monsoon season. The levels showed a high variability in all the ponds during different months of the year and the concentration varied from 0.2 to 11 mg/l. High variability in the dissolved carbohydrate content in various freshwater ponds is also reported by Sumitra Vijayaraghavan[10]. The seasonal trend in the distribution showed a more or less similar pattern in all the ponds.

It is known that the dissolved carbohydrate is a metabolic product of living organisms as well as a breakdown product of dead organic matter. Wangersky[11] has estimated that 10 to 20% of carbon is released to the environment by the actively growing phytoplankton population and also observed higher rates of release when the population is subjected to extreme stress. In the ponds of Ramanthuruthu Island the phytoplankton is high throughout the year and this is well reflected in the distribution of chlorophyll *a* also. During certain months of the year phytoplankton bloom is observed in all these ponds, but this feature is not well reflected in the distribution of dissolved carbohydrate. Emery[12] reported an inverse relationship between chlorophyll *a* and dissolved carbohydrate during the chlorobium bloom. The

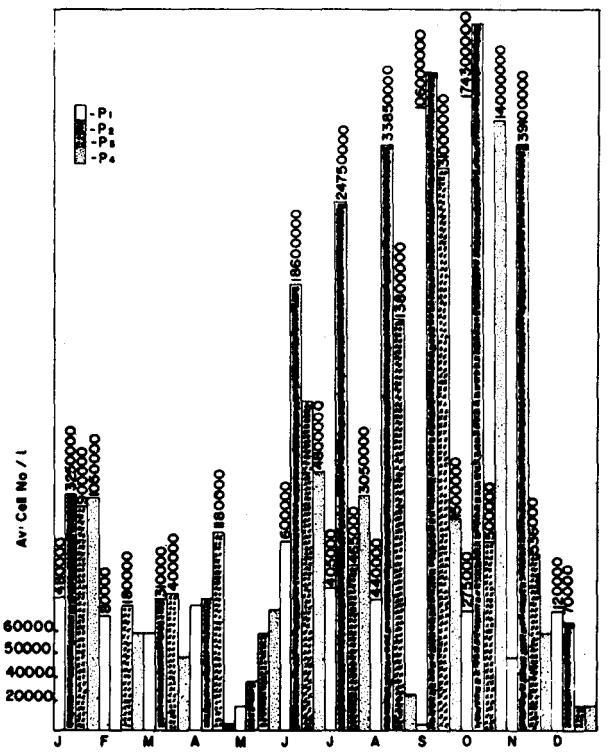

Fig. 2—Phytoplankton population in various ponds during different months of the year

blooms of *Skeletonema costatum*, *Euglena* sp. and *Polytoma* sp. observed in the ponds of Ramanthuruthu Island during July did not indicate any clear relationship with the dissolved carbohydrate. But during the bloom of *Nitzschia closterium* there was an increase in the concentration of dissolved carbohydrate showing a direct relationship with the *Nitzschia* sp. bloom. Walsh[13,14] who studied the dissolved carbohydrate in a semienclosed natural system in a small pond in Massachussetts observed a loss in dissolved carbohydrate corresponding to spring bloom of diatoms with a later seasonal high, produced by a bloom of photosynthetic bacteria. In Ramanthuruthu Island waters also, such phenomenon may be taking place. In general, the dissolved carbohydrate content did not show any clear relationship with the chlorophyll *a* concentration.

Very little is known about the release of dissolved organic materials by zooplankton, although it would seem reasonable that such release may take place, if only through metabolic efficiency. As mentioned already the zooplankton population in these ponds is very poor; so any substantial contribution from this could be ruled out.

All these ponds have been traditionally used for prawn culture and afford favourable environment for the growth of prawns.

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