

OBSERVATIONS ON THE ECOLOGY AND FISHERIES OF THE PULICAT LAKE DURING DROUGHT AND NORMAL PERIODS

K. RAMAN, M. KALIYAMURTHY AND K. O. JOSEPH

*Madras Research Centre of the Central Inland Fisheries Research Institute,
110, Perambur High Road, Madras-600012*

ABSTRACT

A comparative study of various ecological factors of the Pulicat Lake in relation to fishery during a severe drought season in 1975 and a normal season in 1976 is presented. High salinity and temperature condition has affected the plankton production, whereas very low oxygen level has resulted in heavy fish mortality during the closure period of the bar mouth of the lake. For improving the fishery, keeping the present bar mouth permanently open and establishing another connection with the sea at the northern end of the lake are suggested.

INTRODUCTION

LAKE PULICAT, one of the largest salt water lagoons on the east coast of India is an interesting ecosystem with an average water spread area of about 350 km². Its average depth is about 1 m and is connected to the Bay of Bengal through a narrow (200 m) and shallow opening. The lake is subjected to tidal oscillations (30 cm) which is felt upto 8-10 km interior. Detailed description of the lake and its topography have been given by many authors (Chacko *et al.*, 1953; Rao, 1971; Raman *et al.*, 1975). Due to limited freshwater supply and tidal action, the mouth of the lake gets silted up and closed during dry seasons. Chacko *et al.*, (1953) have reported that the mouth of this lake gets closed every five years. But of late due to frequent failure of monsoon in this area, the closure of mouth became almost an annual feature from 1971 to 1975, the period of closure increasing from year to year, resulting in steady decline in fish landings (Anon, 1975). Invariably closure took place around premonsoon period (June/July) and lasted till the outbreak of monsoon (November/December).

The bar mouth plays an important role in estuaries in maintaining a dynamic state of environmental condition induced by tidal incursion from the sea and freshwater discharge from the river. The influx from the sea is greatly responsible for minimising fluctuations in physico-chemical conditions in lagoons (Tampi, 1959). Ingression of fish and prawn seed is effected through the mouth of estuaries and lagoons which form the nursery ground for them to feed and grow. Therefore, it is needless to say that the closure of mouth has a profound influence on the environmental features and fisheries in estuaries and lagoons.

Though lot of work has been done on the hydrography, plankton, primary production, bottom flora and fauna of the Pulicat Lake (Chacko *et al.*, 1953; Michael, 1970; Krishnamurthy, 1971; Rao, 1971; Sreenivasan and Pillay, 1972; Kaliyamurthy, 1973, 1975; Rao, 1974; Raman *et al.*, 1975; Radhakrishnan, 1975), no information is available on the interesting aspect

on the ecology and fisheries of this lake during drought. The year 1975 experienced severe drought, owing to failure of monsoon, and the mouth also remained closed for nearly eight months. So this year was selected for a detailed study in comparison with a normal year (1976 without closure of mouth).

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MATERIAL AND METHODS

Fortnightly observations were made on hydrobiological features. Water samples for physico-chemical studies were collected from five stations in the southern zone and three stations from northern zone and were analysed using standard methods. Plankton samples were also collected simultaneously from the same stations. Methods of collections and analysis are the same as described earlier (Raman *et al.*, 1975). The monthly data collected from stations 1 to 5 and 6 to 8 were grouped to represent southern and northern zones respectively.

OBSERVATIONS

Temperature : The zone-wise surface water temperature (Fig. 1 b) showed no marked trend in its seasonal fluctuations. Due to practical difficulties temperature readings were made at different times of the day in various sampling stations (Raman *et al.*, 1975). This may be the probable reason for the lack of any pattern in its seasonal variations. However, lower and higher values were recorded in monsoon and summer respectively in both the zones. During the period of closure of the mouth (March to October) temperature was uniformly higher when compared with the corresponding period of 1976.

Salinity : As observed by earlier workers, salinity showed very wide variations in its seasonal fluctuations, particularly in the northern zone. Salinity started rising from March, 1975 till it reached the peak in September and a steep fall was noticed particularly in the northern zone in October when the mouth opened due to heavy floods. Though the lake water attains hyper-saline even in normal years (Rao, 1971; Sreenivasan and Pillay, 1972; Raman *et al.*, 1975), very high values were recorded during the closure period (Fig. 1 a).

Dissolved oxygen : As in the case of temperature, dissolved oxygen also was recorded during different times of the day. However, a general picture of the oxygen regime could be drawn from the present observations. More or less a negative correlation is seen between dissolved oxygen, salinity and temperature. During the closure period very low (2.1 to 3.2 ppm) values, particularly during May to August in the northern zone, were observed (Fig. 1 c).

Plankton : Generally both phyto-and zoo-plankton were at their lowest ebb during the year 1975 (Fig. 1 d, e). But, during the closure period several collections particularly from the northern zone of the lake contained lot of debris and no plankters. During this period *Oscillatoria*, *Pleurosigma*,

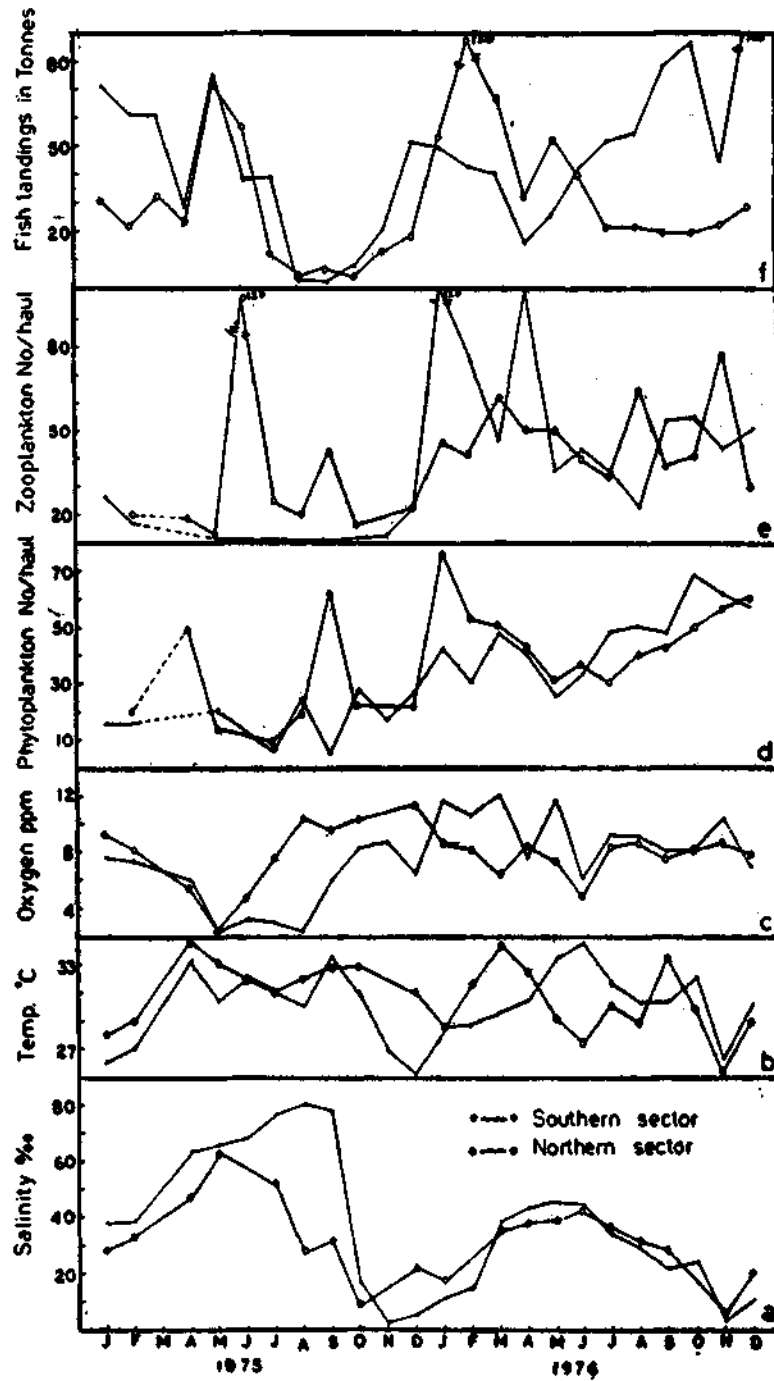


Fig. 1. Seasonal variations: a. salinity, b. temperature, c. dissolved oxygen, d. phytoplankton, e. zooplankton and f. fish landings.

Nitzschia, *Amphora*, *Acartia*, *Mesopodopsis* and nauplii were the plankters occasionally met with, in contrast to normal periods when the plankton was rich both in quantity and quality.

Fisheries : An average of 1000 tonnes of fish is landed annually from this lake. But during the year 1975 landings were only to the tune of 760 tonnes, about 23% less than the previous year. In 1976, 1084.4 tonnes were recorded which could be considered as near normal yield from the lake. The interesting feature of the fishery of the lake during 1975 is a steady fall in landings from May till the bar opened in October, after which the landings gradually improved. During 1976 one peak in January to March and another one in August to December were observed in the southern and northern zones respectively (Fig. 1 f). During the months of May and June 1975 heavy mortality of fishes was noticed. Big-sized dead fishes were found floating in the water. Fishes found dead were mainly *Mugil* spp., *Gerres* spp., *Tachysurus* sp., *Triacanthus* sp., *Brachirus* sp., *Therapon jarbua* and eels (Anon, 1975).

DISCUSSION

From the foregoing account it could be seen that the closure of mouth had lowered the biological productivity by altering the environmental features. During the closure period salinity and temperature were very high and consequently the dissolved oxygen was very low particularly in the northern zone. As mentioned earlier the dissolved oxygen estimations were made during the day time. So it can be reasonably assumed that the oxygen level might be further depleted during night in the northern zone as this area is heavily infested with macrovegetation. Therefore, it can be presumed that the fish mortality observed during May-June might be due to oxygen deficiency than due to higher salinity, since many of the commercially important fishes like *Mugil cephalus*, *Gerres* spp. *Nematolosa nasus*, etc. are known for their tolerance to very high salinities (Nair *et al.*, 1965.)

Sometime after the closure of the bar-mouth, when water level was very much reduced, due to drought fishes congregated in deeper areas and were caught by repeated shore seining which resulted in heavy catches. Later on steady decline in catch was noticed as all the fish were caught already and the remaining were killed by the adverse environmental conditions, particularly low oxygen. This may explain the lowest fish yield recorded during 1975.

Salinity has been found to be an important ecological factor controlling the abundance of many phytoplankton organisms in estuaries. Most of the phytoplankters prefer lower salinities for their growth (Bhattathiri and Devassy, 1975). Though temperature has no apparent effect on the plankton production, uniformly higher temperature will affect it (Qasim *et al.*, 1969). Therefore, very low plankton production recorded during the closure period may be due to higher levels of salinity and temperature.

The present observations show that incursion of sea water through the bar mouth was responsible for maintaining the environmental features without going to extreme conditions, particularly in the tidal southern zone. This is in conformity with the views of Tampi (1959). Occurrence of hypersaline

waters at the northern zone, even during normal years, suggest that the tidal circulation brought about by the present bar mouth is not quite sufficient. Therefore, if another mouth could be established at the northern end at Kodimunai, 40 km from the present mouth, where already a seasonal opening is present (functioning only during flood seasons), and the present one maintained in an open condition by mechanical means, the environmental conditions of the lake could be improved which will result in higher biological productivity and fish yield.

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