

CHANGING ECOLOGY OF COCHIN BACKWATERS

S. Z. QASIM AND M. MADHUPRATAP

National Institute of Oceanography, Dona Paula, Goa-403 004

ABSTRACT

Environmental features of Cochin backwaters have been studied fairly well during the past 10 years. In recent years several man-made changes in the backwaters have introduced marked changes in their ecology. The construction of Thanneermukkom Bund has led to stagnation of water resulting in large accumulation of the 'African payal' *Salvinia* sp. in the upper reaches of the estuary. The construction of a supertanker berth, reclamation of wetlands for housing and other engineering works have affected the fauna and flora adversely. The increasing loads of sewage and industrial wastes in the estuary have created conditions which are extremely destructive to plants and animals of the estuary.

INTRODUCTION

Tropical estuaries are productive ecosystems and form natural mixing areas between marine and freshwater zones. The estuaries are important bodies of water for human use such as fisheries, transport, recreation etc. Moreover, many animals spend, either partially or wholly, their life in estuaries. However, the proximity of estuaries with land renders them highly vulnerable to man-made changes such as engineering works and pollution and these activities lead to progressive changes in the ecology of the estuaries. Therefore, periodic monitoring of the environmental features of the estuaries will indicate the changes in the environment occurring with time.

The backwaters of Kerala, located between Azhikode and Alleppy (09°30'—10°10'N, 76°15'—76°25' E), form a large area (250 sq. km) of shallow, semi-enclosed body of brackish water running parallel to the coastline (Fig.1). Several rivers (Periyar, Pamba, Meenachil and Muvattupuzha) and a network of canals empty themselves into the backwaters discharging large quantities of fresh water during the monsoon months. The backwater system has two permanent openings to the sea one at Cochin and the other at Azhikode. At Cochin the connection is about 450 m wide and forms an entrance to the Cochin harbour. At the northern end of the backwaters (Azhikode), there is another connection with the sea.

Constant mixing with the sea water through tidal exchange gives the backwaters the characteristics of a typical estuary. The channel leading to the harbour at Cochin is periodically dredged and maintained at a particular depth for shipping. The channel area has a depth of about 15 m but the other parts of the estuary are shallow and the region south of Cochin gradually becomes shallower from a depth of 7 m at Aroor to about 2 m at Alleppey. The area north of Cochin to Azhikode is uniformly shallow, with depth ranging between 2 m to 4 m. The bottom of the estuary is generally muddy.

The state of Kerala is heavily populated and the entire backwater system is a centre of intense human activity. The estuary receives a number of sewage drains and industrial effluents. Rapid urbanization and industrialisation, especially around Cochin, and several recent engineering works nearby have changed the ecology of the backwaters. Since the backwaters have been one of the well-studied environments of India, and considerable amount of information is available, it is possible to enumerate the changes that have occurred in the backwaters during the past 10 years or so.

General hydrography

Tides in the backwaters are of a mixed semidiurnal type with a range of about 1 m in the harbour area (Qasim & Gopinathan 1969). Light penetration in the backwater is affected by the turbidity. The euphotic zone varies from 2 m to 6 m with the attenuation co-efficient (k) ranging from 0.60 to 3.00 (Qasim *et al.*, 1968).

The seasonal monsoons have a profound effect on the general hydrography of the backwaters, and each year, with the return of monsoons, the system becomes freshwater dominated. The salinity in the estuary declines rapidly and largely depends upon the place and depth of observation. After the monsoon the system gradually becomes sea water dominated and during the premonsoon months (Feb-April), the salinity ranges from about 34‰ at the mouth of the estuary (Cochin) to 13‰ in the upper reaches (Haridas *et al.*, 1973). Surface temperature usually varies from 31°C to 27°C. A higher oxygen content at the surface usually found during the monsoon months is because, due to high turbidity primary production is largely confined to the surface (Qasim *et al.*, 1969). During the pre-monsoon months the estuary becomes well mixed and homogeneous conditions prevail whereas during the monsoon and postmonsoon months a clear stratification occurs in the water column with low salinity water at the top and high salinity water at the bottom. Cold, high salinity water, identified as upwelled water coming from the coastal regions of the Arabian Sea has been found to enter the channel area of the estuary at Cochin during the monsoon period. (Ramamirtham & Jayaraman, 1963).

Apart from these aspects, several other environmental features of the estuary have been studied by Sankaranarayanan and Qasim (1969), Gopinathan and Qasim (1971), Gopinathan (1972), Wellershaus (1972) and Shynamma and Balakrishnan (1973).

RECENT CHANGES

(a) *Thanneermukkom Bund*

This bund is 1447 m long and was completed in 1975 (Fig. 1). It forms a dam across the backwaters (Plate 1,a) and cuts off the Vembanad Lake from the rest of the backwaters. It was constructed at an approximate cost of about 78 million rupees with the aim of preventing the salt water entering into the lake so as to use it for paddy cultivation. The water flow is regulated with spillways in the bund which

are kept open during the monsoon months but are closed during the pre-monsoon period.

(b) 'African payal'

The weed *Salvinia auriculata* known as the African payal, is believed to have come by accident from Africa or South and Central America to the backwaters. Within a few years it has become a major menace to the backwaters by its prolific spreading (Plate 1, b).

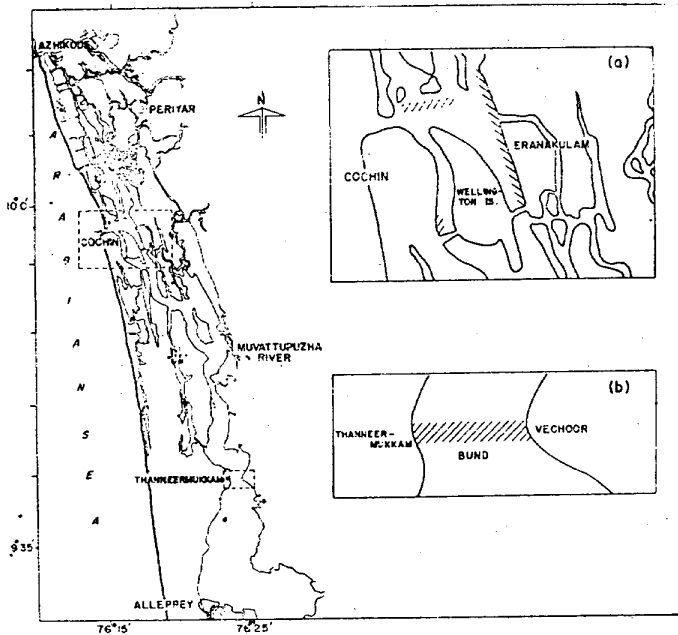


Fig 1. Map of the Cochin backwaters from Azhikode to Alleppey. Inset (a) shows the backwater system at Cochin with its main connection with the sea. Inset (b) shows the portion of the backwater where Thanneermukkom Bund has been built.

(c) Other Engineering Works

A large area of the backwaters around Vallarpadom and Ramanthuruth (near the mouth of the estuary) has been used for the construction of a jetty for oil tankers in 1975. This has resulted in changing the pattern of water flow causing severe depletion of oyster beds and leading to appreciable reduction in the spatfall and settlement of oyster larvae (Purushan, 1978). Heavy siltation occurring in the backwaters (Gopinathan & Qasim, 1971) resulting from dumping of dredged material has led to the formation of several small islands close to the harbour area. The reclamation work constantly going on further leads to the depletion of fauna and flora. The reclamation of large portion of the water front and the construction of fisheries harbour are the other changes that have taken place in the backwaters in recent years (Fig. 1).

CHANGES IN ECOLOGY

The Vembanad Lake area was known to be rich in its fishery particularly of the prawn *Macrobrachium* sp. and the pearl spot *Etroplus* sp. The construction of Thanneermukkam Bund across the backwaters as a barrier to the entry of saline water has prevented the entry of prawns and fishes with the result that there is practically no fishery left in the upper reaches of the backwaters.

Prior to the construction of the bund, salt water used to enter the Vembanad Lake after the monsoon causing the decay of *Salvinia*. At present this area remains fresh water dominated throughout the year resulting in choking of the entire Vembanad Lake and its associated canals and paddy fields of Kuttanad, with *Salvinia*. Moreover, there used to be a regular flushing of the backwater due to tidal influence which has now ceased causing stagnation of water. During the monsoonal outlet of fresh water when the spillways remain open, enormous quantities of weeds are flushed into the rest of the backwater system. The accumulation of weeds has resulted in preventing the light penetration into the water column and thereby affecting the phytoplankton productivity. It has also severely affected the water transport system in the backwater which has a large network.

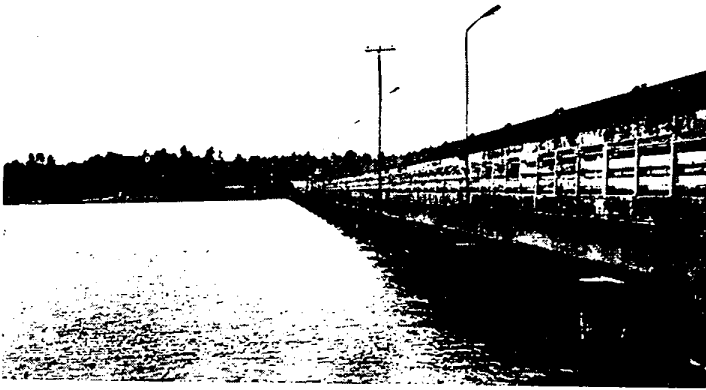
About 1000 tonnes of pesticides are used in the Kuttanad area every year during paddy cultivation (KSSP, 1978). The accumulation of pesticides owing to stagnation of water has severely affected the water quality of the area causing problems in the supply of drinking water from the wells which get affected due to seepage and very often leading to health problems.

Before these changes occurred in the estuary, prawns worth about Rs. 50,000/- used to be caught every day from the Vembanad lake area, but after the completion of the bund there is practically no catch from the lake (KSSP, 1978). The other estuarine fishes which used to enter this area along with the entry of sea water have also disappeared after the bund was completed. The operation of stake nets within and outside the bund has become difficult as there is no flow of water. The problem becomes very acute because of the accumulation of *Salvinia* along with another water weed *Eichornia* sp., which spread out over the water surface like a carpet rendering fishing operation almost impossible. The bund and the weed accumulation has also severely affected the benthic ecology of the area.

The Vembanad Lake has very rich clam shell deposits (mostly *Villorita* and *Meretrix* spp.) which are being recovered and utilized by factories like the Travancore Cements Ltd. and Travancore Electrochemicals Ltd. for the manufacture of cement and chemicals and also by the lime manufacturers. The stagnation of water and weed accumulation are rapidly changing the nature of the substratum affecting clam shell recovery.

Benthos of the Cochin backwaters have been studied by Desai and Krishnakutty (1967) and subsequently by Kurian (1972) and more recently by Ansari (1977). From these studies it has become clear that the density of bivalves, gastropods and

PLATE - I



(a)



(b.)

Plate 1. a View of the Thanneermukkam Bund.
b Congregation of *Salvinia* along the shore.

isopods in the backwaters has shown considerable reduction with time. This has been attributed to increasing pollution in the backwaters.

The backwaters receive large quantities of sewage from Cochin and nearby areas. Industrial wastes are being discharged into the backwaters from the factories situated along the industrial belt at Kalamassery and Udyogamandal. Considerable amount of oil pollution also exists in the harbour area. Further, there are several coconut husk retting areas in the backwaters and several prawn peeling sheds disposing off their wastes into the estuary. A recent study (Remani, 1979) indicates that in some of the polluted areas, the BOD values reach 513.76 mg/L, sulphide 4.97 mg/L and oxygen content becomes less than 0.05 ml/L. The effects of industrial pollution are clearly seen in the form of depletion of biota especially benthic organisms, fish mortality and presence of high ammonia in the water. Some of the benthic organisms such as mussels and oysters have accumulation of zinc higher than the permissible limit (Purushan, 1978; Remani, 1979).

The findings of Gore *et al.*, (1979) have indicated an intense faecal contamination in the backwaters resulting in a high density of coliform bacteria in the water and sediments. The fishes and bivalves collected from the backwaters have been found to contain a rich population of these coliforms rendering them unsuitable for human consumption. Marked increase in the concentration of phosphorous and nitrogen compounds have been found in the backwaters as compared to earlier data collected by Sankaranarayanan and Qasim (1969). This kind of eutrophication of the system can lead to dense phytoplankton blooms associated with a high oxygen demand and considerable decrease in estuarine life. Cochin backwaters were once well known for its capture and culture fishery and the total annual landings have been reported to be about 17,000 tonnes (George & Sebastian, 1970). The man-made changes in the backwaters is affecting the fish production drastically.

From the foregoing account it is clear that in about 10 years the changes occurring in the backwaters have been so rapid that it is hard to believe that this estuarine system, well known for its beauty and lush-green surroundings earlier, is really the same. The damage caused to the backwaters, largely because of many unimaginative human activities is so severe that within the next few years there will be no fauna and flora left. The man-made changes are totally out of proportion causing damage to the ecology of the backwaters beyond repair. If no suitable measures are taken immediately the entire area famous for its rich life only a decade ago, will become virtually dead very soon.

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