

Executive summary of Minor Research Project

“SEASONAL PHYSICO-CHEMICAL CHANGES ON BENTHIC PRODUCTIVITY AND FISHERY POTENTIAL OF MANGROVE ECOSYSTEM WITH SPECIAL REFERENCE TO MANGALAVANAM, COCHIN, KERALA ”

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Mangroves have aroused the interest and curiosity of mankind from the earliest times for various purposes, whether it was for utilizing them for the forest products they yield or the fisheries they support or to broaden our knowledge about them through scientific studies.

Mangrove forest is a component of wetlands that has been recognized as one of the most productive ecosystem. Mangalavanam is an ecologically sensitive area (9°54'N 76°18'E) having an area of 0.0274km²(2.74hectares), located in Ernakulam district, Kerala. It is a patchy mangrove area in the heart of Cochin city. The Mangalavanam is often regarded as the "Green lung of Kochi" due its role in keeping the city's air pollution under control to a certain extent. The area is a roosting place for many kinds of resident and migratory birds.

Physico-chemical analysis of water and edaphic factors of Mangalavanam mangrove forest, Cochin, India, was studied at different sites during pre-monsoon, monsoon and post monsoon.

A seasonal variation in these parameters was observed throughout the study period and seasonal comparisons were made. Benthic and fishery potential was also carried out seasonally. Faunal composition was low and exhibits seasonal variation. Monsoonal floods affect the soil fertility and faunal composition. Only slight annual variations could be observed.

In this study , the present status of mangrove vegetation prevailing in the area , the influence of water quality parameters and edaphic factors on this mangrove distribution, the extent of soil fertility and benthic productivity, and the fishery potential from the area under study were assessed. Effective measures for the proper management of Mangrove forests of Mangalavanam were suggested.

The present study was conducted during pre-monsoon, monsoon and postmonsoon. This mangrove under study is situated in the heart of the Cochin city on Dr. Salim Ali Road near the High court of Kerala. This is declared as a bird sanctuary by the Government of Kerala. This area is considered to be functioning as the lungs of the city, adjoining the Kochi backwaters and the Arabian Sea. It consists of a shallow lake in the middle, with its edges covered with thick mangrove vegetation. Three sites within mangrove area were selected for sampling, S1, S2, S3. S1 is the region of water body near to the shallow lake in the middle. Water body is deeper than the other sites. S3 is near to the coastal region and is shallow. S2 is the region in between S1 and S3 with decreasing depth.



General hydrographical parameters and nutrients of the surface waters were analysed using standard methods (APHA 2005). Mangalavanam mangrove forest consists of primarily of *Avicennia officinalis* with occasional patches of *Acanthus ilicifolius* and *Rhizophora mucronata* species. This mangrove forest is home to different exotic and rare migratory birds. Forty one species of birds were recorded from Mangalavanam representing 12 orders

and 24 families and the most common bird species found here are little cormorant (*Phalacrocorax niger*) and night heron (*Nycticorax nycticorax*). But the urban anthropogenic developmental pressure has spelled doom for the sanctuary. The heavy vehicular traffic, siltation and waste deposition in the area and piling up of non-biodegradable waste in the water body are some serious issues regarding this sanctuary. This is an almost closed system with a single narrow canal link to the estuary and this canal is the only source for tidal propagation. During low tide, the water in the system is completely drained. In mangalavanam the identified species are *Acanthus ilicifolius*, *Avicennia officinalis*, *Acrostichum aureum*, *Avicennia marina*, *Bruguiera parviflora*, *Bruguiera gymnorhiza*, *Derris trifoliata*, *Kandelia candel*, *Lumnitzera racemosa*, *Rhizophora mucronata*, *Rhizophora apiculata*, and *Sonneratia caseolaris*. *Avicennia officinalis* and *Bruguiera* sp. are the dominant species found in this area. They grow densely on the shoreward side, while *Acanthus ilicifolius* occur in the interior of the mangrove forest. *Derris trifoliata* is a conspicuous climber on mangal. Less dominant and scattered species include *Acrostichum aureum* and *Rhizophora apiculata*.

From the study south west monsoon has a profound influence on the study region, creating seasonal variations in the hydrological parameters. The variations in hydrographical parameters could be attributed to the environmental setting.

In the study area salinity varied widely and the near fresh water condition seen during the monsoon season was gradually transformed to a marine condition during pre monsoon season. However true marine condition could be observed only during the pre monsoon season. Hydrographical variations are due to environmental changes. Mangalavanam was less alkaline and showed high nitrate and low silicate concentrations. Because of the almost closed nature of the study area there could be limited exchange with estuary. Salinity plays a role in seasonal variations of phosphate as it controls the flocculation and sedimentation mechanisms in estuarine environments, changing the availability of elements (Kautsky, 1998). Mangalavanam is a congregation of birds. The bird excreta and their remains are not effectively flushed away by tides as this mangrove ecosystem is linked to Cochin estuary which is a microtidal estuary by a narrow canal, the only source of tidal propagation. This leads to the settling of bird guano and dead remains of birds, a rich source of phosphorus, and resulting the reaction between bird guano and clay minerals (Onac and Veres, 2003). Eh analysis revealed that this system is highly reducing during tidal influx. There are reports regarding the highly anoxic condition in this mangrove ecosystem (Rosily, 2002).

Geochemical characteristics of mangrove sediments based on various parameters viz., organic matter content, water table fluctuation, bioturbation (Clark et al 1998), type of vegetation (Kryger and Lee (1996) and ground water movement (Baltzer, et al 1995).

Analysis of the general sedimentary parameters showed the predominance of fine substratum and silt was the major fraction in all seasons in the mangrove sediments. High redox potential indicates anoxic condition and was found to be highly reducing and might be attributed to the high organic matter content. The texture of the sediment has a major role in benthic faunal diversity (Badarudeen et al, 1996).

Mangrove swamps are unique ecosystem in the coastal and insular areas of tropics and subtropics. The canopy of mangroves provides a cool, stable and humid environment, quite favourable to many animals. The excellent supply of organic detritus matter is derived from mangrove vegetation.

The environmental parameters showed variations in different seasons in the study region depending on the topography. The mangrove water was slightly alkaline and contained high amounts of pH monsoon and high during pre- monsoon because of the increased rate of photosynthetic activities. The electrical conductivity and total hardness was maximum in the pre monsoon, and minimum in the monsoon. Apart from this high nitrate value observed in monsoon than pre-monsoon and value shows an increase towards the coast, being higher in S3. Most of the parameters tested were slightly higher in summer than the monsoon seasons. Magnesium, iron, and water hardness shows a gradual increase towards S3. In general, the characteristics and chloride being higher in S1. Calcium, iron and magnesium, were low during of water tested in all the seasons were varied. The physico chemical parameters showed variations in different seasons in the study region depending on the topography. The present study is mainly concerned with the benthic organisms of Mangalavanam. The significant factors that may influence the distribution of benthic fauna are temperature, salinity, dissolved oxygen, *pH* and the nature of the substratum. They naturally includes marine, estuarine, freshwater and terrestrial animals. The major benthic groups observed during the present investigation were polychaeta, crustacea and mollusca. Of these, polychaeta was the most dominant group in terms of population density as well as species diversity is followed by crustaceans and molluscs.

Study was conducted at three different stations for a period of two years during August 2014 to August 2016. Human activities cause wetland degradation and loss by changing water quality, quantity and flow rates, increasing pollutant inputs. Any change in hydrology can significantly alter the soil chemistry, floral and faunal composition. Wetlands

can provide many functions to ecosystem, protecting wetlands in turn can protect our safety and welfare. Benthic and fish fauna were affected by seasonal input. As the soil composition is clay silt benthic fauna were get reduced in this mangrove ecosystem.

This study is a very useful baseline data toward future ecological study, conservation and management of the resources of this economically important wetland in the heart of a polluted city like Kochi.