GENERAL INTRODUCTION
1.0. GENERAL INTRODUCTION

Mangroves represent a typical ecosystem found along many tropical coasts and estuaries (Pannier, 1979). As a nutrient filter and synthesizer of organic matter, mangroves create a living buffer between land and sea. The mangroves are the tropical forests formations encircle or spread by the tidal rivers and / or the sea water, flooded frequently by the tidal water (Naskar and Guha Bakshi, 1987). In other words these are a group of salt tolerant woody plants characterized by typical morphological, physiological and anatomical adaptations such as evergreen woody habit, vivipary, development of pneumatophores, knee, stilt or prop roots for anchorage and salt glands, sclerophyllous tissues, sunken stomata in thick coriaceous leaves to restrict transpiration and for resistance against adverse climatic forcers (Naskar and Mandal, 1999). In different parts of the world mangroves are called as ‘Mangals’, ‘coastal wood lands’, ‘tidal forests’ etc. and are littoral plant formations. The shorter Oxford dictionary describes the word “Mangrove” as obscurely
connected with the Portuguese word “Mangue” and the Spanish word “Mangle” and the English word “grove.” and it dates its origin as 1613. However Martha Vannucci (1984) in her book “The Mangrove and Us” claims the word “mangue” derives from the national language of Senegal.

The SCOR /UNESCO panel (1984) has stated, "Scientists are agreed that mangrove areas, far from being wastelands, are highly productive and comparable to good agricultural land.” According to Teas (1977) mangroves are valuable for shoreline protection and stabilization as well as habitat for wild life and sources of photosynthetic productivity. The rich and diversified life of this ecosystem is due to high energy production capacity of mangroves especially towards estuarine and marine fertility (Heald and Odoum 1970; Macnae 1974). Mangrove environment also serves as the potential area for brackish water aquaculture of prawns, crabs and fishes as it happens to be Nature’s own aquaculture system (Ong 1982) which is more stable and less susceptible to diseases and epidemics. According to the study of Snedaker (1978) 90% of marine fish pass some stages of their life cycle in mangrove habitats. Mangroves are ecological heritages.
1.1. World distribution of mangroves

Mangrove forests are circum tropical in distribution and are found along the intertidal regions of the tropical and sub-tropical areas of the world extending from 24° N to 38° S (Fig.No.1) According to Barth(1982) geographical extension of mangroves can be divided in to two groups: (1) Eastern Group (essentially the Eastern Hemisphere) include East Africa, India, South East Asia, Australia and the Western Pacific. The total number of true mangrove species in this area is 40. (2) Western Group (essentially the Western Hemisphere) including West Africa, Atlantic South America, the Caribbean, Florida, Central America, and Pacific North and South America. The total number of true mangrove species in this area is only eight, although there is a local concentration of species that are incipient mangroves in Western Colombia. Mangroves seen in Hawaii were introduced from elsewhere (Chapman, 1976a). A great number of species which exists in the Indo-Pacific region suggests that the mangroves probably originated there. The Indo-Pacific mangroves are most extensive and diverse in Malaysia, alternating in number of genera and species eastward and westward (Fosberg, 1975). In all 53
Fig. No1. World Distribution of Mangroves
species are considered as being covered by the term 'Mangrove' by Chapman (1976a), and of these 40 are to be found in the Indo Pacific region.

In general distribution of mangroves throughout the world indicates zonal as well as purely individual colonial pattern. Countries with large mangrove forests are Brazil, Indonesia, Australia, Nigeria, Venezuela, Mexico, Malaysia, Burma, Bangladesh, India, Vietnam, Philippines, United States of America etc. Total mangrove area in different parts of the world is not properly known. Nayak et.al in 1996 estimated areas of mangroves in India with the help of Indian remote sensing data. In the state forest report published by the Forest Survey of India details of the mangrove forest areas in the different states of India were given. However it is estimated that the total mangrove area of the world is 70,000 sq.km of this over 4,900 sq.km distributed in India (Anonymous, 2002). It constitutes 7% of world mangroves and 8% of Indias coastlines (Anonymous, 2002). Major areas of mangrove forests in different states in India has been estimated by the Government of India in the status report, December, 1987 published by the Ministry of Environment and Forests.
1.2. Review of literature

The combination of commercial and scientific interest has generated an almost unmanageable literature on mangroves. A number of international symposia on mangroves have been held, some of them leading to extensive published proceedings. Regional treatments about coverage of mangroves are given by Karsten (1890 & 1891) and Schimper (1891) for East Africa, Schimper (1891), Haberlandt (1910) gave cosmopolitan treatments about mangroves. Regional treatments were given by Davis (1940), for South Florida. A general account of the ecology of mangroves written by Van Steenis is included in Ding Hou’s account of the Rhizophoraceae for ‘Flora Malesiana’ (1958). The best account for mangal is given by MacNae (1968), and is clearly written by a person who saw in detail the vegetation he described. Lugo and Snedakar (1974) provide a more modern ecological summery. Walsh (1974) gave cosmopolitan treatments about the coverage of mangroves. Walsh et al (1975) published an extensive proceedings on international symposia on mangroves. Regional treatments are given by Percival and Womersley (1975) for Papua New Guinea. Chapters with varying

Van Rheede (1678-1703), in his work 'Hortus Indicus Malabaricus' gave the first account of Indian mangroves. Roxburgh (1814), in his well known work 'Hortus Bengalensis', published in 1896 described the flora of Sundarbans. Sir Hooker's 'Flora of India' also appeared in the mean time. Schimper in 1891, published his classical work 'Die Indo-malayichen Stanflora'. Extensive collections of the plants of Sundarbans were done, and, based on that information Prain (1903) published his findings in the 'Records of Cronicle of Survey of India'. The major contributions of the knowledge on the mangrove forestry of Indian sub continent were made by Hooker (1872), Prain (1903), Blatter (1905), Cook (1908) Gamble and Fisher (1915-1936), Troup (1921), Suri (1928), Curtis
(1933), Champion (1936), Cornwell (1937) and Navalkar (1951). Ecological studies in relation to the mangrove environment along the Goa coast was done by Jagtap T.G. (1985). Mangrove vegetation, its structure, ecology, management and importance with special reference to Andaman and Nicobar islands was studied by Dagar, J.C. (1987). Environmental factors and distribution of mangroves in Sundarbans with special reference to the *Heritiera* forms was done by Karim (1988). Sundarbans mangroves-ecology and wildlife was described by Chaudhuri and Chakarabarti, (1989). Ecology and faunal association of intertidal mangrove habitats in the Hooghly-Matlah estuarine system was contributed by Ghosh et al., (1987). Ramdial, (1991) studied the role importance of mangrove forest under the project of 'A global Network of Mangrove Genetic Resource centers'. Status of Mangroves along the countries bordering the Arabian Sea was done by Untawale and Jagtap (1992). Ecology of halophytic vegetation in India was reported by Dagar 1995. Eco-philosophy and Eco-dharma in mangrove environment was studied by Kathiresan (1996). Litter fall and energy flux in a mangrove ecosystem was studied by

In the work of Troup (1921), he summarized the account on Kerala mangroves by Bourdillon (1908). Bourdillon reported the occurrence of two species of Rhizophora from Kollam. Gamble and Fisher (1915-1936) gave an account of the mangroves of the Kerala coast. A concise account of the mangroves in Kerala was made by Troup (1921). Thomas (1962) and Rao and Sastry (1974), who studied the mangroves in the Veli area of Thiruvananthapuram, reported the occurrence of ten species of mangroves. Blasco (1975) reported the presence of Acanthus ilicifolius and Cerebera odollum from the backwaters of Kollam. Kurien (1980), studied the
mangroves of the Vembanad estuary and Ramachandran et al., (1985 & 1986) have done a detailed study of the mangroves along the entire coast of Kerala. They have reported the occurrence of 39 species of mangroves and mangrove associates. Ramachandran and Mohanan (1987) studied the mangroves in the Kumarakom area and suggested certain perspectives in the management of mangroves. Chand Basha (1991 and 1992) has summarized the distribution of mangroves in Kerala. Eco-biological studies of mangrove Rhizophora species was studied under the post graduate programme in Mariculture (CMFRI) by Pretha and Rajagopalan (1993). A comparative study of the mangrove ecosystem in Kumarakom with that of Quilon to assess the man made changes was done by Mohandas (1993). Mangroves as indicators of coastal change was reported by Blasco et.al, (1996). Unni and Kumar (1997) presented a paper titled “Biodiversity in the mangrove vegetation of Kerala” in the Workshop on Mangroves of Kerala. Structure, composition and conservation of birds in Mangalavanam mangroves Cochin were reported by Jayson (2001). Mangrove wetlands and aquaculture development in Kerala was studied by

1.3. Relevance of the present study

Mangrove forest recently identified as the most useful natural resource systems are essential life supporting system which play vital role in ecological stability. Mangrove ecosystems are receiving increasing attention, but we still lack much information about their structure and function. There are still fundamental gaps in our knowledge of the ecology of mangroves. We are still far from understanding energy flow and food web dynamics in mangrove environments and how the mangrove connect with other ecosystems. There is a great need to better understand the effect of environment change and pollution on mangrove flora and fauna. Animals that are highly dependent on mangroves need additional study, particularly with respect to larval supply and recruitment. Such ecobiological research can be linked to management of mangroves and associated fishery resources. The foregoing scope of mangrove research was actually rooted in the primary data. The present study deal with the
important fundamental properties of mangroves in relation to ecological parameters. This primary data can be considered as a standard reference, so any other alterations in the physico chemical and biological characters can be easily detected which will provide a way for early conservation. Conservation of mangrove ecosystem is essential to protect many marine species from extinction. However, the basic information essential for mangrove management such as species diversity, zonation pattern, hydrological and physico chemical parameters are dreadfully meager from the Ayiramthengu mangroves. Hence it was attempted to study the ecology and biodiversity of Ayiramthegu mangroves.

1.4. Study area

Ayiramthengu [9°6’ to 9°8’ N; 76°28’ to 76°29’ E] is situated about 6Km west of Oachira town, on the bank of the Kayamkulam estuary [Fig.No.2]. The mangrove here covers 20 acres of area. This long chain of mangrove vegetation is the only extensive one left almost untouched by man along the Kerala coast. The area is bounded on
Fig. No 2  Map of Kerala Showing Ayiramthengu Area in the Kayamkulam Kayal

[Map of Kerala showing the location of Ayiramthengu area in the Kayamkulam Kayal]
Fig. No 3  Map of Ayiramthengu Area
Fig. No. 4 Lay out of Ayiramthengu fish farm showing the mangrove area
the east by Kayamkulam estuary, on the west by the Kollam-Alappuzha waterways connected to Arabian sea, on the north and south by two canals[Fig.No.3 & 4]. Flood waters of the Pamba and Achankoil rivers flow into the estuary through the commercial canal which links the estuary with these rivers. A number of other canals and few streams and drains in the region also joint the estuary at different points. The estuary opens to the Arabian Sea at Valiyazheekal. The mangroves, fish farm and the adjoining land cover an area of 56 acres.

About 75 years ago Govt. of Kerala acquired this area(of the Kayamkulam estuary) from Mankombi Potti. The rich and diversified life of this ecosystem paved way for the formation of fish farm by government. At first fish farm and mangrove area were under the control of Agency for Development of Aquaculture in Kerala (ADAK). The objective of the fish farm was socio-economic emancipation of traditional fisherman coupled with the production of more fish for domestic consumption. Now this area is under the control of Fisheries Resource Management Society (FRMS).
Fig. No 5 Study Sations 1, 2 and 3 at Ayiramthengu

Station No.1
Station No.3
MANGROVE AREA
Station No.2
Ayiramthengu mangrove area share the boundaries of three panchayats, western area (fish farm) represent Alappad panchayath, 70% of mangrove area by Clappana panchayath and northern part of mangrove area (30%) by Devikulangara panchayath. Station I is characterized by influx of fresh water into the mangrove area. Station II represent the area of luxuriant mangrove growth showing entangled respiratory roots. Station III represents the open area where tides and waves are predominant (Fig.No.5). Original photographs of stations were shown in plate I.

1.5. Different aspects studied

The basic information essential for mangrove management such as species diversity, zonation pattern hydrological and physico-chemical parameters are dreadfully meager from the Ayiramthengu mangrove which is the naturally occurring mangrove ecosystem. Hence in the present work effort has been made to study the important properties of mangroves in relation to ecological parameters. The following aspects were studied:

1.5.1 Hydrography

Three stations were selected from the area of study. Monthly variations of temperature (atmospheric and water),
turbidity and the parameters such as dissolved oxygen content, hydrogen ion concentration, carbon dioxide content, salinity, nitrate content, nitrite content, silicate content, phosphate content and total dissolved solids in the water were studied from January 2002 to December 2002.

1.5.2. Plankton

Monthly variations of the planktonic organisms (phytoplankton and zooplankton) based on qualitative and quantitative studies were also done.

1.5.3. Benthos

Sediments of Kayamkulam estuary were studied in relation to changing hydrographical conditions. Contents of organic carbon, moisture, hydrogen ion concentration, benthic flora and fauna were studied in relation to hydrographical changes and attempts were made to describe the textural distribution on the above basis. Surficial sediments also indicated variation in texture resulting from detritus settlement influenced by mixing conditions in the estuary.
1.5.4. Flora and fauna

Extensive study of the flora and fauna of Ayiramthengu was done.