Chapter 1
INTRODUCTION

Kuttanad the land of agriculture is a unique wetland of Kerala, (lat 9°8’, 9°52’ and long 76°19’, 76°44’) comprising marine, estuarine and fluvial systems. It is a highly complex ecosystem with a total area of about 1157 sq km comprising 66048 ha of wetlands, 31086 ha of dry garden lands, and 18623 ha of backwaters known as Vembanad Lake. The two deltaic formation, one at the confluence of the three river systems namely –Achencoil, Pampa and Manimala, and the other of the Meenachil River, constitute the core area of Kuttanad (Aravindakshan and Joseph, 1990), which is a recent sedimentary formation. Most of the land in this area is paddy field which is subjected to agricultural operations twice or thrice a year. The land scape includes six agroecological zones namely, Upper Kuttanad, Lower Kuttanad, North Kuttanad, Lake lands, Vaikom and Purakkad Kari. Most of the areas in Kuttanad are water logged almost throughout the year and subjected to flood during monsoon period and sea water ingression during the summer season. The garden lands are one meter above the sea level which is formed by the deposition of alluvium. The wet lands 0.5 to 2m below the sea level are reclaimed for rice cultivation. The rural population density is about 800 per sq km but in some areas it exceeds 2000 per sq km. (KWBSP, 1989). Fisheries is one of the most important activities which involves about 21000 fishermen, either fulltime or part time.
The ecology of Kuttanad is greatly influenced by the mixing of flood water and sea water entering the Vembanad Lake. The famous rice bowl of Kerala has now become the poison bowl (KSSP, 1992), mainly due to intensive agricultural practices, unscientific establishment of various developmental projects and the sheer lack of proper sanitary facilities and waste water management. The wide ranges of variations in salinity from pure water to seawater provide a favourable environment for rich aquatic life. The paddy fields of Kuttanad, which merge with kayal, are subjected to saline water ingressions, are the breeding grounds of prawn.

Due to rapid industrialization and human population growth the chances of an aquatic system being polluted are great. The physico chemical characteristics are greatly affected due to discharge of domestic, industrial effluents and several other factors during day in and day out. The effluents of distillery units have been found quite obnoxious creating the serious problem of water pollution, leading to the damage of the flora and fauna of the water bodies. Along with this, hundreds of retting grounds seen along the Kuttanad area in and around Alleppey, Chertallai and Vaikom also cause havoc to Vembanad aquatic system.

The aquatic ecosystem of Kuttanad is passing through a phase of rapid ecological deterioration. The aqua-ecocrisis takes its origin from the anthropogenic activities such as excessive pesticide and fertilizer application, coconut husk retting etc. The agroecological zones of Kuttanad and the Vembanad Lake are closely associated and the intricate networks of canals,
and small channels locally called ‘thodu’ connect every nook and corner of Kuttanad with the lake. Hence anthropogenic activities affecting the ecology of one of these systems will have serious impacts on the other and hence when considering the ecology of the region the two systems cannot be compartmentalized and treated separately. Monsoon and salt water incursion during summer, once served a washing effect. But commissioning of Thottappally spillway (1954) and Thanneermukkom barrier (1975) changed the whole scenario of the rice bowl of Kerala.

Bunding of the shallow part of the lagoon started at least 100 years ago. The bunds were not intended to make the land flood free but to create land for punja crop. The establishment of the barrier and spillway was made with an intention to intensify the paddy cultivation and it was expected to increase the area two fold or even three fold. The construction of Thottappally spillway was to ensure the second paddy cultivation during monsoon. The barrier was constructed to prevent the incursion of salt water to paddy fields during summer. By preventing the incursion of salt water it was thought that a second agricultural season would be available for paddy cultivation during summer. The developmental activities in Kuttanad also had long range effects on the rice cultivation. The elimination of the risk from natural hazards, lack of scientific paddy cultivation, use of high yielding rice with low resistance to pest and disease and the non judicious application of fertilizers have resulted in the incidence of pests and diseases and the consequent crop loss in Kuttanad region. It has been found that saline water, although
adverse to rice production, is very much essential to maintain an ecological balance in Kuttanad. In earlier days the farmers usually constructed temporary bunds known as “muttu” across the canals and rivers to prevent the ingression of salt water. These bunds were pulled down soon after the harvesting. The total prevention of saline water by Thanneermukkom barrier has affected the Kuttanad ecosystem to a great extent and it is a fact that this structure (which is not completed even now) stands as the single human interference which has brought about major changes in this wetland system. It is reported that it has generated different problems such as accumulation of aquatic pollutants from various sources, weed growth, depletion of fishery resources due to the lack of salinity intrusion etc. (Kannan, 1979; Kurup and Samuel, 1987; KWBP, 1989; Nair and Pillai, 1993 and Menon, 1994). During the southwest monsoon fresh water condition prevail for sometime as far as the bar mouth up to the estuary. Before the construction of Thanneermukkom bund the entire estuary would have become saline or brackish during the pre-monsoon period.

The estuarine fish fauna consists of marine, fresh water and the true estuarine inhabitants. Certain fishes reproduce in estuary and live in certain brackish salinity range. Fish distribution in the estuary is directly related to salinity (Kurup and Samuel, 1987). It was found that 70% of prawn landed at Cochin consists of species which spend part of the life cycle in the estuarine environment. The value of this prawn is estimated as Rs. 100 million per year (KWBP, 1989).
One of the major effects of the barrier is the proliferation of water weeds, especially *Salvinia* and *Eichornia*. The saline water reaching the upper parts of Kuttanad was effective in keeping the growth of these weeds under check. The total absence of saline water has caused the rapid growth of these weeds posing serious threat to paddy cultivation, fisheries, inland transport and human health. The prevention of saline water incursion into Kuttanad has adversely affected the growth and survival of other estuarine organisms also. The giant fresh water prawn *Macrobrachium rosenbergi* is now facing total depletion as it needs saline water for the completion of the life cycle.

Coconut husk retting has contributed much to aquatic pollution in Kuttanad. It is basically a microbial process which will be faster in saline water. The retting of husk results in the liberation of products of pectinolytic activity. Evolution of foul smelling H\textsubscript{2}S and the depletion of dissolved oxygen are the important changes associated with retting. H\textsubscript{2}S results in air and water pollution. Very long years of retting have adversely affected the aquatic systems of Kuttanad thereby reducing considerably the fishery potential of the system. Abdul Azis (1987) has made a thorough investigation regarding the effects of retting in back waters and identified it as an alarming source of pollution in Kerala. Studies made by Indo Dutch Mission (1989) recorded high levels of faecal bacteria in waters. The level being in general ten times the allowable level according to Indian standards.
The indiscriminate use of fertilizers and pesticides cause severe pollution in Kuttanad. According to a publication of K.S.S.P (1992), insecticides and fungicides contribute a major bulk to pollution in Kuttanad. It was found that about 500 tones of pesticides are used in Kuttanad during every crop year. Under ordinary condition, only about 40% of these fertilizers are used by plants and the remaining is lost by seepage, runoff and volatilization (Joseph, 1987). The higher concentration of nutrients in water causes the excessive growth of water weeds, which leads to the depletion of oxygen, in turn, affect the growth of aquatic plants and animals. Due to the excessive use of pesticides, the native parasites and predators of paddy pests are also killed which results in the proliferation of pests in this area.

Because of the lack of proper washing out facilities the agrochemicals and other pollutants accumulate in the aquatic systems. Before commissioning of Thanneermukkom barrage the incursion of saline water removed the accumulating toxicants to the sea. With the construction of Thanneermukkom barrage and its operation the southern side of Vembanad Lake become a static pool. The drained water from the paddy fields with large quantities of fertilizers and pesticides become stagnant in rivers, lakes and canals. Besides these chemicals, industrial effluents and human and agricultural wastes emptied into the Kuttanad water system convert it into a poison bowl.

There have been several fragmentary studies on Vembanad lake and related regions of which, the most notable are those of Devassy and

The near total absence of a comprehensive study involving hydrography, nutrients, plankton and fishes in Kuttanad, the progressive bio deterioration in and around Kuttanad, the need of a scientific and ecofriendly Kuttanad Development Scheme, and the pressing need for revitalizing the agriculture as well as the fishery potential, prompted the present investigation to plan an year long collection and analysis of samples for diverse parameters concerning Kuttanad. The present study, it is hoped, will provide enough information—physical, chemical, biological—to formulate guidelines concerning the future of Kuttanad.