CHAPTER IV

FISH DIVERSITY IN RETTING AND NON-RETTING AREAS

4.1 Introduction

Fishes are the most important biological resource available from the water and they form a considerable portion of the world's natural aquatic resources. They are used as a source of food, medicine, fertilizer and for pet trade. There are approximately 25,000 known fish species world over (Nelson, 1994). Fishes not only provide valuable and healthy food to the humanity but also provide opportunities for employment and recreation. An outstanding feature of the Kerala's coastal zone is the presence of a large number of perennial or temporary estuaries popularly known as backwaters (*Kayals*). Backwaters, being the largest common property ecosystems, play a dominant role in the economy of Kerala. Thirty backwaters occur along the 590 km long coast of Kerala covering an estimated area of around 242,000 ha. An important characteristic of backwaters is their biological diversity, which refers to the diversity of various species of living organisms, plants and animals, the presence of various ecosystem services, and genetic diversity. Such diverse combinations of living organisms and ecological services constitute the natural resource entitlements of the local communities (Subramanian, 2000). The wide variety of fish and shellfish resources, aquaculture systems, the brackish water agriculture, mangroves and innumerable forms of micro-organisms are directly useful and sustain the economy of local population. The brackish water body benefits coir industry of Kerala as rural communities use estuaries and the nearby wetlands for soaking coconut husks.

The evolution of a modern sector consisting of various coir processing units, and their activities has produced a number of spill over effects on the estuarine ecosystem and on the people living in the nearby villages. Pollutants released into the backwaters through coconut husk retting have caused severe

reduction in the productivity of fishing activities. Extensive clay and sand mining has reduced the water holding capacity of the ecosystem causing water logging and reduced fishing. The threat imposed by the activities of modern stakeholders to the health of backwater ecosystem is severe and dangerous to the level exceeding the carrying capacity of the system.

In this chapter the results of the fish diversity in the retting and non retting zones of the Kadinamkulam estuary in different seasons during the period March 2004- February 2005 is discussed in detail.

4.2 Review of Literature

The inland waters of India support a very diverse fauna of fishes. A substantial part of fish production in India is contributed by the estuaries, backwaters, coastal cracks, and large brackish water tracts bordering the coast of India (Nair *et al.,* 1983). The fish fauna in the estuaries and backwaters of India are represented by fin fishes and shell fishes. The early information on the estuaries fish fauna in India is that from Hooghly-Matlah estuary and associated creaks reported by Hamilton (1822); Sewell (1934) in their studies. Chacko *et al.* (1954) gave an account of the fisheries of Adayar and Vellar estuaries respectively. Radhakrishna and Janakiraman (1975) have studied the mangrove molluscs of Krishna and Godavari estuaries. James *et al.* (1986) reported 28 species of fishes from Ennore estuary. Rao (1970) studied the fish fauna of the Pulicat Lake with special reference to milk fish. Natarajan *et al.,* (1979) explained the fisheries of Vellar estuary while Brinda and Bragadeeswaran (2005) studied the economically important juvenile fishes of this estuary. Manna and Bharathi (1985) gave a checklist of marine and estuarine fishes of Digha, West Bengal.

The backwater environment of Kerala forms an indispensable habitat for a variety of biologically and economically important resident and migratory aquatic fauna. These interconnected backwaters spanning about 62,500 ha preferred habitats for about 200 resident migratory fish and shell fish species, and forms the

crux of the inland fishery resource of the state. The fishing activities in the backwater support about 0.2 million fisher folks and provide employment to about 50,000 fishermen (Unnithan *et al.,* 2005). These backwaters are grounds of prawns, crabs and fin fishes and the breeding grounds for the freshwater prawns. Edible oysters occur in all these brackish waters. One of the early reports on fishes of Kerala is by Day (1865). Shetty (1965) made a comprehensive description of the fishery practice with a listing of the commercially important fish and prawn species of the Vembanad Lake. Kurup and Samuel (1987) reported 150 species of fishes belonging to 56 families from this lake; Kurup *et al.* (1993) who estimated the fishery potential of the Vembanad during the post barrage phase, found 115 species of fin fishes, six of penacids, four paleomonids and three species of crabs in this lake. Mary (1 958) and Nair *et al.* (1983) studied the fishery resources of Ashtamudi Lake and reported 97 species belonging to 39 families. Shibu (1991) recorded 211 species belonging to 17 families of fishes from the Paravur Lake. Unnithan *et al.* (1990) observed thirty species of fishes from Kadinamkulam backwaters. Harikrishnan and Azis (1999) reported 33 species from inland water bodies of Kerala.

The Edava - Nadayara - Paravur backwater system with the exception of the retting areas supports a rich fishery. Seasonal variations in the Crustacean plankton population with reference to the non-retting areas were noticed by Aziz and Nair (1982). The retting zones of Kayamkulam backwater also showed low incidence of fishery resources (Nandan *et al.,* 1989). This has further authenticated the fact that retting activity has not only led to low diversity of fauna in the retting zones, but also in the non retting zones. Remani *et al.* (1989b) observed the presence of only the tolerant species like *Arius* species and *Etroplus* species from the retting zones of Cochin back water. Studies conducted by Shetty (1965) in the Vembanad Lake had also reported on the pollution problem arising from retting activity and its effect on the fishes. Studies conducted by Devi (1988) in the Cochin backwater had revealed that, only stray numbers of caridean prawns and gobids were present in the retting zones, whereas several species of prawns and fishes were present in the non retting zones. It was also observed from this study

that, retting of coconut husk resulted in the formation of a black layer of organic matter, which besides affecting the production of plankton and benthos, also spoils the nursery ground of some commercially important fishes like mullets, pearl spot and milk fishes inhabiting the area. The effect of pollution due to coconut husk retting on the reproductive potential of the green mussel, *Perna viridis* was reported by Kumar and Alagarswami (1986). Ecology and distribution of benthic macrofauna in the Ashtamudi estuary of Kerala were attempted by Nair *et al.* (1984).

Pollution in Cochin backwaters due to coconut husk retting with special reference to benthos was studied by Remani (1979). Indicator organisms among benthic communities which dominated maintaining high population densities in retting yards of Cochin backwaters were also studied. Various species of Polychaetes which are pollution tolerant are abundantly seen in the retting yards (Remani *et al.*, 1982). Studies on the variations of Polychaete fauna in areas affected by retting was attempted by Antony and Nambissan (1982). Achary (1987) studied the characteristics of clam resources of Vembanad lake. Unnithan *et al.* (1977) studied about the incidence of fish mortality from industrial pollution in Cochin back waters. Sunilkumar (1981) studied about the benthic fauna of mangrove swamps of Cochin area.

Studies undertaken by Nandan (1997) in the retting zones of Kadinamkulam-Anchuthengu back water had reported the massive depletion in the fishery wealth of this region. Form his study he collected a total of 37 species of fishes, 5 species of prawns and two species of crabs and bivalves from the non retting zones of Kadinamkulam -Anchuthengu backwater, whereas only 20 species were present in retting zones, that too collected dead. No shellfishes were observed in the retting zones of this backwater during the study. The retting zones of Kayamkulam backwater also showed low incidence of fishery resources, 17 species of fishes were reported from the retting zones and 30 numbers were present in the non retting zones in monsoon season (Nandan and Unnithan, 1998). Earlier studies conducted by Mary (1958) reported 125 species of fishes from the same

back water. This has further authenticated the fact that retting activity has not only led to low diversity of fauna in the retting zones, but also in the non retting zones.

The backwaters of Kerala are known for the rich resources of fish and shellfishes. Retting activity in the backwaters has not only affected the very existence of the planktonic and benthic organisms but also the valuable fishery resources. Mass mortality of fishes due to intense pollution from anoxia coupled with sulphide and other organic pollutants could be observed from the retting zones of the backwaters particularly during the dry and stagnant premonsoon period. The study shows that the crustaceans were totally absent from the retting zones whereas they were present in unpolluted areas of Kadinamkulam estuary. Seventeen species of fishes were recorded from the non retting zones, whereas only seven species (*Channa* stariatus, *Oligolepis* acutipennis, *Pertica filamentosa, Etroplus suratensis, Etroplus maculatus, Tachysurus caelatus* and *Oreochromis mossambicus*) were present in the retting zone capable of surviving in the anoxic-sulphide rich conditions.

4.3 Materials and Methods

The fish samples were collected from the selected stations of Kadinamkulam estuary representing the major fish resources of this estuary such as Kotrakiri (SI), Kadinamkulam (SII), Madanvila (SIII) and non retting station Perumathura near Pozhi (SIV). The representative samples were collected with the help of fisherman during the study period from March 2004 to February 2005 in pre monsoon, monsoon and post monsoon seasons. Each station has an appropriate quarter of 100 m circumference for sample collection. The fishes were captured with the help of suitable sized fishing nets. The captured fishes were counted and the selected samples were preserved in 5% formaldehyde solution for identification. The specimens were identified upto the lowest possible taxonomic level using the key of Day (1878), Fischer (1978) and Jhingran (1983). For the assessment of impact of coconut husk retting on fish diversity, comparisons of fish catch data, from all four stations studied, the retting zones, as well as of non retting

zone, among and between them was done in terms of species, number of individuals present in each station in three different seasons. Abundance of individual fish species was judged in terms of their frequency of occurrence and number of individuals.

4.4 Results and Discussion

Fish diversity observed during different seasons from four different study stations in the Kadinamkulam estuary are depicted in the Tables 14-16. In the present study the fish diversity were reduced to a total of 28 species, and among them, only eighteen species were found in retting zones. In this study no shell fishes were observed in the retting zones. The fish like *Sardinella* was not found in the retting zones but in monsoon season, it was seen the non retting area like Pozhi. Ten fish species are merely associated with non retting zones. Ten species rarely found in retting zones and seven species commonly found both in retting and non retting zones. Among the 28 species of fishes identified, the fish *Oreochromis mossambicus* and *Meghalops cyprinoids* are the abundant species in this estuary during all three seasons. From the present study on the diversity and abundance of fishes it can be seen that the fish diversity in Kadinamkulam estuary was under threat. Previous studies by Nandan (1997) reported 37 fin fish species, five species of prawns, and two species of crabs and bivalves in the Kadinamkulam estuary, and of these twenty species of fin fish species were identified in the retting zones. No shell fishes were observed in the retting zones in his study also.

Therefore the uncontrolled pollution problems in the Kadinamkulam estuary mainly due to coconut husk retting decreased the fish diversity than that recorded in previous studies. The clay and sand mining activities also hasten the dispossession of fish diversity. In the case of shell fishes, it can be seen that the non retting areas of Kadinamkulam estuary supports its diversity and there is no much reduction in its diversity, but in retting zones, the shell fishes were not detected.

Table 14. Fin fish and shell fish diversity in the retting and non retting zones of Kadinamkulam estuary during pre-monsoon season

Sl. No.	Fish Species*	SI	SII	SII	SIV
1	*Glossogobius giuris*	+	+	+	+ +
2	*Mugil cephalus*	+ +	+ +	+ +	+ +
3	*Liza parcia*	+	+	+	+ +
4	*Therapon jarbua*	+	+	+	+ +
5	*Etroplus suratensis*	+ +	+ +	+ +	+ + +
6	*Etroplus maculatus*	+	+	+	+ + +
7	***Oreochromis mossambicus***	+ + +	+ + +	+ + +	+ + +
8	*Cynoglossus lida*	+	+	+	+ +
9	*Stolophorus indicus*	+ +	+ +	+ +	+ +
10	*Chanos chanos*	+	+	+	+ +
11	*Liza macrolepis*	+ +	+ +	+ +	+ +
12	*Sphyraeno jello*	+ +	+ +	+ +	+ +
13	*Gerreomorpha setifer*	+	+	+	+ +
14	*Brachirus orientalis*	-	-	-	+ +
15	*Thysanophrys indicus*	-	-	-	+ +
16	*Pseidogobius javanicus*	-	-	-	+
17	*El,otris fusca*	-	-	-	+ +
18	*Leiognathus equulus*	-	-	-	+
19	*Gerres oyena*	+ +	+	+ +	+
20	*Hyporthampus limbatus*	-	-	-	+ +
21	*Hemiramphus cantori*	-	-	-	+ +
22	*Rhynhorapus georgi*	-	-	-	+ +
23	*Tachysurus maculates*	+	+	+	+ +
24	*Megalops cyprinoids*	+ + +	+ +	+ +	+ +
25	*Pranesus duodecimalis*	-	-	-	+ +
26	*Valmugil scheli*	-	-	-	+
27	*Chanda commercinalis*	-	-	-	+
Shell fishes					
1	*Penaeus indicus*	-	-	-	+ + +
2	*Matapenaeus monoceros*	-	-	-	+ +
3	*Macrobrachium monoceros*	-	-	-	+ +
4	*Macrobrachium idila*	-	-	-	+ + +
5	*Scylla scrrata*	-	-	-	+ + +
6	*Neptumus palagicus*	-	-	-	+ +
7	*Vilorita cyprinoides*	-	-	-	+ + +
8	*Crassostrea madrasensis*	-	-	-	+ +

*Showing number of abundant (+ + +), common (+ +) and rare (+) species

Table 15. Fin fish and shell fish diversity in the retting and non retting zones of Kadinamkulam estuary during monsoon season

Sl. No.	Fish Species	SI	SII	SII	SIV
1	*Glossogobius giuris*	+	+	+	+ +
2	*Mugil cephalus*	+ +	+ +	+ +	++ +
3	*Liza parcia*	+	+	+	+ +
4	*Therapon jarbua*	+	+	+	+ +
5	*Etroplus suratensis*	+ +	+ +	+ +	+ + +
6	*Etroplus maculatus*	+	+	+	+ + +
7	***Oreochromis mossambicus***	+ + +	+ + +	+ + +	+ + +
8	Cynoglossus lida	+	+	+	+ +
9	*Stolophorus indicus*	+ +	+ +	+ +	+ +
10	*Chanos chanos*	+	+	+	+ +
11	*Liza macrolepis*	+ +	+ +	+ +	+ +
12	*Sphyraeno jello*	+ +	+ +	+ +	+ +
13	*Gerreomorpha setifer*	+	+	+	+
14	*Brachirus orientalis*	-	-	-	+ +
15	*Thysanophrys indicus*	-	-	-	+ +
16	*Pseidogobius javanicus*	-	-	-	+
17	*El,otris fusca*	-	-	-	+ +
18	*Leiognathus equulus*	-	-	-	+
19	*Gerres oyena*	+ +	+	+ +	+
20	*Hyporthampus limbatus*	-	-	-	+ +
21	*Hemiramphus cantori*	-	-	-	+ +
22	*Rhynhorapus georgi*	+	+	+	+ +
23	*Tachysurus maculates*	+	+	+	+ +
24	*Megalops cyprinoids*	+ + +	+ +	+ +	+ +
25	*Pranesus duodecimalis*	-	-	-	+ +
26	*Valmugil scheli*	-	-	-	+
27	*Chanda commercinalis*	-	-	-	+
28	*Sardinella*	-	-	-	+ +
Shell fishes					
1	*Penaeus indicus*	-	-	-	+ + +
2	*Matapenaeus monoceros*	-	-	-	+ +
3	*Macrobrachium monoceros*	-	-	-	+ +
4	*Macrobrachium idila*	-	-	-	+ + +
5	*Scylla scrrata*	-	-	-	+ + +
6	*Neptumus palagicus*	-	-	-	+ +
7	*Vilorita cyprinoides*	-	-	-	+ + +
8	*Crassostrea madrasensis*	-	-	-	+ +

*Showing number of abundant (+ + +), common (+ +) and rare (+) species

Table 16. Fin fish and shell fish diversity in the retting and non retting zones of Kadinamkulam estuary during post monsoon season

Sl. No.	Fish Species	SI	SII	SII	SIV
1	*Glossogobius giuris*	+	+	+	+ +
2	*Mugil cephalus*	+	+	+ +	+ +
3	*Liza parcia*	+	+	+	+ +
4	*Therapon jarbua*	+	+	+	+ +
5	*Etroplus suratensis*	+ +	+ +	+ +	+ +
6	*Etroplus maculatus*	+	+	+	+ +
7	***Oreochromis mossambicus***	+ + +	+ ++	+ +	+ + +
8	*Cynoglossus lida*	+	+	+	+ +
9	*Stolophorus indicus*	+ +	+	+ +	+ +
10	*Chanos chanos*	+	+	+	+ +
11	*Liza macrolepis*	+ +	+ +	+ +	+ +
12	*Sphyraeno jello*	+ +	+	+ +	+ +
13	*Gerreomorpha setifer*	+	+	+	+
14	*Brachirus orientalis*	-	-	-	+ +
15	*Thysanophrys indicus*	-	-	-	+
16	*Pseidogobius javanicus*	-	-	-	+
17	*El,otris fusca*	-	-	-	+ +
18	*Leiognathus equulus*	-	-	-	+
19	*Gerres oyena*	+ +	+	+	+
20	*Hyporthampus limbatus*	-	-	-	+ +
21	*Hemiramphus cantori*	-	-	-	+ +
22	*Rhynhorapus georgi*	+	-	+	+ +
23	*Tachysurus maculates*	+	+	+	+ +
24	*Megalops cyprinoids*	+ +	+ +	+ +	+ +
25	*Pranesus duodecimalis*	-	-	-	+ +
26	*Valmugil scheli*	-	-	-	+
27	*Chanda commercinalis*	-	-	-	+
Shell fishes					
1	*Penaeus indicus*	-	-	-	+ + +
2	*Matapenaeus monoceros*	-	-	-	+ +
3	*Macrobrachium monoceros*	-	-	-	+ +
4	*Macrobrachium idila*	-	-	-	+ + +
5	*Scylla scrrata*	-	-	-	+ + +
6	*Neptumus palagicus*	-	-	-	+ +
7	*Vilorita cyprinoides*	-	-	-	+ + +
8	*Crassostrea madrasensis*	-	-	-	+ +

*Showing number of abundant (+ + +), common (+ +) and rare (+) species