A Study on the Status of Valapattanam River with Special Reference to its Ecology and Socio-cultural Aspects.

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Prof. T. P. Sreedharan

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Introduction

Land and water are the basic aspects of development of any economy. Economic development is the output of development of these natural resources in a sustainable manner. Developing the land resources is highly related to the availability of water and thus, management of water resources becomes the key factor of economic development. It is because of this fact that watershed based planning has acquired much importance in recent decades. In this approach of development, river basin studies become vital, rivers being the medium for the mobility of surface water. As a unit of development planning, smaller watersheds are much relevant, but, an understanding of the macro basins viz river basins provides better ideas on the scopes and issues of development in a given area. Thus, river basin studies have acquired much importance in the scenario of planning for sustainable development. The present attempt is not to make such a detailed study of the river basin, but it tries to understand the different aspects and areas for such a detailed study, in a participatory manner. This implies a process of self-learning by the people of the locality who are the actual beneficiaries of any development activity. More than any other river, Valapattanam River has influenced the economy of the district and thus, it is quite clear that any attempt in future for the development of Kannur district would require a better understanding of this water body and its basin.

Objectives

The study was taken up to create a base for conducting an in-depth study of the Valapattanam river basin, including aspects of culture, resources, man-made modifications and land-use patterns along the river tract from its catchment area to its point of confluence with the Lakshadweep Sea. Such a study would contribute in evolving action plans for managing the natural resources associated with the river basin and rejuvenating the affected parts of the river. Moreover the action plans are designed in a location specific manner so that the monitoring and management of the river coming within their territory could be taken up by the local self-governments under their annual plans. However before attempting an in-depth investigation, the present study aims to have a preliminary understanding, which would throw light on the issues and necessity of an in-depth and elaborate study of the basin.

The major objectives of the preliminary study are:

1. To map the important features like, major tributaries, protected areas, human settlements, and historical sites along the river basin.
2. To make a participatory assessment of the socio-cultural aspects of people living along the river basin and their dependency on the river and
3. To document the existing bio-diversity potential of the river basin.

Methodology

The study is primarily of participatory nature. Members representing all local bodies on both the banks of the river were contacted and a meeting was conducted to take their feed back. A team of volunteers was identified in each local body, discussing with office bearers of the bodies. The local units of the KSSP also were involved in the fieldwork. A

reconnaissance survey was conducted along the riverbanks for documenting socio-cultural and environmental conditions. Secondary sources of information like publications, pamphlets, reports, data, etc were also referred from the sub-centers of CWRDM, revenue department and other relevant sources. Information from scientific papers and research reports were also used. A map of the river system was supplemented with additional information collected through the study. In order to understand the impact of human influences on the river, such as, economic and cultural activities, pollution etc., informal discussions were conducted with senior citizens and other concerned people of the locality.

Review of literature

The Valapattanam River can rightly be called the life stream of Kannur District. Apart from being one of the largest rivers in the Northern Kerala, it has many historical, socio-economical and cultural importances along with its ecological significance. The records on the importance of Valapattanam River goes back even before the medieval age, where it is figured prominently in the History of Malabar (Logan 1887; Innes 1951; Rajendran 1979 & Menon 1972). As a major connecting link between the mainland and Arabian Sea, the ancient commercial port called Baliapatam developed on its southern bank, near the estuary. Traders from Arabia, Egypt and Europe had their associations with Baliapatam long back. Proximity to the Arabian Sea and facilities of trade and communication further favoured settlement of many Muslims at Baliapatam. Subsequently several Arab Scholars also visited this part of Malabar, which is evident from travelogues. One of the earliest mosques, believed to have established by Malic Dinar, is located here. It is considered as one of the most outstanding architectural

structures in the Malabar Region (Menon, 2002). Innes (1951) had mentioned about the royal links of Valapattanam with the King Cheraman Perumal and later with of Kolattiri dynasty. Rajendran (1979) wrote about an early factory on the banks of the river and conflicts between the Dutch and British over establishment of trade centres in the Baliapatam area.

Apart from the historical literature, few scientific studies were attempted to investigate the water quality, mangroves and agriculture in the estuarine part of the Valapattanam River. Lakshmi et al (2000) have analysed the physicochemical and microbial characteristics of water and sediments from the estuarine part of the Valapattanam River. Morphometric analysis of the drainage basin was conducted by Mahamaya Chattopadhyay (1984). Sashikumar (2002) has documented the status and diversity of wetland birds found in the Kattampally area. Literature on distribution and composition of mangroves of the Valapattanam and Kunhimangalam areas could be seen in the reports of Basha, 1991 & 1992; Mohanan, 1999 and Lakshmi et al., 2000.

Dependence of local communities on the estuarine cum wetland ecosystems of Kunhimangalam and Pazhayangadi areas were studied by Nayak et al (2000). Nair et al (2002) have investigated the socio-cultural reasons for declining the traditional Kaipad cultivations and the influence of changes in ownership rights over the bunds in the Pazhayangadi and Kuppam areas.

The Ministry of Environment and Forests, Government of India has identified the Ezhimala-Payyannur-Valapattanam stretch as one among the six high priority areas for Integrated Coastal Zone Management Areas in Kerala. The Centre for Environment and Development (2004) has conducted a survey to map the land use pattern and distribution

status of mangroves along the coastal districts of North Kerala, which also included the Valapattanam area. A study conducted by CESS (2003) investigated into the issue of sand mining in Valapattanam River and estimated the quantity of removal as well as the replenishment.

Apart from the studies conducted in the lower reaches, few surveys were carried out in the upper catchment forests of the Valapatanam River. Fish diversity of the hill streams of Aralam wildlife Sanctuary was conducted by Shaji et al (1995); the Malabar Natural History Society has documented the birds and butterflies of the Aralam and Kottiyur forests.

However, no attempt has been made so far to cover the over all status of the Valapattanam River which is exerting its impact upon the socio-economic conditions of a large section of people of Kannur District to a significant scale. In these backgrounds the present study attempts to document the overall status of the Valapattanam River.

PHYSICAL FEATURES

Valapattanam River is one of the important rivers in north Kerala. Out of the 44 rivers of Kerala, seven east-flowing rivers are in Kannur district and Valapattanam River is the longest among them. It is the ninth longest river in the State and by the quantum of water resources, it gains fourth place. The Valapattanam basin is bounded by latitudes 11º 49' 30" N and 12º 13' 50" North and longitudes 75º 58' 55" E and 75º 17' 22" East. The length of the river is 110.50 Km^2 with a catchment area of 1907 km of which approximately 1321 km^2 of area falls within the territory of Kerala State and the remaining in the Karnataka State. About seventy per cent of the Valapattanam catchment is in the Western Ghats region, where the annual rain fall ranges from 350-400 cm. 20%

of the catchment which comes in the midland area gets an annual rainfall of 300 cm and the rest which is in the coastal area, gets around 200-250 cm of rain.

Origin

The main Stream of Valapattanam River is Bavali, which originates from the northern slopes of Brahmagiri forests of Karnataka State and reaches Ambayathode of Kerala State after flowing 20 km from the originating point. Further it flows through the Kottiyur Reserve forest and Aralam Wilidlife Sanctuary. There is no connection between this stream and the Bavali River in Wynad district except the similarity in name. The name Bavali is derived from the name of the place it originates i.e., *Bahuvali* on the Brahmagiri, according to some people. There is another version that the word *Vangmayi theertham* later became Bavali. Chekuthan thode from Valad in Wynad flows to the west of Boys Town, passes through Palchuram, joins with Sreelankan thode and becomes Ambayathode and Ambayathode merges with Bavali. After flowing three km, it reaches the historic place of worship called Kottiyur Devasthanam. The Devasthanam includes Ikkare Kottiyur on the south bank and Akkare Kottiyur on the north bank of the river and a small islet of 14 acres in between. Ikkare Kottiyur is a small forest of six acres and Akkare Kottiyur is reserve forest. For the month long Vaisakh festival in June, more than five lakh people come here to worship.

Ramachi thodu coming from Karnataka forest and Chamachi thodu coming from Kolithattu forest, join together at downstream of Meenmutti water falls to become Cheenkanni River. It flows 10 km via Adakkathodu and joins with Bavali at Kalikayam near Kanichar. After flowing about five km towards south, it reaches Matappurachal where it meets with Kanhirapuzha, which originates from 29th mile at Periya pass and

flows through Nidumpurachal and Thundi. From this point, it flows northwards around five km and reaches Ayyappankavu where Aralam River meets Bavali. Aralam River starts from the Kottappuram mala in Karnataka, at 872 m from MSL and flows 20 km through Aralam wild life sanctuary before it reaches Ayyappankavu.When Aralam River joins with Bavali, it becomes wider and deeper to form Iritty River and it meets with Veni River or Vallithodu River at Vattiyara near Iritty. The Peratta branch of the Veni River, coming from Karnataka forest and another branch coming from Makkuttam forest joins at Koottupuzha to form Veni River and it flows via Vallithodu to meet Iritty River. From this point, it flows 8 km towards west to reach the Kuyilur Barrage of Pazhassi Irrigation Project and flows uninterrupted during monsoon season.

During November, when the Barrage shutters are closed and water reaches the FRL, a big reservoir lake is formed up to Ayyappankavu in Bavali, up to Vallithodu in Veni River and up to Perumpazhassi in Aralam River. From Kuyilur, the river flows about 18 km towards northeast without any interruption and reaches Malappattam Munamb, where another important tributary, the Sreekandapuram River is waiting to join.

From the southern slope of Vaithal mala, two streams viz, Munnooru Kochi and Chathamala thode, join at Kudiyanmala to form Chemberi River and it reaches Payyavur after flowing 12 km. Another stream coming from the Karnataka forest, reaches Vanchiyam, after which it is called Chandanakkampara River and meets with Chemperi River at Payyavur to form Irude River. Another branch, which comes from Kambam Medu in Karnataka, and flows via Kanhirakkolli, Manikkadav and Mattara, joins with Kalanki thodu to form Nuchiyad River. Nuchiyad River flows via Ulikkal, Pareekkalam and Kandakasseri and joins with Irude River to become Sreekandapuram River.

Sreekandapuram River flows 20 km from Irude via Kanhileri, Sreekandapuram and Chengalayi, reaches Malappattam Munamb and joins with Irikkur River when it becomes Valapattanam River.

From this point, during the 30 km journey towards the sea, Valakkai thodu joins from the right side. It is coming from the northern slopes of Nayanar mala, via Chembanthotti, Chuzhali and Valakkai to join Valapattanam River at the north side of Therlai thuruthu. When it reaches Kattampalli after flowing 15 km westwards, Munderi River joins from the left. This tributary is coming from Kuttiattur, touching Munderi, Mayyil, Kolacheri, Chirakkal and Narath Gram Panchayath and passing through the Kattampalli regulator cum bridge. From this point, Valapattanam River forms into a lake. Through the Mattul kayal, which extends up to Valapattanam, Azhikode, Mattul and Payangadi, it merges into the sea at the Azheekkal estuary.

The drainage pattern of the river is dendritic. The river hosts the Pazhassi Irrigation Project at Valimbra. At Valapattanam, the river forms extensive flood plains and is joined by Pazhayangadi River, and ultimately drains into the sea at Azheekkal azhi (river mouth). The tidal influence is felt even at Parippayi, almost 30 km upstream. The Valapattanam River inundates extensive low-lying areas at Kattampalli. The floodwaters used to reach up to north of Kakkad, to the east up to Chekkikulam and to the north up to Valavilcheleri, prior to construction of the Kattampalli weir.

Run off

The run off of the Valapattanam River is controlled by monsoon rains. Of the average annual stream flow of 4779 Mm^3, about 85% is from the southwest monsoon and the remaining is contributed mainly by northeast monsoon.

Physiography

The Valapattanam River flows through the three major physiographic regions of Kerala such as the highlands (>75m), the midlands (75-8m) and the lowlands (<8m). The major landforms in the highlands include isolated hillocks and valleys. Lateritic mounds and intervening valleys are characteristic features of the midland regions. The lowlands are characterised by nearly level or gently slopping surface with a network of natural fluvial regimes.

Geology

The major geological formation of the Valapattanam basin is the Archaean crystallines. The rock types include quartz-mica schist with kyanite, pyroxene granulite, quartz-feldspar-hypersthene granulite, hornblende-biotite gneiss and biotite-hornblende gneiss. A small portion of the basin, close to the river mouth areas, is covered by Tertiary and Quaternary formations. The Tertiaries are represented by sandstones and clay stones with lignite intercalations, known in geological literature as Warkalli Formation (Padmalal & Maya 2002). The Quaternaries are represented by coastal sands and alluvial sediments.

Climate and Rainfall

The Valapattanam basin experiences a tropical humid climate. On an average, the basin receives an annual rainfall of 2807 mm; out of which a substantial proportion is contributed by the southwest monsoon alone. The maximum, minimum and mean temperature are: 32°C, 27.5°C and 23°C, respectively. The mean humidity of the basin is 78% in the early morning and 74% in the evening.

Soil

The soils of the Valapattanam River vary in their depth, texture, internal drainage and degree of erosion. Five different types of soils are identified in the basin – forest loam, laterite soil, river alluvium, brown hydromorphic soil and coastal alluvium. Forest soils are confined to the eastern hilly areas of the basin and are rich in organic matter. Lateritic soil is the predominant soil type and occurs mainly in the midland and hilly areas of the basin. Brown hydromorphic soils are confined to the valleys between undulating topography of the midlands and the low-lying areas of the coastal strip. The river alluvium, on the other hand, is developed in river valleys and coastal alluvium occurs in the lowlands close to river mouth areas.

Structure of the Catchment

Around 546 Sq km of the catchment area, coming under Karnataka boundary, is dense reserve forest, except a few patches of grassland. These rich evergreen forests are the vital factor for the perennial flow of Valapattanam River. When shuttered in November, the Pazhassi Barrage used to be full by mid December only because of the consistent flow from the streams of catchment forests.

Tributaries like Vanchiyam, Kanhirakkolli, Peratta, Makkottam, Aralam, Cheenkanni, and Bavali originates from the Karnataka forests and enter into the Kerala State. Their length varies from 5 to 19 km. While all these tributaries are perennial, other tributaries which originate from the Kerala forests become dry by the month of February. In the Kerala part of the catchment, virgin forest is scarce. Kudiyanmala reserve on the slopes of Vaithalmala, the reserve forest on the Kunnathur mala, Kolithat reserve to the east of Adakathode and the Kottiyoor reserve are the remaining forest patches. In the north east

of the catchment, there are Kanakakkunnu mala, Vaithalmala, Kunnathur mala, Kambam Medu, Arabikkulam, Kottappuram, Santhigiri, Palukachimala, Palchuram and Brahmagiri and in the southeast, there is Thirunelli. The height of these mountains varies from 300 to 1572 m (Vaithalmala).

Landuse / Land cover

The landuse / landcover of the Valapattanam basin can broadly be classified into agricultural land, forestland and wasteland. The landuse changes of the basin exhibit unique variation towards downstream. The uplands are covered primarily by forests and forest plantations. The midland exhibits dominance mixed agricultural and horticultural crops. Paddy cultivation dominates in the downstream part of the basin, in addition to mixed agricultural / horticultural crops.

Table 1. Land use/Land cover of Valapattanam Area

Sl. No.	Land cover Classes	Area in ha
1.	Sea	5104.17
2.	Water body	3356.52
3.	Mangroves	571.17
4.	Water logged Mud flat/marsh	1815.91
5.	Water logged Mud flat/marsh with scanty mangroves	655.31
6.	Aquaculture / water logged areas	199.30
7.	Agriculture	391.93
8.	Built up/exposed land /sand dunes	2790.68
9.	Barren/rocky areas	511.82

Source: CED 2004

In the lower reaches Valapattanam River extends wide into many wetlands and estuaries before merging into the sea, where majority of the area comes under the saline water intruded zone and the marshy, waterlogged mud flats. Due to the constant salinity fresh-water paddy and other agriculture is reduced to an area of about 392 ha. Aquaculture is practiced in a limited area (199 ha) where the tidal water lagoons are available. Area under mangroves are shrinking and currently about 517 ha only with mangroves and its associated vegetation. At many places the mudflats and mangroves along the mainland or cultivated lands are either encroached or reclaimed for cultivation or other purposes.

ECOLOGICAL IMPORTANCE

Estuaries

Estuaries are tidally influenced ecological systems where rivers meet the sea and freshwater mixes with seawater. Estuaries also form crucial transition zones between land and water that provide unique biological and geological functions like, they provide habitat to varieties of micro and macro organisms; nurseries to many marine organisms including commercially valuable fish species; filtration of nutrition and sediments from upland, flood control, etc. The Valapattanam River has two significant estuaries, of which the Valapattanam estuary is the major one and other being Kattampally estuary.

Valapattanam Estuary

Valapattanam is the largest estuary in the North Kerala, with a total area of 3077.6 ha. It is the fourth largest estuary in the State, where the Vembanad Lake is the largest one followed by Cochin backwaters and the Ashtamudi lake of Kollam district. Valapattanam estuary has a good cover of mangroves, which covers about 67.71 ha of the Pappinisseri panchayat (Ramesh et al 2003). The panchayat is located in the Southwestern part of Valapattanam River. The northeastern part of the panchayat, besides

the *Irinavu Thodu*, extends into a marsh patch. These marshy areas are dominated by both true mangroves as well as its associates. Dominant mangroves of this area are: *Avicenia officinalis, Avicenia marina, Rhizophora mucronata, Rhizophora apiculata, Sonneratia caseolaris, Sonneratia alba, Aegiceras corniculatum, Excoecaria agallocha* and *Kandelia candel*. A total of 56 species of wetland dependent birds have been reported from this area. The common fishes found in the area are, Pearl spot, Tilapia, White Sardine, Malabar labeo, Fringed-lipped Carp and Spotted etroplus. Part of the marshy lands contiguous to the estuary was under intensive *Kaipad* paddy cultivation until a decade ago. However, the recent increase in salinity even during monsoons, due to the structural modifications across the river basin, the area under *Kaipad* cultivation got reduced to a great extent. Other major threats to the Valapattanam estuary are coconut husk retting, land reclamation, dumping of slaughter-house waste, disposing of dead carcases of animals, domestic sewage, etc.

The Kattampally Estuary

The Kattampally River is one among the major tributaries of Valapattanam River. The River originates from Kutiyattoor and Mayyil areas and joins Valapattanam at Kattampally, which is about 11 km from the sea. Due to its closeness to the sea, the Valapattanam estuary extends into Kattampally and forms the Kattampally estuary. Apparently, the estuary at Kattampally, the adjoining wetlands and their catchments form part of the Valapattanam river basin. There exists no barrier or bund in the entire Valapattanam estuarine system except the regulator cum bridge at the confluence point of Kattampally tributary and Valapattanam estuary at Kattampally. The barrage was constructed in 1967 with 13 operable shutters, lock gates and the Road Bridge in order to control mainly the floodwaters as well as salt water into the Kattampally estuary and

surrounding cultivable wetlands of about 1267 ha. It was also aimed at the irrigation of further 4000 ha of adjoining lands. The road-bridge was to enhance transportation between Chirakkal and Narath Panchayats. However, at present all the shutters of the existing regulator at Kattampally are leaking due to wear and tear and are not capable of arresting the saline water intrusion into Kattampally wetlands from the sea through Valapattanam estuary. This directly has an impact on the paddy cultivation of this area and a total area of about 750 ha has been left fallow during the past few years (Chandrasekaran, et al., 2002). Earlier the salinity level in the estuarine water was found to be decreasing during the monsoon due to flushing effect and dilution. The situation has been changed once the dam was constructed at the upper reaches across Valapattanam River for the Pazhassi Project to store and divert the river water for irrigation and drinking purposes. Thus, portions of the monsoon as well as summer flow to the river from major part of the Valapattanam basin are being diverted. Consequently the flushing efficiency of the Valapattanam River got reduced at its lower estuarine areas. As the ebb and flow of saline water was reduced, the soil of kaipadu land became hardened due to excess salinity. Thus a large extent of Kaipad cultivation around the Valapattanam estuary was also abandoned. The regulator also has its impact on the fish diversity and catches since it became a block to the breeding and migration of fish species of both freshwater and marine environments.

Mangrove Ecosystems

Mangroves are unique coastal wetland ecosystems with complex associations of plant; animal and microorganisms adapted to inter-tidal zones and river mouths in the tropical and subtropical regions of the world. Moreover mangroves function as a natural reservoir

of biodiversity constituting a bridge between the terrestrial and aquatic ecosystems. The inter-tidal flora and fauna found among the mangroves are rich and vary according to location, salinity level, etc. The mangrove associated fauna and micro-organisms are highly interdependent and delicate. The micro-flora and fauna associated with the system serve in controlling pH, leaching of metals and nutrient cycling (Ananthakrishnan 1982). Mangrove ecosystem has a number of ecological functions. They harbour a rich community of plankton, which form the source of food for crabs, prawns and fishes. They also form the breeding and nursery grounds for many marine and freshwater fishes. They recycle polluted water, prevent floods and bank erosion, reduce the fury of waves and wind and recharge ground water. Evidences show that the coastal tract of Kerala once had very rich stretches of mangrove vegetation and it has became confined to fragmented patches in Ernakulam and the three northern coastal districts of Kerala (Basha 1991, Subramanian 2002). Though the existing mangrove areas are highly localised, the species diversity of these mangroves and its associates is comparatively rich over other areas.

Physicochemical Characteristics

The major abiotic factors influencing estuarine and mangrove ecosystems in Kerala include topography, tidal amplitude, pH, temperature, salinity, dissolved-oxygen (DO), organic and inorganic matters (Mohanan 1999). All these factors independently or in association with others influence and determine the formation, distribution and productivity of these ecosystems. Physicochemical characters of the Valapattanam River, such as the seasonal variation in temperature, pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Salinity, Hardness, Dissolved Solids, Chlorides, Nitrate, Phosphate, Sulphate, Sodium, Potassium, Calcium

and Magnesium, was studied by Lakshmi, et al., (2000). Temperature and pH are important parameters influence fish life in the estuaries. In Valapattanam, a temperature variation between 24oC and 16oC was recorded during pre-monsoon and monsoon period. Variations in pH were recorded from 6.4-7.87, especially at the mangrove areas, where high fish population was found. Maximum conductivity (EC) of 46, 975µs observed at the bar mouth and minimum of 36.7µs in fresh and unpolluted water. Likewise, a maximum of 30,064 ppm of Dissolved Solids (TDS) were observed at the bar mouth and minimum of 23.48 ppm at the fresh waters. Dissolved oxygen is an important factor for the aquatic life and it reflects the physical and biological processes prevailing in water. In Valapattanam River, DO varied from 6.53-7.53 ppm during the pre-monsoon and 7.66-8.86 ppm in monsoon season. The BOD values were low in Valapattanam river basin. Except during the monsoon season, high salinity (32.7 ppt) was observed in the lower reaches of the river due to salinity intrusion from the estuary. Nitrate-nitrogen and phosphate contents were also low in the river, irrespective of seasons. Maximum concentration of phosphate recorded was 0.015 ppm and minimum was 0.003 ppm. During pre-monsoon the sulphate content goes to a high level of 1200 ppm at the mangrove areas whereas in the upper regions it is around 40 ppm. Sodium and chloride being the major constituents of seawater, high concentration of these salts were found in the estuary and mangrove areas. Corresponding to the total hardness, calcium and magnesium concentrations are high in the lower areas. Concentration of potassium decreases during monsoon probably due to monsoon flows as well as due to absorption by certain mangrove associates.

Protected Areas

The upper catchment of Valapattanam River being on the western slopes of the Southern Western Ghats, with steep and rugged terrains contribute to diverse tropical forest habitat types. Though portions of the catchment are in the Karnataka State under the Coorg forest Division, most of the area lies on the Kerala Slopes. Most of these forests are contiguous and harbour diverse forms of rare, endemic and endangered plants and animal species. Obviously most of the areas are under protected category at different levels. The Aralam forests are declared as Wildlife Sanctuary and the adjoining Coorg division and the Kottiyoor forests are under reserve category.

Aralam Wildlife Sanctuary

Aralam Wildlife Sanctuary is the northernmost protected area of Kerala, situated on the Southeast slopes of Kannur District. It forms the major catchment of Cheenkannipuzha, which is a major tributary to the Valapattanam River. The sanctuary was constituted in the year 1984 incorporating the forested areas of Aralam, Kelakam and Kottiyoor reserve villages. Now it has a total area of 55 km2. The Cheenkannipuzha, being a major tributary to the Valapattanam River originates from the forests of Aralam, the perennial nature and flow in the Valapattanam depends largely on the watershed services of the Aralam Wildlife Sanctuary. The Sanctuary exhibits slope from east to west. Cheenkannipuzha forms the main drainage system on the southern side, which flows to the west. Streams such as the Narikkadavu, Kurukkuthode and Meenmuttithodu form the Northern upper reach, which flow southwards to join Cheenkannipuzha. In addition a network of small streamlets join the main drainage at different points from east to west including the Chavachithode in the eastern boundary. On the Northwestern side water drains to Urittipuzha, which is also a tributary of Valapattanam River.

Kottiyoor Reserved Forests

This is the only reserve forest in Kannur District. It originally includes the Kottiyoor reserve with an extent of 5550 ha and Kannoth extension with an area of 450 ha. It is out of these reserve forest areas that portions had been adjoined to constitute the Aralam Wildlife Sanctuary. At present in Kottiyoor, the net area of vested forests is about 3975 hectares (Cherian Kunju 2001).

The Kottiyyor range has tropical evergreen, semi-evergreen and moist deciduous forest formations. The Tropical evergreen vegetation is the climax vegetation seen on the higher Western Ghats slopes of the Kottiyoor Reserve. The physiognomy and species composition of these forests are very much similar to that of Aralam Wildlife Sanctuary since they are contiguous. Natural canebrakes occur in wet hollows of the slope forests, extending outwards to various lengths, depending on species, more conspicuous in high rainfall areas. Evergreen formations of Kannavam and Kottiyoor areas have such natural canebrakes. *Calamus hookerianus* and *Calamus thwaitisii* are the common cane species found in these forests.

Natural growth of bamboo brakes could be seen in localities of Peruva, Chembukkavu, Nedumpoil, Chikkeri and Kannavam. Of which, Kannavam has the major concentration of bamboo brakes.

Paniya and Kurichia are the two tribal communities living in the Kottiyoor forest area, of which Paniyas are the economically under privileged ones. Kurichians are living in colonies, which are located far from one another, mostly in the reserve forests of Kannavam range. Both the tribes sustain themselves by fishing in the hill streams and collecting non-wood forest products from the surrounding reserve forests.

Forest Patches

Apart from the Kottiyoor and Kannavam reserve forests, there are a few patches of forests in the catchment of Valapattanam River. The forest that extends from Kunnathoor padi to Padamkavala is 399 ha in area. This land is vested from erstwhile landlords as per the 1971 Act. Out of this, 60 ha have been converted into cashew garden and six ha into Acacia plantation. The forest patch on the northwest of Padamkavala is the Kanjirakolli beat which is consisting an area of 599 ha. Another isolated patch of forest is the Kudiyanmala reserve (397 ha), which is in a highly degraded condition.

Biodiversity Potential

From the origin out of the highland pristine rainforest slopes of the Western Ghats to its confluence with the Lakshadweep Sea at Azhikkal, the Valapattanam River passes mostly through the midlands. On the lowlands it forms two major estuaries and all along its way there are many unique habitats. Such a range of habitats from topical rainforests to estuarine mangrove ecosystems harbours rich diversity of plants, animals and microorganisms. Many rare, endemic and endangered species of plants and animals are reported from the Valapattanam basin. The biodiversity of the Valapattanam basin could be broadly grouped into a) biodiversity of catchment forests and b) diversity of estuarine and river ecosystem.

Floristic of the Catchment forests

Major vegetation types of the forested tracts in the catchment of Valapattanam River could be classified into:

1. West-coast Tropical Ever Green Forests

2. West-coast Tropical Semi Evergreen Forests

3. South Indian Moist Deciduous Forests

4. Southern Hill-top Evergreen Forests and

5. Plantations

About 22 sq km (34%) of the forests of the Aralam Sanctuary is fairly undisturbed and belongs to West-coast Tropical Ever Green Forests. The dominant upper storey of these forests consist of *Artocarpus heterophyllus, Biscofia javanica, Callophyllum elatum, Canarium strictum, Cullenia exarillata, Dipterocarpus sp., Drypetes elata, Dysoxylum malabaricum, Elaeocarpus tuberculatues, Holigarna arnottiana, Mesua ferrea, Pallaquium ellipticum, Persea macrantha, Polyalthia officinalis* and *Vateria Indica*. In the second storey, *Aglaia eleagnoidea, Actinodaphne hookeri, Baccaurea courtallensis, Cinnamomum malabathrum, Democarpus longon, Elaeocarpus serratus, Garcinia morella, Litsea wightiana, Myristica dactyloides* and others. Wild palms such as *Aranga wightii* and *Pinanga dicksonii* and good growth of rattans (*Calamus sp.*) can also be seen in these forests. Profuse shrubs like *Lasianthus sp., Psychotria sp., Solanum sp., Strobilanthus sp., Thottia siliquosa*, etc. are found in this vegetation formation. Ground flora is sparse in the evergreen forests and few species like *Anomum sp., Arisaema leshenaultii, Centella asiatica, Elettaria cardamom, Ophiorrhiza bruonis, Sarcandra sp.*, various species of *Begonia* and *Elatostemma* are found. Woody lianas are represented by *Caesalpinia bondice, Entada pursetha* and stranglers like *Derris, sp., Dioscorea sp., Smilax zeylancia, Thunbergia sp., Tragea involucrate,* etc. Epiphytes represented by various species of *Orchids, Aroids* and *Pteridophytes*.

The Semi Evergreen Forests has a mixture of both evergreen and deciduous species. The prominent Evergreen species are *Artocarpus heterophyllus, Biscofia javanica,*

Callophyllum elatum, Hopea wightiana, Mangifera indica, Mesua ferrea, Myristica dactyloides, etc. Deciduous components are *Bombax ceiba, Dalbergia latifolia, Dipterocarpus sp., Pterospermum rubiginosum, Toona ciliata,* etc.

Principal species of Moist Deciduous Forests are: *Albizia sp., Bombax ceiba, Dalbergia latifolia, Grewia tiliafolia, Lagerstroemia microcarpa, Schleichera oleosa, Terminalia bellarica, Tetrameles, nudiflora,* etc. Giant lianas like *Sptholobus roxburghii, Entada pursetha,* etc are common in these forests.

The Southern Hill-top Evergreen Forests are found mostly above 1200 m elevation, where the prominent species are *Callophyllum polyanthum, Cinnamomum sulphuratum, Elaeocarpus munroii, Garcinia sp., Memeceylon sp., Syzygium sp.,* and members of *Lauraceae*.

Plantations of teak and Eucalypt could be seen in the lower slopes of the sanctuary.

Mammals

A total of 23 species of mammals were recorded from the Aralam Wildlife Sanctuary and adjoining areas. Of which, the arboreal mammals include five species of primates; Malabar giant squirrel (*Ratufa indica indica*) and the Large brown flying squirrel (*Petaurista petaurista*). The Coorg race of the Giant squirrel (*Ratufa indica benghalensis*) was also reported from the Sanctuary. Large mammals included the Indian elephant, Sambar deer, Barking deer, Mouse deer, wild pigs and gaur. Tiger, leopard and the wild dogs are the major predators of the sanctuary. Many of these species are endemic to the Western Ghats and are listed under threatened category of IUCN list.

Amphibians & Reptiles

About 23 species of amphibians were recorded from the Aralam area. Of these, *Micrixalus nudis, Rana curtipes, Philautus pulcherrimus, Racophorus malabaricus* are endemic to Western Ghats (see figure). Twenty-two species of reptiles including the King cobra were reported from this tract.

Birds

A recent bird survey has shown a total of 188 species of birds from these forests. Of these, 12 species are endemic to Western Ghats and 18 species are in Schedule I of Wildlife Protection Act 1972 and eight species are globally threatened birds. Rare and endangered birds like Nilgiri Wood Pigeon, Malabar Pied Hornbill, Great pied Hornbill, Ceylon Frogmouth and broad-billed roller are frequent in these forests. High altitude endemic species like black and orange flycatcher, Kerala Laughing thrush were also reported from the Ampalapara (1, 450m ASL) area.

Fishes

A total of thirty-nine species of fishes were recorded from the streams of the Aralam Sanctuary area (Shaji et al 1995). Species such as *Pristolepis marginata, Batasio travancorica* and *Osteochilus thomassi* are new records to this area. Besides these, the endangered *Tor khudree* also abounds in the Cheenkannipuzha. List of species found in the Catchment streams of Valapattanam is given in Annexure-I.

Invertebrates

A survey by Jafar Palot (2000) revealed of 114 species of butterflies, 18 species of Odonates (Dragon flies and Damsel flies) from these forests.

Biodiversity of Estuarine and Riverine System

This part of the river includes unique habitats like, mudflats, mangroves, backwaters, reservoirs and other wetlands. Of which the mangroves are the significant and prominent habitats with peculiar composition of plant and animal species.

Mangrove Flora

Natural vegetation found on coastal wetlands and along estuaries is mostly the mangroves and their associate plants. In the Valapattanam and **i**s extended saline marshes, more than 85 species could be seen. Of these about 20 species are true mangroves. The common ones are *Acanthus ilicifolius* (Chulli), *Aegiceras corniculata* (Pookandal), *Avicenia marina* (Uppatti), *Avicenia officinalis* (Oori), *Barringtonia racemosa (Samudrakka), Bruguiera* cylindrica (Chakkara Kandal), *Bruguiera gymnorrhiz, Bruguiera parviflora, Bruguiera sexangula, Ceriops tagal, Derris trifoliate, Excoecaria agallocha* (Kommatti), *Excoecaria indica, Kandelia candel* (Kandal), *Lumnitzera racemosa* (Kadakandal), *Rhizophora apiculata* (Kandal), *Rhizophora mucronata* (Pranthan Kandal) *and Sonneratia alba* (Appakkad), *Sonneratia apetala* and *Sonneratia casealaris* (Blathi). Mangrove species are utilised by the local communities as medicine, fodder as well as fuel wood.

Table 2. Prominent mangrove associates of Valapatanam Estuary

Sl. No.	Scientific Name	Family
1.	*Acrostichum aurem*	Pterridaceae
2.	*Ardisia littoralis*	Myrsinaceae
3.	*Caesalpinia nuga*	Caesalpiniaceae
4.	*Calamus rotang*	Palmaceae
5.	*Callophyllum inophyllum*	Clusiaceae
6.	*Cayrantia trifolia*	Vitaceae

7.	*Cerebra manghas*	Apocynaceae
8.	*Clerodendrum inermi*	Verbenaceae
9.	*Crinum difixum*	Amaryllidaceae
10.	*Cyperus difformis*	Cyperaceae
11.	*Cyperus hispen*	Cyperaceae
12.	*Cyperus malaccencis*	Cyperaceae
13.	*Cyperus pumilus*	Cyperaceae
14.	*Fimbristylis miliaceae*	Cyperaceae
15.	*Fimbristylis aestivalis*	Cyperaceae
16.	*Mariscus javanicus*	Cyperaceae
17.	*Pycreus polystachyus*	Cyperaceae
18.	*Dalbergia candenatensis*	Papilionaceae
19.	*Dalbergia spinosa*	Papilionaceae
20.	*Derris trifoliata*	Papilionaceae
21.	*Dolichandrone spathaceae*	Bignoniaceae
22.	*Hibiscus tiliaceus*	Malvaceae
23.	*Ipomea compamulata*	Convolvulaceae
24.	*Melastoma malabathricum*	Melastomaceae
25.	*Morinda citrifolia*	Rubiaceae
26.	*Pandanus tectorius*	Pandanaceae

Above table shows the common flora associated with the mangroves. These are also found along the riversides, sedges, on the bunds and in the marshes. Kannur and its surrounding villages being traditional centres of indigenous medicinal practitioners, almost all these plant varieties are used in preparations of medicinal compounds. The screw-pine (*Pandanus sp.*) is used as a raw material for making mats and other handicrafts by certain communities living along the river basin.

Riparian Flora (Trees on the riverbanks)

Different types of trees and plants are found along the riverbanks and their association is called as the riparian vegetation. It has the peculiar combination of evergreen, semi-evergreen and deciduous members. The common tree species found along the Valapattanam River include Puzhamaruthu (*Terminalia arjuna*), Poomaruthu (*Lagerstoemia flosreginae*), Cheru (*Semicarpus anacardium*), Karuva (*Cinnamomum sp*.), Edala (*Olea dioica*), Athi, Vellila, Vaka (*Albezia sp*.), Neerkanjiram, Punna (*Callophyllum sp*.), Karappa, Neermathalam, Uruppu, Parom, Pezh (*Carea arborea*), Nhana (*Sysigium sp*.), *Trema orientalis*, *Thespesia populnea*, *Ichnocarpus frutescens*, *Pongamia pinnata*, Ath, Attuvanchi, Kallurvanchi, and Pannal.

In addition to these a number of herbs, shrubs and stranglers can be seen along the riversides. These plants have many local values such as food, ritual, medicine, fodder and manure (Annexure-II). Due to constant disturbances and removal of vegetation along the riverbanks, most of the species found are of secondary growth. True riparian trees could be seen intermittently towards the upper reaches of the river from Iritty area.

Fauna

Faunal diversity of Valapattanam estuary is rich with microorganisms, planktonic forms, and various species of invertebrate and vertebrate fauna. The faunal components could be distinguished into priphytic, benthic and nektonic communities based on their ecological niches (Khaleel 2004). During monsoon and pre-monsoon, the mangroves and estuaries are rich in Phytoplankton and Zooplanktons. The common phytoplankton found in the Valapattanam estuary and mangrove areas are *Scenedesmus, Navicula, Clasterium, Netrium, Pleurosigma, Eunotia, Nitzschia, Cyclotella Coscinodiscus, Ankistrodesmus,*

Surirella, Pedisastrum, Cosmarium, Ulothrix, Triploceras and many species of *Diatoms. Euplotes, Rotifer, Paramecium, Euglypha, Difflugia, Euplotes, Stylonichia*, etc are the common Zooplankton. The benthic fauna of the Valapatanam estuary consists of many species of arthropods; especially mud crabs, aquatic leeches, polycheates, molluscs and larvae of various animals.

The common crab species found in the estuary are: *Scylla serrata* (Mud crab), *Charybdis cruciata* (Mask crab), *Portunus pelagicus* (Spotted crab), *Maluta lunaris* (Armed crab), *Euca sp*., etc.

Clams, Mussels, Oysters, Shells and Barnacles are the molluscs found in the estuary. *Perna indica, Perna virdis* (Kallummakka), *Meretrix cassia* (Elambakka), *Crassa malabarica, C. cucalata* (Muru) are the edible molluscs having good commercial value in the Valapattanam area. *Telescopium sp.* (Purikka), *Barnacles, Murex sp*. and *Bullia sp*. could be seen along the mud during low tides.

Economically important crustaceans like *Penaeus monodon* (Tiger prawn), *Penaeus indicus* (Naran), *Metapenaeus dobsonii* (Poovalan), *Metapenaeus affinis* (Kalanthan), *Macrobrachium sp* could also be abundant in the estuarine waters. The spiny lobster (Panulirus sp.) is also seen in the Valapattanam estuary.

Fishes

The common fishes found in the Valapattanam Estuary is of *Etroplus suratensis* (Karimeen), *Etroplus maculates* (Chootachi), *Mugil cephalus, Mugil cunnesius, Mugil parsia,* (Malan), *Chanos chanos* (Poomeen), *Lates calcarifer* (Narimeen), *Megalops cyprinoids* (Palankanni), *Eleotris fusca* (Nongal), *Leognathus sp.* (Mullan), *Scatophagus argus* (Kachai), *Arius sp.* (Aeta), *Anguilla sp.* Sping Eel (Aral), *Parastromatus niger*,

Tilapia mossambica (Thilapia), *Channa marulius* (Varal), *Daysciaena albida* (Kallangiran), *Thysariophrys indicus* (Ariyan), *Rasbora daniconius* (Pullan), *Tachysurs sp*.etc.

Birds

The mudflats, mangroves, marshes, *kaipad* fields and the extended waters of Valapattanam and Kattampally estuary makes good habitat for many water birds of resident as well as migrant ones. The marshy wetland of Purathyil and Munderipalam area, which is an extension of Kattampally estuary, is an important area for migrant birds. Rare and endemic raptors also could be seen in these areas. The Common Kingfisher, Pied Kingfisher, Stork-billed Kingfisher, Small Green Beaeater, Crow Pheasant, White breasted Waterhen, Indian Moorhen, Purple Moorhen, Bonzwinged Jacana, Pheasant-tailed Jacana, Red Wattled Lapwing, White bellied Sea Eagle, Brahminy Kite, Pariah Kite, Marsh Harrier, Little Grebe, Little Cormorant, Grey Heron, Purple Heron, Little Green Heron, Large Egret, Little Egret, Indian Reef Heron, Chestnut Bittern, Black Bittern, Indian Night Heron, Spotted Munia, etc are the resident birds found in the wetlands of Valapattanam Estuary. Pampurutthi Island, located in the southeast part of the Kattampally estuary is an important area of Heronry and roosting. Cormorants, Egrets and Darters are regularly nesting and breeding in this area. Eastern Swallow, White necked Stork, Brown headed Gull, Plovers, Wood sandpiper, Little Stint, Blue-tailed beaeater, Cotton Teal, Garganey Teal and Lesser Whistling Teal are the migrants found in the Estuaries.

SOCIO-CULTURAL INFLUENCES

History of Human Habitations

About 50 km upstream from the river mouth, both the banks of Valapatanam River were inhabited since new Stone Age. There are a number of sites along the river, which testify human habitations in Palaeolithic and Neolithic Ages. In 664 AD Muhammed Ibnu Malik Dinar and his ten sons came to Musris (present day Kodungallur) for propagation of Islam. In the auspices of their mission Mosques were constructed in Kodungalloor and Madai (Payengadi). Later a few of them traveled along Neythara River (Valapattanam River) and reached Surukandapuram (Sreekandapuram). The remnants of the mosque on the banks of the river could be seen even today. Nearby areas like Irikkur and Chengalai also became flourishing centers of pepper and spice trade. Mostly the descendents of Muslim community engaged in trade got settled along the Valapattanam River.

Timber Market & Plywood Industries

Timber trade has a long history for this region. The rich forest resources of the eastern hilly region have attracted many entrepreneurs to this district. Once the river Valapattanam had a perennial flow, draining from the forests of Coorg and Aralam area to the Arabian Sea at Azhikkal estuary. The forest provided the best quality teak and rosewood. There was high demand for hardwood species like *Terminalia paniculata, Lagerstroemia lanceolata, Pterocarpus marsupium, Artocarpus hisutus,* etc. Using the natural river flow was an economical and convenient means to transport timber from these forests to the river mouth. The main timber markets were thus concentrated around Valapattanam (Baliapatam) and Azhikkal areas and the timber used to be exported to countries like Arabia, Egypt and Europe.

From the timber industry emerged another allied sector, the plywood manufacturing industries of Kannur. The advantage or river transportation has encouraged concentration

of a number of plywood factories along the Valapattanam River. The most famous of these is the Western India Plywoods Ltd. It is the largest integrated wood-processing complex in the country, which was established in the year 1945 immediately after the Second World War. It was established by Khader Kutty Saheb, a pioneer in industrialisation of this area, as a small plywood-manufacturing unit on the bank of Valapattanam River. The company has innovated methods to minimise loss of timber during processing and to maximise value addition using latest technologies and has diversified into all types of wood products. It is also famous for its special products that find applications in space research and hi-tech specifications. Now it is the largest wood processing complex in Southern Asia and a market leader in wood industry (George 2003).

Migration from Travancore

Apart from Muslims, who are converts from Hinduism, Christians also dominate the population. A good numbers of Christians migrated from Central Travancore to Kannur District in latter period of the 20th Century. The first batch of them reached at Madampam, in 1943, which is on the bank of Valapattanam River. About 200 Christian families belonging to the Knanaya sect from Kottayam were also settled in these areas. Towards the end of Second World War the flow of migrants to the areas around Valapattanam got accelerated. Up to the end of 1960s, transport was mainly through Valapattanam River. Now the upper reaches of the river in Peravoor, Irikkur, Iritty and Thaliparamba blocks are occupied by large numbers of Christian migrants from south.

Although habitation was confined to isolated villages in the olden days, it has become contiguous now, except some long patches of paddy fields and hillocks on the banks.

After Land reforms and Tenancy protection Acts of Sixties and Seventies, habitation near the riverbanks have increased substantially. It is remarkable in Gram Panchayaths like Narath, Kolachery, Mayyil, Kuttiattoor, Koodali, Kalliasseri, Kurumathur, Chengalyi, Sreekandapuram, Malappattam and Irikkur and Taliparamba Municipality. Riverbanks in Azheekode, Valapattanam and Pappinisseri Gram Panchayaths are mostly industrial areas, mangrove forests or uninhabitable wetlands and thus, habitation in these areas has not increased much.

Large-scale migration from Travancore, which started in 1942 and increased after independence, resulted in large-scale deforestation of the private forests in the catchment of the river. These forests, where shifting cultivation (Punam krishi) was the practice, vanished within 10-15 years and short-term crops were cultivated, which later gave way to plantations crops. The physical structure of the river, its water resources, the fish variety and population, all were affected adversely by the unhindered slaughter of wooded areas.

The migrant habitation initiated in Chemberi in 1942 has changed the geographical structure of a large area like Eruvessy, Payyavur, Ulikkal, Payam, Ayyankunnu, Aralam, Kanichar, Kelakam, Kottiyur panchayaths. Deforestation and large-scale agricultural activities in the forestland increased the sand deposits in the river. Various trade centres sprouted in these areas like Kutiyanmala, Chemberi, Nellikkutti, Chandanakkampara, Paisakkari, Vattiyamthode, Mattara, Manikkadave, Iritty, Vallithode, Koottupuzha, Peratta, Edur, Karikkottakkari, Thundiyil, Kelakam, Neendunokki, and Ambayathode. The various institutions like schools and churches are symbols of the sea changes that occurred due to migration.

Tribal colonies

Tribal colonies situated within 500 m of the riverbanks were recorded and it was revealed that about half of them are situated on the riverbanks. People from these colonies sustain themselves by fishing from the river and utilising the bamboo and screw-pine (*Kaitha*) resources, abundantly available on the banks, as raw material for making value added handicrafts. As these plant varieties began to disappear due to human interference and plastic materials became the order of the day many of the natural artisan products got marginalized. This cut the very source of income of the tribal communities. There are altogether 28 tribal colonies in 10 Gram panchayaths, adjacent to the Valapatanam River. Details are shown in the table below:

Table 3. Tribal Colonies found along the Valapatanam River

Gram panchayath	Site of the colony	Tribe	No of families
Kottiyur	Ambayathode	Paniya	25
	Palchuram down	Paniya	25
Kelakam	Ramachi	Kurichya	12
	Ramachi	Paniya	15
	Kariyam Kappi	Paniya	10
	Muttukutty	Paniya	20
	Pookkund(islet)	Paniya	15
	Chettiyamparamb	Paniya	6
	Valayanchal	Paniya	15
Muzhakkunnu	Pulimunda	Paniya	11
Aralam	Vietnam	Paniya	22
	Aralam	Paniya	16
	Kaithakkuzhi	Paniya	8
Payam	Edur	Paniya	8
	Chemmaram	Paniya	13
	Kunnoth	Paniya	13
Ayyankunnu	Uruppukutti	Paniya	11
	Vaniyappara	Paniya	14
	Charal	Paniya	11
Keezhur Chavasseri	Kottakkunnu	Paniya	11
Ulikkal	Kokkad	Paniya	14

	Manippara	Mavilan	10
Payyavur	Kanhirakkolli	Karimpalan	20
	Vanchiyam	Karimpalan	10
	Vanchiyam	Kurichyar	10
Eruvessi	Uravukund	Mavilan	8

Islets

There are number of small and big islets in the Valapattanam River. The 14-acre islet in front of the Kottiyur temple is under the control of the Kottiyur Devasthanam. It is used as a rest place during the festival period. There are four islets in Cheenkannipuzha- the one acre Valumukku thuruth, three acre Muttumatti thuruth and other two unnamed ones. The Paniya colony at Pookkund is on an islet having an area of six acres.

There are three islets of more than 500 m length between Aralam and Muzhakkunnu panchayaths on both sides of Palappuzha Bridge. One among them, an 8-acre islet is owned by a person for cashew plantation. The other two are used by the residents of the nearby tribal colony for cultivating banana and vegetables. There is a 2-acre islet in Veni puzha at Madathi. Trees in the five-acre Kokkad thuruth in Ulikkal panchayath are completely felled illegally and presently, sand is also mined in large scale. A park is developed on the 13.8 acre wide islet within the Pazhassi reservoir at Perumparamb.There are two small islets of less than one acre at Malapattam and Eruvessi.

As the flow of the river slows down after the confluence of Irikkur River and Sreekandapuram River, big deltas are formed. They are, Therlayi, Korlayi, Kolthuruthi, Pamburuthi, Bhagat sing island, A.K.G Island and Puramad. Therlayi is the area separated from the mainland when water from the Valakkai thode split into two. All others are formed from deposits of silt. Therlayi, Korlayi, Kolthuruthi and Pamburuthi

are densely inhabited and have acquired the status of villages. All these four islets have schools, temples, mosques and libraries. Recently a bridge is built to Kolthuruthi and a road connects Pamburuthi with mainland. A.K.G Island and Puramad thuruth are under the control of Taliparamba Municipality. The Bhagat Singh Island, which is owned by Pappinisseri Gram Panchayath, has become a coconut plantation. The panchayath is getting substantial income from toddy tapping and coconut. Apart from these, sizeable areas under mangroves also can be considered as islets. Generally, the islets in the upstream have not come under the administrative control of the panchayaths and steps for conservation are not taken by the local bodies.

Dependence on River

Valapattanam river network is flowing through 34 panchayaths in all the three Taluks of Kannur district. It tremendously influences the life of People who reside within half a km of the riverbanks. It is assessed that there are about 4 lakhs people under the direct influence of the river. Washing, bathing, irrigation, animal husbandry, fishing, fish farming, retting of coconut husks, brick manufacturing, curing of cement construction materials and sand mining are important human activities. There are a number of temples, ghats and ferries along the river. The areas of human interaction with the river are highly varied.

There were few settlements in Kuttiattoor and Sreekandapuram panchayaths which fully relied on fishing from Valapattanam River. Although these colonies are still there, they are compelled to look for other sources for their earning. It is alleged that the Kattampalli and Pazahssi dams and the 3000 odd pump sets used for lift irrigation, has spoiled their river based sustenance. Around 50 bridges constructed across the river network within

the last 50 years and the resultant reduction in the water transport has made around 100 ferry men jobless. There are 20 ferries still existing, with boats and passengers round the clock. The Mattool- Azheekkal ferry adjacent to the estuary is the busiest one with around 2000 passengers a day (Annexure-III). Ferries at Vattiyara, Payam, Aralam and Eruthumkadav are within the Pazhassi reservoir. Ferries at Kalloori, Mannoor and Mullakkodi are gradually discarded by the people. Many busy ferries have gone into oblivion due to the emergence of new bridges. Pappinisseri, Parassinkkadav, Kandakasseri, Nuchiyad, Vattiyamthode and Vallithode do not have ferries now.

There are 47 bridges having more than one span and 10 m length across Valapattanam River. Iritty Bridge, constructed in 1887 and reconstructed in 1924 is the oldest one. Valapattanam Rail Bridge was opened for traffic in 1908. Muderikkadav Bridge opened in 2002 and Valapattanam second Rail Bridge opened in 2003 are the latest additions. Malappattam Munamb Kadav Bridge is under construction. (Annexure-IV)

Fishing

The wide estuary, backwaters and the extended wetlands are created together by the Valapattanam River, Kuppam River (Taliparamb River) and Kuttikkol River (Payangadi River) where they confluence together and join the Arabian Sea. The uninterrupted tides facilitate the migration of marine fishes to the estuaries and even up to the less saline areas of the river. Up to 6 km upstream, salinity is equal to that of the sea- 2.4 to 3.6%. Beyond that, salinity is reduced due to neap tide and flow of the river. As there are mangroves and mangrove-associated species found up to 10 km upstream from the estuary, the environment is conducive to breeding and movement of marine fish species. There are lot of people who make their life from fishing in the Valapattanam estuary and

Kattampalli estuary, using nets and hooks. Different types of fishes like Chemmeen, Karimeen, Crab, Varal, and Tilapia are seen in this area. 15 km upstream from the estuary, between Parassinikkkadav and Malappattam munamb, oyster is abundantly available. In the landholdings adjacent to the riverbanks, oyster shell deposits are seen. Around 30 m lime shell is collected from this area every year. The Kattampalli regulator became instrumental for deterioration of fish resources in the Munderi estuary. Stagnation of water, the increased presences of pesticides, the increase in water temperature, etc have caused loss of regeneration sites for fish varieties. There are lots of deep trenches in the river near the forest areas. Practice of fishing using copper sulphate, dynamite, electric shock and some indigenous poisonous fruits are widely used in these areas, causing great loss to fingerlings and thereby, fish resources. A number of indigenous species of fishes are seen in the deep trenches of the river in the upstream. They include Cheru, Varal, Mushu, Mananhil, Katti, Kuruva, Kooral, Aaral, Kallemutty, Kola, Aranhil, Chottavala, Kari, Koori, Chillon, Kanichon, Mathipparal, Vaka, Kuttivaka, Pananvaka, Pulon, Karimeen, Konch, Vatton, Kotichipparal, Paral, Vazhakkapparal, Manhapparal, Nettiyil pottan, Velinhil etc.

Sacred Groves

Sacred Groves or Kavus and associated habitats constitute a unique network of ecosystems that are intertwined with the life and culture of people in northern Kerala. Sacred groves were once common feature in most villages along the Valapattanam basin. Due to changes in the social structure, beliefs and landholdings, many of the traditional sacred groves were converted into other forms of land-use. The important sacred groves now found along the Valapattanam River are the following:

Sl. No.	Sacred Grove	Area (ha)	Location
1.	Kunnathoorpadi Muthappan Sthanam	21.0444	Payyavoor
2.	Nilamuttam Mosque	0.8094	Irikkur
3.	Ayillar Kavu, Ikkare Kottiyoor	36.423	Kottiyoor
4.	Mammanikunnu Kavu	01.60	Irikkur

Among these, the Ayillar Kavu located in Ikkare Kottiyoor is the largest one (36.4 ha). The Kottiyoor festival is famous and large numbers of people both from the surrounding villages as well as from other districts of Kerala participate in the rituals. The Nilamuttam Kavu is owned as well as maintained by the Muslim community of that area, which is an evidence for the Hindu-Muslim cultural relations and harmony.

Kaipad Cultivation

Kaipad is a peculiar type of paddy cultivation found only in the estuarine parts of Kannur District in Kerala. In the earlier days farmers of this region, used to cultivate one crop of paddy during the month of June-July to October-November, the period of high rainfall. Indigenous cultural methods coupled with local saline resistant paddy varieties have made rice cultivation peculiar to this area. In the Kaipad areas, the cultivation is done by mound method. Alternatively in some locations, saline resistant seedlings are raised in non-saline nurseries and transplanted in the months of June-July to the Kaipad fields.

Most of the Kaipad fields could be seen along the low-lying deltaic areas of Valapattanam River and Kattampally estuary area (see figure). Hence the Kaipad lands are also known as Kattampally soils, which are spread over the Narath, Chirakkal, Puahathi, Elayavoor, Chelora, Munderi, Kuttiattur, Mayyil and Kolachery Panchayats of

Kannur district (Johnkutty et al 2002). The Kaipad land comes under the category of coastal saline soil, which is rich in organic matter (deltaic alluvium) in nature.

Places of worship

Along the banks of Valapatanam River and its tributaries, about 200 places of worship, of different size and importance, are recorded. Among these, the most important Hindu shrines having daily pooja, are Muthappan temple at Parassinikkadav, Ammakottam Mahadevi temple, Mamanikkunnu Devi temple, Keeezhur Shiva temple, Vayathur Kaliyar temple and Kottiyur temple. In Parassinikadav temple, around 2000 pilgrims come daily and it may goes up to 10000 during festival seasons. Around 1500 pilgrims come to the Keezhur Shiva temple during the festival days and the Kottiyur temple is visited by around 5-6 lakhs of pilgrims during Vaisakh festival. At all these three centres, people use to have ceremonial bath in the river.

The Malikdinar Mosque at Pazahyangadi near Sreekandapuram, Mosques at Ayar munamb, Chengalyi, Irikkur, Nilamuttam and Pedayagode also are situated on the banks of the river. At all these Mosques, *Urus* of one week is conducted. The important churches at Podikkund, Madampam, Vembuva, Paisakkari, and Kandakasseri are located on the riverbanks.

Burial Grounds

Cemeteries of Keezhur, Mecheri, Edur, Paisakkari, Vembuva churches and burial grounds (Manna) of Velimanam, Irikkur, Pazhayangadi, Neerozhukku, Sreekandapuram and Chengalyi Mosque are located adjacent to the Valapattanam River.

Towns near the riverbanks

There are no municipal towns along the riverbanks, although two Municipal areas are adjacent to Valapatanam River (Mattanur and Taliparamba). The fast growing trade

centres on the banks are attaining the status of towns and they include Valapatanam, Kambil, Parassinikkadav, Chengalayi, Sreekkandapuram, Chemperi, Kudiyanmala, Irikkur, Vattiyamthode, Manikkadav, Iritty, Thundiyil, Kelakam, Kottiyur, Peratta, Kootupuzha, Edur, Karikkottakkari and Vallithode.

Sand mining

Information on sand resources of the Kerala Rivers is scarce and whatever available is confined to Periyar, Pamba, Manimala and Chalakkudy rivers (Padmalal and Maya 2000). However the increasing demand in the construction and other development sectors depend on the major riverbeds, which is obviously reflected as large-scale sand mining in Valapattanam River. Grama panchayats grant permission for mining by auction or on royalty. Illegal mining is much more than the legally permitted mining activity. According to the 2002 statistics, 13 Gram panchayaths and two Municipalities are having approved mining sites in the river. The following table shows the number of sites in each local body and approximate quantity of sand mined daily:

Table 4. Sand mining in Valapattanam River

Name of the Local body	Number of sites auctioned	Daily exploitation (Truck load)	Quantity in Cubic Meter
Pappinisseri GP*	5	225	900
Kolacheri GP	4	250	1100
Mayyil GP	4	40	200
Malappattam GP	2	15	60
Chengalayi GP	4	70	350
Kuttiattoor GP	1	10	50
Koodali GP	3	20	100
Sreekandapuram GP	2	15	60

Irikkur GP	2	15	60
Keezhur chavasseri GP	2	125	500
Payam GP	4	5	20
Ayyankunnu GP	3	3	15
Aralam GP	3	2	10
Mattanur Municipality	1	20	100
Taliparamba Municipality	4	85	500
Total	**44**	**900**	**3025**

*GP – Grama Panchayat

Altogether, from 44 mining ferries, around 3025 m^3 sand is mined daily. On an average, mining takes place for about 250 days a year. Thus, the annual exploitation comes around 7.5 lakh m^3.Apart from this, lot of soil is dug out from different islets and dam site for reclaiming low lands.

A Rapid Reserve Estimation (RRE) survey was carried out in the Valapattanam River between Irikkur Bridge and the tributary confluence of Sreekantapuram *River* near Koyyam for a channel distance of about 11 km by Padmalal and Maya (2000). The investigation revealed that this part of the river channel accounts for about 2.01×10^6 m^3 of sand. At the present rate of uncontrolled mining, the sand reserve at this section will be exhausted within a few of years exposing the bed rocks almost in the entire stretch. This definitely imposes severe damage to the already degraded riverine system. The river stretch upstream of Irikkur Bridge is mainly rocky in nature and the sand deposits are found as sporadic patches. In case of sand replenishment to Valapattanam, data of the Central Water Commission (CWC), for the Valapattanam river (1989/90 - 1998/99) reveals that, on an average, about 100449 metric tonnes (equivalent to 12556 truck

loads) per year of sand is being transported down to the river gauging station at Perumannu as suspended load.

Pollution

Obviously garbage and other wastes are accumulating in almost all these centres and sewage water and market wastes are dumped in to the river at Irikkur, Iritty and Sreekandapuram. At other places, garbage including plastic materials, paper and hotel wastes are thrown into the river. When compared with Periyar and Chaliyar, Valapatanam River is less polluted. Most of the industries causing pollution are confined to the upstream at a distance of 10 km from the river mouth. Factories in Azhikode, Valapatanam and Pappinisseri panchayaths like the Western India Plywood, Western India Cottons, Fibre Foam, and a number of small and medium plywood factories are dumping their polluted effluents into the river. Many timber and sawmills use the lagoon as their yard for keeping their stock of timber. Plywood factories are also using the river for saline seasoning. All these industrial activities along with retting of coconut husks and leaves, add to the pollution level of the river. Slaughterhouse wastes from the nearby market places, effluents from the cement brick casting centres etc also contribute to the pollution. Increasing usages of pesticides, fungicides and other chemicals for plantation crops like cashew, paddy, pepper, areacanut and rubber in the catchment pose an increasing threat to the Valapattanam River.

Irrigation Projects

The river water is used for irrigation through Vented Cross Bars, Check Dams and Lift Irrigation works. The Pazhassi Irrigation Project started on an estimate of Rs 4.42 crore in 1964, has been recently declared abandoned incomplete after spending a huge amount, 40 times more than the original estimate, ie, Rs 176 crore and it is now declared as a

drinking water project. The project, which targeted to irrigate 11525 hectares of paddy fields claims to have achieved the facility for 7448 hectares. The work of 150 crore Barapol Irrigation Project which aims to irrigate 15000 hectares has not been started. The proposed and un-implemented Madampam regulator cum bridge targets to irrigate 200 ha of paddy field in Sreekandapuram and Chengalyi Gram panchayats.

Drinking Water Projects

The existing three small drinking water schemes are at Kottiyur, Palappuzha and Irikkur. Pazhassi Project as stated earlier has been declared as Drinking water scheme recently. There are four pumping stations already within the reservoir. Canals are used to take water to Koothuparamba, Thalassery and Mahe Municipalities. There are separate pumping stations and tanks for the Kannur water supply scheme and the Kolachery drinking water scheme. A pumping station is already constructed for the Irikkur drinking water scheme ten years back. In addition to this, a new Japan aided project is initiated for the Pattuvam drinking water scheme recently. When the works of all these projects are completed, Mahe, Thalasseri, Koothuparamb, Kannur, Taliparamba, Mattanur Municipalities and the surrounding panchayats would be benefited. Kolachery, Kuttiattoor, Mayyil, Koodali and Munderi panchayats would be covered by the Kolachery Scheme; Padiyur, Malappattam, Sreekandapuram and Chengalayi panchayats by Irikkur project and Pattuvam, Kurumathur panchayaths and Taliparamba municipality by Pattuvam project. Altogether, the Pazhassi project will provide piped drinking water connections to about eight-lakh population.

Hydroelectric projects

At present there are no hydroelectric projects existing in the Valapatanam river network. The Vanchiyam Micro hydel project was approved in 1989. The initial work of the

project which aimed to generate 4 MW electricity started in 1992 at an estimate of rupees 2.25 crore. The private company, which took up the work, withdrew from the project after completing the works of the canal and the weir. The project is in an abandoned condition for the past eight years. Chathamala-Adakkathode Micro Hydro project and Palchuram and Aralam (Barapol) Mini hydro projects are still on paper. Other projects under consideration are the Palchuram Project to generate 22.4 MW electricity using the water from Chekuthan thode that makes a water-fall at the Palchuram valley, at an estimated cost of 45 crore rupees and the Rs 150 crore Aralam project to generate 60 MW power.

Azhikkal Port

The State of Kerala is endowed with about 600-km. long coastline. Historically, many small ports, including Azhikkal, used to be fairly active along the coastline during the olden days catering to the sea-borne trade that existed between Kerala and other parts of the world. Even now Azhikkal is a potential site, which could be developed to a minor port. It is having a large expanse of water body at the confluence of Valapattanam River estuary with Lakshadweep Sea. Considering such natural advantage, the Department of Ports, Government of Kerala has a plan to develop a commercial Port at Azhikkal at the mouth of Valapattanam River. The establishment of such a port would increase the commercial potential, especially the traffic towards the Lakshadweep islands. Moreover as the international shipping route passes very near the Kerala coast the Azhikkal port can invite more ships, which would ultimately help in the comprehensive development of the district and the state at large. The Department envisages the development of the harbor with private sector participation. ICICI- KINFRA Ltd., has looked into the possibilities of developing this port with private initiative. ICICI Kinfra would associate with HOWE

(India) Pvt. Ltd. in this venture. The agencies are currently in the stage of demand assessment of the port at Azhikkal.

Scope of Tourism

The Valapatanam river basin has plenty of locations and facilities to develop tourism. Palchuram, Meenmutty water falls, Aralam Wildlife Sanctuary, Barapol, Kanhirakkolli and Vaithal mala are places suitable for trekking and eco-tourism. The Kannur district Tourism Promotion Council has arranged facility for boating at Kuyilur and Iritty. However, this facility is stopped on court order over the complaint of diesel contamination in drinking water. A huge theme park is planned at Parassinikkadav, making advantage of the terrain and increasing flow of pilgrims to the Parassinikkadav temple. Tourist resorts have already come up at Parassinikkadav and Kattampalli. The Kotti-Kottappuram boat service arranged by the inland water transport department, linking Parassinikkadav, Valapatanam, Mattul, Thekkumbad islet, Pazhayangadi and Kottappuram was a real attraction as it provided ample opportunity to traverse the final phase of the river through the mangrove forests and scattered islets. However, it is abandoned on economic grounds. If planned with proper vision, tourism could be an important source of development to this area and people.

Present condition of the riverbanks

Around 30 km from the estuary towards the upstream, the riverbanks are very low and muddy of about 1-1.5 m height. At many places due to the unregulated sand mining, riverbanks are collapsing. The monsoon floodwaters are also eroding the riverbanks. On the northern bank of the river, laterite hillocks of 6-10 m height could be seen at Mankadav, Parassinikkadavu, Kanicheri and Nanicheri. On the southern bank, narrow flood planes extend up to Pavannur ferry. A 40 m hillock slopes down to the river to the

east of Pavannur ferry. This hillock is prone to constant erosion by monsoon floods. Up to Kambil ferry, mangrove forests are seen on both sides of the river and they protect the riverbanks from erosion. River banks at Sreekandapuram and Irikkur are high up to 6-8 m. Flood planes are very less here. Riparian vegetation could be seen along the banks in this part of the river. Illegal felling of trees also is taking place in these areas. Kolantha, Chengalayi, Chakyara, Avanakkol, Madampam, Manneri, Mannur etc are places where riverbanks are collapsing and eroding in large scale. As an average of 7.5 lakh m^3 of sand mined every year from the river is not replenished. As a result, the riverbed becomes uneven, creating whirlpools, which again accelerates bank erosion.

Conclusion

An attempt is made to document the present status of the Valapatanam river system for a detailed study in future. In this context, a coordinated effort is required to utilize the development scopes of the Valapatanam River, and a public awareness campaign has to be initiated on this. Pollution and over exploitation of sand are the two major issues that require immediate attention. Conservation of mangroves has to be taken up seriously. Development plans related to small township areas sprung up in the recent past is another area of concern.

Few of the issues could be solved or regulated with participation of local people and local bodies. Urban pollution problems, waste disposal at Parassinikkadav and sand mining along the river are few priority issues. A few administrative decisions have to be taken in this regard. Since the river and the riverbanks are considered to be no man's property, the ownership of the river is a confusing issue. In some cases, the revenue department is handling it and in others, the local bodies are claiming rights. This has to be resolved at the Government level and the riverbanks should be surveyed and demark at the earliest to

avoid illegal confiscation. For practical reasons, Local Self Government Institutions are the apt agencies to handle the conservation and developmental issues of the river provided all technical and legal supports are provided to them. However, it has been observed that most local bodies are least concerned about the issues related to the river and rather they consider the river as a source of income. The policy related to the river system has to be discussed among the stakeholders, concerned gram panchayats and municipalities. To supplement this effort, a detailed study of the basin needs to be conducted, which would contribute more input into this.

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Annexure I

Fish Fauna of the Valapattanam Catchment

Sl. No	Species	Family
1.	*Parambassis thomassi* (Day)	Ambassidae
2.	*Anguela bengalensis bengalensis* (Gray)	Anguillidae
3.	*Mystus montanus* (Jerdon)	Bagridae
4.	*Mystus malabaricus* (Jerdon)	Bagridae
5.	*Mystus cavasius* (Ham-Buch)	Bagridae
6.	*Batasio travancoria* (Hara & Lav)	Bagridae
7.	*Bhavania australis* (Jerdon)	Balutoridae
8.	*Nemacheilus triangularis* (Day)	Balutoridae
9.	*Mesonoemacheilus guentheri* (Day)	Balutoridae
10.	*Schistura nilgiriensis*	Balutoridae
11.	*Xenentodon concila* (Ham)	Belonidae
12.	*Channa Orientalis* (Schneider)	Channidae
13.	*Channa marulius* (Ham-Bush)	Channidae
14.	*Etroplus suratensis* (Bloch)	Cichlidae
15.	*Clarias dussumieri* (Val)	Clariidae
16.	*Lepidocephalichithys thermalis* (Valenciennes)	Cobitidae
17.	*Osteochilichthys thomassi* (Day)	Cyprinidae
18.	*Osteochilichthys nashii* (Day)	Cyprinidae
19.	*Puntius fasciotus* (Jerdon)	Cyprinidae
20.	*Punitus ticto* (Ham & Buch)	Cyprinidae
21.	*Puntius amphibious* (Val)	Cyprinidae
22.	*Puntius denisonii* (Day)	Cyprinidae
23.	*Hypselo barbus curmuca* (Han-Buch)	Cyprinidae
24.	*Tor khudree* (Sykes)	Cyprinidae
25.	*Salmostoma boopis* (Day)	Cyprinidae
26.	*Garra mullya* (Sykes)	Cyprinidae
27.	*Parlusciosoma daniconius* (Han)	Cyprinidae
28.	*Barlius bakeri* (Day)	Cyprinidae
29.	*Barlius canarensis* (Day)	Cyprinidae
30.	*Barlius gatensis* (Valenciennes)	Cyprinidae
31.	*Danio aequipinnatus* (Mc Clelland)	Cyprinidae
32.	*Aplocheilus lineatus* (Val)	Cyprinodontidae
33.	*Awaous gutum*	Gobiidae
34.	*Sicyopterus griseus* (Day)	Gobiidae
35.	*Mastacembelus armatus*	Mastacembelidae
36.	*Mastacembelus guentheri* (Day)	Mastacembelidae
37.	*Pristolepis marginata* (Jerdon)	Nandidae

38.	*Ompok bimaculatus* (Bloch)	Siluridae
39.	*Glyptothorax madraspataum* (Day)	Sisoridae

Annexure II

Flora observed along the Valapattanam River

Sl. No.	Scientific Name	Family	Habit
1.	*Glinus oppositifolius*	Aizoaceae	Herb
2.	*Aerva lanata*	Amaranthaceae	Herb
3.	*Achyranthes aspera*	Amaranthaceae	Herb
4.	*Centella asiatica*	Apiaceaerae	Herb
5.	*Rowolfia tetraphylla*	Apocynaceae	Herb
6.	*Calotropis cylindrica*	Asclepiadaceae	Shrub
7.	*Blumea sp.*	Compositae	Herb
8.	*Eupatorium odorum*	Compositae	Herb
9.	*Tridax procumbens*	Compositae	Herb
10.	*Vernonia divergens*	Compositae	Herb
11.	*Vicoa indica*	Compositae	Herb
12.	*Elephantopus scaber*	Compositae	Herb
13.	*Eclipta alba*	Compositae	Herb
14.	*Spheranthus indicus*	Compositae	Herb
15.	*Ipomea biloba*	Convolvulaceae	Straggler
16.	*Luffa sp.*	Cucurbitaceae	Straggler
17.	*Melothria maderaspatana*	Cucurbitaceae	Straggler
18.	*Euphobia hirta*	Euphorbiaceae	Herb
19.	*Phyllanthus niruri*	Euphorbiaceae	Herb
20.	*Tragea involucrata*	Euphorbiaceae	Herb
21.	*Abrus precatorius*	Fabaceae	Climber
22.	*Entada sp.*	Fabaceae	Liana
23.	*Indigofera uniflora*	Fabaceae	Shrub

24.	*Pongamia pinnata*	Fabaceae	Tree
25.	*Samanea saman*	Fabaceae	Tree
26.	*Vigna sp.*	Fabaceae	Herb
27.	*Mappia foetida*	Icacinaceae	Straggler
28.	*Hyptis suaveolens*	Lamiaceae	Herb
29.	*Leucas apsera*	Lamiaceae	Herb
30.	*Sida acuta*	Malvaceae	Herb
31.	*Sida cordifolia*	Malvaceae	Herb
32.	*Mimosa pudica*	Mimosoideae	Herb
33.	*Ficus benghalensis*	Moraceae	Tree
34.	*Boerahavia diffusa*	Nictaginaceae	Herb
35.	*Axonopus compresses*	Poaceae	Grass
36.	*Cynodon dactylon*	Poaceae	Grass
37.	*Imperata cylindrica*	Poaceae	Grass
38.	*Zizyphus oenoplia*	Rhamnaceae	Climber
39.	*Morinda tinctoria*	Rubiaceae	Tree
40.	*Oldenlandia corymbosa*	Rubiaceae	Herb
41.	*Cardiospermum helicacabum*	Spindaceae	Straggler
42.	*Scoparia dulcis*	Scrophulariaceae	Herb
43.	*Physalis minima*	Solanaceae	Herb
44.	*Datura stramonium*	Solanaceae	Shrub
45.	*Helicteres isora*	Sterculiaceae	Shrub
46.	*Triumfetta rhomboidea*	Tiliaceae	Shrub
47.	*Centella asiatica*	Umbelliferae	Herb
48.	*Clerodendron inermae*	Verbenaceae	Shrub
49.	*Stachytarphetta indica*	Verbenaceae	Shrub
50.	*Curcuma longa*	Zingiberaceae	Herb

Annexure-III

Ferries of Valapatanam River

Ferry Point	River	Site
1. Azheekkal	Valapatanam	Azheekal-Mattul
2. Kalloori	Munderi	Kalloori-Kannadipparamb
3. Narath	Valapatanam	Narath-Mankadav
4. Kambil kadav	Valapatanam	Kambil kadav-Kambil
5. Mullakkodi	Valapatanam	Mullakkodi-Nanicheri
6. Erahikkadav	Valapatanam	Eranhi-Korlai-Kurumathur
7. Kakkidikkadav	Valapatanam	Kakkidi-Thelai
8. Manakkad	Valapatanam	Manakkad-Therlai
9. Perumparakkadav	Valapatanam	Perumpara-Kandakkai
10. Chekkikkadav	Valapatanam	Koyyam- Chekkikkadav
11. Munamb kadav	Valapatanam	Koyyam-Munamb
12. Munamb kadav	Valapatanam	Munamb-Nambram
13. Kolanthakkadav	Sreekandapuram	Kolantha-Thavarul
14. Adurkadav	Sreekandapuram	Adur-Chengalayi
15. Parippinkadav	IrikkurRiver	Parippan kadav-Poyyakadav
16. Chuliyad kadav	Irikkur	Chuliyad-Pavannur
17. Nidukulam	Irikkur	Nidukulam-Chola
18. Mannur	Irikkur	Mannur-Irikkur
19. Vattyara	Iritty River	Iritty-Vattyara
20. Payam kadav	Bavali	Payam-Payam kadav
21. Ayyankav	Bavali	Ayyappankav-Aralam

Annexure -IV

Bridges on Valapatanam River and tributaries

Sl No.	Name of the Bridge	Name of the River	Name of the Road
1.	Valapatanam Railway-1	Valapatanam	Chennai-Mangalore
2.	Valapatanam Railway-2	Valapatanam	Chennai-Mangalore
3.	Valapatanam NH	Valapatanam	Kannur-Taliparamba
4.	Kattampalli Mayyil	Munderippuzha	Puthiyatheru
5.	Munderkkadav	Munderippuzha	Munderi-Kannadipparamba
6.	Niranthode Chekkikkulam	Munderippuzha	Cheleri-
7.	Nirathpalam Cherupazhassi	Munderippuzha -	Mayyil
8.	Parassinikkadav Aqua duct	Valapatanam	Parassini-Mayyil
9.	Kolthuruthi	Valapatanam	Kodallur- Manakkad
10.	Manakkad	Valakkai River	Valakkai-
11.	Valakkai	Valakkai River	Taliparamba-Sreekandapuram
12.	Thatteri	Valakkai River	Niduvalur-Chuzhali
13	Chalil vayal	Valakkai River	Chembanthotti-Chuzhli
14	Kokkayi	Valakkai River	Sreekandapuram-Naduvil
15.	Chembanthotti	Valakkai River	Naduvil-Sreekandapuram
16.	Sreekandapuram	Sreekandapuram River	Taliparamba-Iritty
17	Odath palam	Sreekandapuram River	Sreekandapuram-Payyavur
18.	Payyavur palam	Sreekandapuram	Sreekandapuram-

		River	Payyavur
19.	Eruvessi	Sreekandapuram River	Eruvessi-Poopparamb
20.	Nellikkutti	Sreekandapuram River	Poopparamb-Nellikkutti
21.	Chemberi	Sreekandapuram River	Chemberi-Kutiyanmala
22.	Mannumkund	Sreekandapuram River	Chemberi-Kutiyanmala
23.	Ponmala	Sreekandapuram River	Pulikkurumba-Kutiyanmala
24.	Kutiyanmala	Sreekandapuram River	Kutiyanmala-Areekamala
25	Vembuva	Sreekandapuram River	Payyavur-Poopparamb
26.	Vannayikkadav	Sreekandapuram River	Vannayikkadav-Nellikkutti
27.	Kandakasseri	Nuchyad River	Kanhileri-Kandakasseri
28.	Nuchyad	Nuchyad River	Payyavur-Ulikkal
29.	Vattiyamthode	Nuchyad River	Ulikkal-Manikkadav
30.	Mattara-1	Nuchyad River	Mattara-Manikkadav
31.	Mattara-Manikkadav	Mattara thode	Mattara-
32	Irikkur	Irikkur River	Irikkur-Chalode
33.	Uliyil	Irikkur River	Mattanur-Iritty
34.	Pazhassi dam	Irikkur River	Kuyilur-Veliyambra
35.	Thanthode palam	Eruthumkadav	Taliparamba-Iritty
36.	Iritty palam	Iritty River	Iritty-Koottupuzha
37.	Vallithode	Venippuzha	Vallithode-Edur
38.	Koottupuzha	Venippuzha	Thalasseri-Coorg

39.	Kacherikkadav	Venippuzha	Iritty-Kacherikkadav
40.	Anappandi	Aralam River	
41.	Palappuzha palam Aralam	Bavali-	Kakkayangad
42.	Kalikkayam	Bavali	Kanichar-Aralam
43.	Keezhpalli	Aralam	
44.	Manathana	Kanhirappuzha	Peravur-Manathana
45.	Thundiyil	Kanhirappuzha	Peravur-Thundi
46	Kelakam Adakkathode	Bavali	Kelakam-
47.	Kottiyur Nadappalam	Bavali	Ikkare Kottiyur-Akkare Kottiyur