RAMSAR CITES IN KERALA

VEMBANAD - KOL WETLAND (VKW)

Introduction

Location and area

Vembanad - Kol - Wetland – System, one of the three Ramsar sites in Kerala (November 2002), is the largest estuarine system of the western coastal wetland systems (09° 00’ – 10° 40’ N Latitude and 76° 00’ -77° 30’ E Longitude), and is spread over the districts of Alappuzha, Kottayam, Ernakulam and Thrissur, Kerala. The VKW is a complex aquatic system of 96 km. long coastal backwaters, lagoons, marshes, mangroves and reclaimed lands, with intricate networks of natural channels and man-made canals extending from Kuttanad in the south to the Kol lands of Thrissur in the north. The total area of the wetland system is 1521.5 sq. km., approximately 4% of the State's geographic area. The wetland is mostly waterlogged with depths ranging from 0.6 m to – 2.2m and is typically divided into two distinct segments - the freshwater dominant southern zone and the saltwater dominant northern zone.

Physical features

Based on physiography, Kerala is divisible into three near-parallel and north-south trending tracts, viz., the highland (>75.0 amsl), the mid land (7.5 m – 75.0 amsl) and the lowland (<7.5 m amsl). Geologically, the highland is typically underlain by crystalline rocks of Pre-cambrian age, where as coastal land and parts lowermidland are covered by sedimentary rocks of Tertiary age. A ubiquitous laterite capping occurs over crystalline rock basement of midland and the Tertiary sedimentaries. Recent and sub-recent sediments occur in low-lying areas and river valleys. VKW is fed by 10 rivers, all originating in the Western Ghats, flowing westwards through the wetland system to join the Lakshadweep / Arabian Sea. The area enjoys the full benefit of the southwest monsoon. The estuarine zone and organics rich sedimentary substratum of the inshore region makes it a highly preferred and desirable habitat for shrimps breeding. Vembanad is renowned for its live clam resources and sub-fossil deposits.
Vembanad wetland - Kumarakom area and its Environs (CED, 2003a)
Hydrology

The entire VKW receives drainage from ten rivers, Keecheri in the north to Achankovil in the south, adding up to a total drainage area of 15,770 sq km (40% of the area of the State), and an annual surface runoff of 21,900 Mm³ (almost 30% of the total surface water resource of the State). Physiographic peculiarities have always been the major constraint that adversely affected the utilization of water
resources in the region. Total annual utilizable yield of the ten rivers draining into the wetland system is estimated to be 12582 Mm³. In Keecheri-Puzhakkal, Karuvannur, Chalakudy, Muvattupuzha and Meenachil rivers, the total requirement for various purposes considerably exceeds the utilizable yield, and therefore, the scenario underscores the need for better management strategies.

The total storage for irrigation and power generation, in the basins of rivers draining into the VKW, is of the order of about 6000 Mm³, which is nearly half of the average flood flow to the wetlands. So, the reservoirs help in containing the floods to the wetlands to a larger extent (Indo-Dutch Mission, 1989). In general, reservoirs often act as sediment and nutrient traps. The major interventions in the river basins of this wetland system are irrigation and hydroelectric projects, besides the network of roads and a number of bridges. There are three irrigation projects in operation and five others nearing completion. The total irrigation potential is estimated to be 100200 ha with a total storage capacity of around 1345 Mm³. Nine of the Kerala’s hydroelectric projects are built in this area, with an installed capacity of 1400 MW.

Muhammed and Nambudripad (1999) of CWRDM successfully applied the Hydraulic Research Station (Wallingford, UK) model for long-term salinity prediction for Vembanad wetland, which can also be used for the study of optimum operation of the Thanneermukkom barrier and the Thottappally spillway and for analyzing the impact of future interventions and water withdrawals from the river basins and the estuary.

The Thanneermukkom barrier, (at least 1250 m long) was constructed in a narrower part of the Vembanad Lake, in order to prevent the ingress of salinity into the polders of Kuttanad during summer season and also to retain the fresh water inflow from the rivers into the lake. Only two-thirds of the original number of gates is opened in July to release flood flow, but the gates are closed mid-November. The structure has been relatively successful in keeping the water in the Kuttanad free of salinity and adding another crop in dry season. Drawback of the structure has been the loss of opportunity for marine fish and prawns to migrate upstream, an increase in weed growth in the upstream and finally, severely restricted the natural flushing of pollutants too.

The usually flooded areas of the Thrissur Kol also suffered from salinity intrusion through the inlets at Chetwai and Kottappuram. Enammakkal barrage was constructed about five decades ago, to prevent salinity intrusion into the Kol lands from Chetwai. Regulator at Enammakkal and the minor one at Kottenkottuvalavu in the lower reach of the Karuvannur river act both as spillway for the flood waters from the Kol land and as a regulator of salt water entry. As the capacity is, somewhat less, a new proposal is on the way.
A sample of tidal data at Thirunallur (36 km from mouth) shows semi diurnal character and several kinds of cyclicities and harmonics. Tidal range attenuates rapidly from the mouth, up to about 15kms, but near the Manappuram bottleneck, very high tidal ranges of 110 and 133cm have been attained in certain summer months. As expected, the range is lower during heavy monsoon flow.

During the monsoon, flow propels towards the sea during the entire tidal cycle, except very close to the mouth. With decrease in river discharge, flow reversal occurs. Velocity variations are quite pronounced during a tidal cycle, while depth-wise changes are relatively small. The flushing time, is time required to replace the existing freshwater in the estuary at a rate equal to the river discharge. By applying the modified tidal prism method to the Kochi estuary, the flushing time was found to be of the order of 16 – 21 days during summer.

**Biodiversity**

Though wetland system is extensively rich in biodiversity, there hasn’t been any comprehensive study on its flora and fauna. Table - 1 is a summary of available data.

In a study of Vembanad lake, Bijoy and Unnithan (2004) recorded 24 species of green algae, 10 species of blue green algae, one species of yellow brown algae, 13 species of desmids and 19 species of diatoms from the Vembanad lake. The Indo - Dutch Mission study (1989) listed the aquatic plants of the area. The major aquatic plants of the area are: *Eichhornia crassipes, Salvinia molesta, Nymphaea stellata, N. Nouchali, Nymphoides cristatum, N. indic, Hydrilla verticillata, Najas minor, Limnophila heterophyll, Aponogeton crispium, Potamogeton pectinatus, Scripus validus, Cyperus corymbosus* and *Ischaemum barbatum*. The study conducted by CED (2003a) recorded 8 pteridophytes and 202 Angiosperms of which 68 are trees. The floristic diversity of the area includes 14 Mangroves and more than 30 Mangrove associates, present in the area, of which the true mangrove, *Exoecaria agallocha* and *Bruguiera sexangula* are considered as rare species.

The wetlands support diverse fauna, including a large variety of fish, prawns and clams, reptiles and birds and provide a habitat for both anadromous and catadromous fish species. Almost all the 20 groups of Zooplanktons recorded from Kerla backwaters are present in VKW.

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Table 1: Biodiversity of Vembanad Wetland (compiled from various sources)
The growth and distribution of fish in the backwaters are greatly affected by the salinity range of the water. With the onset of southwest monsoon, in the estuary, salinity declines rapidly to almost that of fresh water, resulting in a decline of a number of estuarine fish species. From September onwards, the brackish water habitat gradually re-emerges in the backwater and marine fish, tolerant to a wide salinity ranges, appear in the lower reaches of the estuary. During the pre-monsoon period, the physico-chemical conditions at the mouth and lower reaches of the estuary are very similar to those of the adjacent sea. Coastal marine fish, tolerant to wide salinity fluctuations, migrate over long distances into the estuary. The fish fauna identified from the whole area comes to 102 species, mainly of mullets. Molluscs include the black clam (*Velorita cyprinoids*; *V. cornucopia*), *Mertrix meretrix*, *M. costa* and *Ostria calculata*. The mussels, *Perna viridis* and *P. indica* and the brackish water oyster, *Crassostrea madrasensis*, occur abundantly in the backwaters and river mouths. The soft-organic matter rich -sediment-substrata of the in-shore region are an ideal habitat for shrimps. Estuarine zone plays an important role in the life cycle of many shrimps caught and the entire Vembanad-Kol, acts as nursery for important shrimps like *Penaeus indicus*, *P. monodon*, Metapenaeus dobsoni, *M. monoceros*, *M. affinis*, *Macrobrachium rosenbergii*. Marine prawns, belonging to the family Penaeidae, are exploited both in the marine and estuarine waters. They spawn in the sea and the larvae migrate to the estuary to feed on the nutrient-rich environment. Among other Penaeids are *Penaeus indicus*, *Metapenaeus monodon* and *M. dobsoni*. The fresh water prawns of Kochi backwaters include *Macrobrachium rosenbergii* and *M. idea*. These fresh water prawns live in both fresh and brackish waters. The crustaceans include the edible crab *Scylla serrata* also.

The avifauna of this area requires special mention. During the winter months, the Vembanad supports the third largest population of more than 20,000 waterfowls in India. The birds come from different region and stay here for breeding and feeding. Kol lands provide a congenial habitat for a wide variety of birds including the waterfowls. In Mangalavanam, primarily a bird refuge, 149 birds were identified and of which 50 were migratory.

The area is also rich in insect biodiversity. CED study identified 26 species of insects from the area. Majority of them are butterflies belonging to the order Lepidoptera.

**Inland navigation**

The waterways formed by backwater, estuaries, lagoons and canals, spread over 196 km in the north-south and 29 km in the east-west directions, play an important role in the transportation system of the Vembanad region and practically, almost all the villages can be accessed through water transport. Muvattupuzha, Meenachil, Pamba and Achencoil rivers, draining into the lagoon, are navigable upto distances of about 30 km upstream in the tidal reach. The Kottappuram-Chetwai waterway supports the
inland navigation through the heart of Kol lands. A survey in 1986, revealed that out of a total of 14.74 million tons of cargo, of which inland waterways handled 1.74 million tons (11.84%). The Government of India has declared the Kollam-Kottappuram segment of west-coast canal system, passing though the Vembanad-Kol system, covering a distance of 209 km, as a National Waterway

**Tourism**

The VKW with its extensive network of rivers, lakes, canals, and lagoons fringed by lush green coconut groves and paddy fields, harbouring a variety of birds, is one of the most attractive backwater systems in the world. There are many historic places situated on the shores and hinterlands of the Vembanad-Kol backwaters. The offset of SW monsoon, is marked by scheduling of spectacular rowing competition involving several magnificent and large wooden canoes in the backwaters, which obviously attract thousands of spectators including foreign tourists. Further, the VKW is a treasure trove for ornithologists and bird lovers because of its rich avifauna. Tourism industry in this belt is now flourishing well especially in Kumarakam, Alappuzha and Kochi, of which Kumarakam has the top tourism potential. As a result, many new tourism facilities (like resorts and hotels) are coming up without any care or concern to the natural system or culture or heritage of the area.

**Pressures**

The unplanned development and economic activities for supporting the needs of increasing population continues to exerted ever growing pressure on the ecosystem.

The Vembanad estuary receives effluents from chemical and engineering industries, food and drug manufacturing industries and also from paper, rayon, rubber, textiles and plywood industries. It is estimated that nearly 260 mld of such industrial effluents reach the estuary from the industrial belt of Greater Kochi. In addition, the Cochin shipyard and port are releasing sizable quantities of waste oil, paints, metal and paint scrapings. The traditional retting practice in coir sector of this area also exerts pressure on the system.

The annual fertilizer consumption in Kuttanad alone is estimated as 20000 tons (CWRDM). Agriculture and aquaculture practices prevalent in the drainage basins are also partly responsible for eutrophication through deposition of eroded top soil and agrochemicals and pesticides.

Kochi city generates 2550mld of urban sewage that enters the Vembanad directly. Slaughter house wastes from the markets and hospital wastes also reach the system through the extensive network of canals in Kochi and through the rivers. Construction and industrial sectors here depend on wetlands for mined materials fuelling an extensive mining operation – a brisk business.
Present status of this land-water system is the result of a series of massive human interventions and consequences. The hydraulic/hydrologic interventions within the entire wetland system also exerted pressure in the sustainability of wetlands. The first and oldest were the reclamation and creation of the Wellington Island and the Shipping channel maintained in the Cochin harbour. Then came the major reclamation and bunding works in the Kuttanad area for improving agricultural output in the area. The third intervention was the construction of the Thottapally Spillway (1955) (fig:1) to divert floodwaters of Achankovil, Pamba, Manimala and Meenachil directly to the sea. The last intervention was the Thanneermukkom barrier (1975) (Fig : 2) built to prevent salinity ingress into the farmland of Kuttanad in summer. All the above interventions, except the first significantly altered the original flow pattern, salinity ingress, pollution dispersion and other characteristics. The Pathalam bund, a temporary barrage, is constructed each year on the Eloor branch of Periyar River since 1981, to prevent salinity ingress from Vembanad backwater and contamination of the water supply to the industrial units (rare earths, fertilizers, insecticides, catalysts and chemicals). But the enormous quantities of wastewater (about 8000 m$^3$) discharged daily into this branch are not flushed out, leading to stagnation and buildup of pollution to toxic levels.

Authorised and unauthorized sand mining is common in all areas of Vembanad wetland system. The uncontrolled mining of shells from the lake is also posing a threat to the eco system. Dredging of the sub-fossil lime shell to a depth of 7 m for industrial purpose is also going on.

**ASHTAMUDI WETLAND**

**Introduction**

*Location and area*
Ashtamudi Wetland (*Ashtamudi Kayal*, area = 61.4 km²), Ramsar site No. 1204, is near Kollam City (08°57'N 076°35'E) in Kerala and falls in Kollam City Corporation and adjoining Grama Panchayats. This extensive estuarine system, the second largest and deepest in Kerala, is connected to sea and is of extraordinary importance for its hydrological functions and biodiversity. Like fingers of a palm, it has multiple branches viz. Ashtamudi Kayal, Kumbalathu Kayal, Kanjirakkottu Kayal, Kandanchira Kayal and Karipuzha Kayal and opens to the sea through an inlet at Neendakara. The major river discharging into the AW is Kallada whose chief tributaries are Kulathupuzha, Chenduruni, and Kalthuruthy rivers.

**Physical setting**

Seaward portion of the AW is in the lowland, while toward east and south, i.e., landward, the hinterland falls in the midland. Geologically, the lake basin and environs are underlain by the Quaternary and Tertiary sediments and sedimentary rocks, in that the former is made of marine and fluvial alluvium of recent age, and the latter consists of Laterite, sandstones and clays of Warkalai formation.

The various landforms noticed are:

- **Coastal plain**: This unit consists of sandy plain with alternating ridges and swales and a narrow modern beach. Mostly utilised for human settlement and mixed crops.

- **Undulating uplands**: These are dissected uplands of 10-20m in height to the east and south with nearly flat tops and gentle slopes, carved out of tertiary formations.

- **Valley fills**: Broad valleys formed by dissection and erosion of Tertiary formations, are filled with alluvial materials. Such valleys are intensely cultivated with paddy.

- **Alluvial plain**: Vast alluvial plains of the Kallada River constitute this unit. This plain consists of several topographic lows, formed of marshes, water logged areas and palaeochannels.

- **Islets**: There are a number of islets or ‘Thuruths’ in the Ashtamudi Kayal. They possibly formed by erosion of loose tertiary sediments from parts of hinterland and deposition in the lake.
Ashtamudi, the deepest estuary in Kerala, receives discharge of Kallada River (length = 120 km; Basin Area = 1700 km² and discharge = 3375 Mm³) basin receiving an average annual rainfall of 2400 mm. The Ashtamudi wetland also serves the role of containing the flood waters, which otherwise would have had an adverse impact on the thickly populated coastal land and parts of the city of Kollam. A major intervention affecting hydrology of the wetland was the construction of Kallada dam in the upper catchment, built to irrigate 61630 ha of paddy and upland crops. This 85.3 m high 35 m long (area - 23 km² @ FRL) straight gravity masonry dam created a large reservoir of storing 505 Mm³ of water, is the
largest irrigation dam and reservoir. The dam reduced the summer flows significantly, aggravating salinity ingress in the wetland and into the river.

**Biodiversity**

Ashtamudi wetland ecosystem, a home to a wide variety of flora and fauna (table 2.), once had very good mangrove vegetation, but now stands reduced to a very small patch near the Asramom Park. Around 7 species of true and mangrove associates occur in this area. The floristic diversity covers around 72 species of herbs, shrubs and grasses, of which about 35% are medicinal plants and 92 tree species have been identified from the area.

Asramom area was once a repository of a variety of plants and its dependant animal species. The woody trees like *Holigharrna arnottiana*, *Syzigium travencoricum*, *Z. zeylanicum* etc., are still present of which *Z. travencoricum* is an endangered species (Red Data Book of Plants), *Calamus rotang*, an endangered species is present mainly in this site. *Rhizophora apiculata*, *R. mucronata*, *Ardesia littoralis* and *Avicennia marina*, once abundant in this mangrove area, have completely degraded.

The wetland supports 57 species of birds (6 migratory and 51 resident species) and 97 species of fish (42 typically marine, 3 estuarine, 9 estuarine-riverine and 15 marine-estuarine). About 40 species of wetland dependant birds are noted in Ashtamudi Lake, out of which 45% are long distant migrants. Terns, plovers, cormorants and herons are most abundant birds.

The CED (2003a) study reported 45 insect species, including 26 species of butterfly, 5 odonates, 9 hymenopterans, and 2 orthopterans, 1 hemipteran and 2 coleopterans. About 29 zooplankton species have also been identified. From the water body, 9 phytoplanktons such as *Amphora*, *Borosigma*, *Cyclotella*, *Cymbella*, *Gyrozigma*, *Meloziva*, *Navicula* and *Nitzschi* have also been identified.

**Tourism**

Ashtamudi Lake promises high potential in tourism industry, especially in areas like Backwater cruises; hotel facilities along the lake shore, etc. The internationally famous Ashtamudi Resort known for its ayurvedic treatments and oil massages are situated right on the shore of Ashtamudi Lake. The Kerala Tourism Development Corporation (KTDC)
operates luxury boat for cruises for domestic as well as international tourists. Tourism related activities in and around Ashtamudi Lake is already earning sizable revenue for the State. Due to all such factors, economic potential of the lake is also very high.

**Pressures**

More and more industries including tourism coming up adjacent to the shores and basin are without effluent and waste treatment facilities. Effluents from the industries like ceramic, aluminium, paper, match, spinning mills and cashew factories, located in the drainage basin of Kallada river and the backwater are released into the system. Small scale industries and other livelihood earning activities like fish processing units, boat building yards, food processing units, slaughter houses, etc., are also noticed. The effluents released from such units include fish spoilage and residues, slaughter house wastes, waste oil, paints, metal and paint scrapings etc. Coconut husk retting and related operations, though of small scale, are intensive, contributing heavily to the organic pollution load of the open water bodies. Wastes from the houseboats and resorts are also ultimately released into the wetland, raising nutrient levels, pathogens and other organic substances leading to pollution and eutrophication and finally degradation of the ecosystem. The lack of a well planned waste management programme for urban as well as rural areas also exerts great pressure on the system.

The fishing boats fitted with outboard engines releases large quality of hydrocarbons into the system. Legal and illegal encroachment and reclamation of wetlands are on the rise in many areas for creating infrastructure facilities to the rising urban population. Such actions cause shrinking of the wetlands and destruction of biodiversity.

The agricultural practices warrant the use of chemical/organic fertilizers and insecticides/pesticides, and the residues on entering the system cause pollution and eutrophication. The modern aquaculture also demands the use of many nutrients, inducing changes in the ecosystem.

Land use changes and deforestation in the watershed as well as the increase in withdrawal of surface and ground water from the river basin for irrigation, domestic, industrial and other uses have also put forth pressure on the system through stream flow changes. Hydrological interventions, like the Kallada Dam also exert pressure on the system. Natural process like floods, erosion, sedimentation and natural disasters do exert pressure in the AW. The hydro period of the wetland has changed due to the seasonal variations in the fresh water inflow into the wetland. Since hydrology is the single most important factor of the wetland and the hydro-period is the signature of the wetland, the changes is the hydro-period are sure to bring about changes to the wetland ecosystem.

**SASTHAMKOTTA LAKE (SL)**
Introduction

Location and area

Placed at an elevation of 33 m above MSL, the Sasthamkotta Lake, the largest freshwater lake in Kerala (373 ha), is a designated Ramsar site since November, 2002. The lake is surrounded by low standing hills on all sides except south, where a bund (embankment) has been built to store larger volume fresh water and separate the lake from adjacent rice paddy fields. Water in the lake is special in that, it does not contain common salt or other minerals and metals. SL is located in Kunnathur Taluk of Kollam District, (76°36'27" – 76°39'55" E. Long and 9°00'40" – 9°04'05" N Lat. Average depth of the lake was measured as 6.53m and maximum depth as 15.2m. The soil around the lake for about 10 - 20 m is mostly Kaolinite rich (derived from laterite) and hence, does not allow water to flow into the lake to any appreciable quantity. Earlier it was believed that the lake owed its supply mainly to the infiltration of ground water (Menon, 1967). However, later studies showed that Sasthamkotta Lake is a rain fed lake showing increases in water level at the end of monsoon rains. The yearly rainfall in the catchment area (area = 12.69 km²) of the lake is 282.16 cm and it has a storage capacity of 22.4 Mm³. It also consists of extensive marshy land, wet paddy fields and water bodies like 'Chelur pola' and 'Chirayathu Kayal'. An ancient Sastha Temple on its northern shores with resident troupes of monkeys, lends its name to the lake and town, adds sanctity to the waters and it is an important pilgrim centre.
Sasthamkotta Lake and Environs (CED, 2003a)

**Physical setting**

SL consists of two water bodies, viz., the main Sasthamkotta Lake and the adjacent Chelur Kayal, separated by a laterite ridge. These water bodies are surrounded by gently undulating lateritic hills on all sides except south where it is bordered by the alluvial plains of the Kallada River. A number of smaller water bodies and waterlogged areas occur in the river flood plains in the south and southwestern parts of Sasthamkotta Lake.

Geomorphologically the area can be divided into the following units:
• Undulating uplands: This unit consists of nearly rounded or flat topped lateritic mounts or hills with gentle slopes and intervening valley fills. The hill slopes are fairly thickly vegetated mostly with mixed crops and plantations.

• Valley fills: These are irregular valleys occupying the low-lying areas between lateritic hills, mostly filled by alluvial and colluvial deposits. Presently they are cultivated and densely populated.

• Flood Plains/Alluvial plains: Vast alluvial deposits occur in the flood plains of the Kallada River to the south. This unit is underlain by river alluvium mainly sand and silt and is mainly cultivated. Several water bodies and waterlogged areas occur in the flood plain.

**Hydrology**

The lake is separated from the flood plain by a 1.5 km long earthen embankment constructed prior to 1956. The mean annual temperature is 26.7° in winter and 29.2° in summer, and the average annual rainfall is 2180mm. The hills, surrounding the lake, cover an area of 935 ha, drainage empties into lake.

The quantity of water stored in the lake is estimated as 22.4 Mm³. The maximum water depth in the lake is about 13m. Water input to the lake is partly from of direct rainfall on the lake basin (8 Mm³), from surface runoff and groundwater inflow from the 935 ha. catchment (12 Mm³, assuming 60% runoff coefficient), thus making up a total of 20 Mm³. The average depth to water table in the area is around 3.89 m below ground level. Outflow from the lake is in four ways: spillage, groundwater seepage, evaporation from the Lake surface, and pumpage for water supply. Only the last two are known, the annual evaporation loss is of the order of 5 Mm³ (assuming 3.5 mm/d average evaporation), and the annual water withdrawal is 8 Mm³ at a pumpage rate of 22 MLD (million litres per day) (KWA figures). These jointly constitute about two-thirds of the inflow.

**Biodiversity**

About 29 species of herbs, shrubs and grasses and around 56 species of trees have been listed from this site (table 3). The land adjacent to shore line is dominated by grass species. In some areas, wild pineapple varieties have been planted for increasing soil stability and to prevent soil loss. The watershed of the lake has mainly coconut based agroforestry system with trees such as *Mangifera indica*, *Anacardium occidentale*, *Artocarpus integrifolia* etc. The lake is infested with weeds like *Eupatorium odoratum*, *Cyprus rotundus*, *Mimosa pudica*, *Panicum repens*, *Cynodon dactylon* etc.
About 13 species of insects have been identified from the area out of which 9 are butterflies, 2 odonates and 2 hymenopterans. Twenty-seven species of fresh water fish and two species of prawns were reported from Sasthamkotta Lake. Nearly 11 species of fishes are now available from Sasthamkotta Lake. This is attributed to the fact that, Sasthamkotta Lake is a stand alone water body and does not have connection with any other type of water bodies, whether stagnant or flowing. Migratory fauna is also very scarce in and around Sasthamkotta. Since drinking water is supplied to Kollam area from Sasthamkotta Lake, entire water body is separated from any inflow by a long ‘bund’.

Migratory birds like teals are also present in this wetland. A total of 34 species of wetland dependant birds are reported from Sasthamkotta Lake. Out of which around 21% are long distance migrants.

### Tourism

An ancient Sastha temple present near the lake lends its name to the town. So mostly religious tourists visit here, their frequency is very low. However, tourism in this lake is not welcomed by the people residing in Sasthamkotta as it alters the water quality. Presently one privately owned row boat permitted by District Tourism Promotion Council (DTPC) is being used for sight seeing. Accommodation is available at the PWD (Public Works Department) Rest House.

### Pressures

The water of Sasthamkotta Lake is used for supply of drinking water by Kerala Water Authority to Kollam Municipality and suburbs. The lake serves as a major source of water, sink for various pollutants and transformer in the cycling of nutrients, chiefly carbon, nitrogen, sulphur and phosphorus. It also serves as an ideal habitat for diverse flora and fauna. The lake offers considerable scope for fresh water aquaculture. Population growth will put added pressure on resources because of the rising demand for land for housing and other developments, demands on living resources for food, recreation and fresh water. The increasing human settlements in the catchment area of the lake also increases various types of stresses in the ecosystem in terms of pollution due to solid waste, sewage, fertilizer residues and other chemicals, aesthetic issues, etc

Other major pressures are (i)Reclamation of the land for agriculture along the banks and adjacent areas, unscientific cultivation practices such as Tapioca cultivation in hill slopes causing soil erosion

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Table 3: Biodiversity of the Sasthamkotta Lake (CED, 2003a)
(ii) Entry of agricultural and domestic waste including sewage from surrounding area entering the lake, (iii) Pollution by used by professional washer men (dhobis), (iv) Pollution from pilgrimage ultimately reaching lake and (v) Land use Change - encroachment into the wetland creating various environmental pressures on the landscape and habitat transformation and reduction in biodiversity. The native inhabitants say that the area surrounding the lake supported greater number of trees in the past and that it is now denuded. The number of residences on the banks of the lake has been on the increase recently. There occurs pollution from local tourists who visit the area. There is a ferry service across the lake transporting people between West Kallada and Sasthamkotta. Dhobis are using the lake for washing clothes.