

**Report on Visit to Pichavaram in Tamil Nadu –  
a wetland included under National Wetland  
Conservation and Management Programme of the  
Ministry of Environment & Forests.  
30<sup>th</sup> September 2008**



**Planning Commission  
Government of India  
New Delhi**

**October 2008**

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**1. Context**

An Expert Team was constituted by the Planning Commission, Government of India, to review the status of implementation of the National Wetland Conservation and Management Programme (NWCMP) of the Ministry of Environment & Forests, by visiting selected wetlands in the country. The Expert Team made, on-the-spot review and assessment of the Pichavaram Mangrove wetland near Chidambaram in Tamil Nadu. This was the fourth wetland visited after Chilika, Vembanad-Kol and Deepor Beel.

**2. Visit itinerary**

The Team comprising Dr. Indrani Chandrasekharan, Advisor(E&F), Planning Commission, Dr. T. Balasubramanian, Director, CAS in Marine Biology, Annamalai University and Dr. V. Sampath, Ex-Advisor, MoES and UNDP Sr. National Consultant, visited Pichavaram on 30<sup>th</sup> (FN) September 2008 and held discussions with Mr. F.R. Ikram Mohammed Shah, District Forest Officer, and was met by Mr. P. Asokan, District Environmental Engineer of the Tamil Nadu Pollution Control Board, Cuddalore.

Discussions were held during the site visit to the wetland and later in the Annamalai University campus at Chidambaram. The report incorporates the inputs provided by the DFO in his presentation.

**3. Mangroves**

Mangrove forests are distributed throughout the tropical and subtropical coasts of the world. They are particularly well developed in estuarine areas of the tropics, where they reach their greatest areal extent. The World's mangroves span over 30 countries with a total area of 99,300 sq. km. The largest mangrove area occur in Indonesia (30%), Brazil (10%), Australia (8%), India and Nigeria (7%, each). World-wide mangroves are disappearing at an alarming rate. In some developing countries about 80% of mangroves were lost in the last three decades.

Mangroves occur in the coastal states and islands of India. The mangrove areas in India are generally categorized as deltaic, estuarine, backwater, sheltered and insular bay. As per 1987 data, the total mangrove area in India extended to 6740 sq.km. The largest extent of mangroves occur in West Bengal (Sundarbans) spread over 4200 sq.km, followed by Andaman and

Nicobar Islands (1190 sq.km) (Source: MoEF, 1989). Small patches of mangroves are found in Gujarat, Maharashtra, Andhra Pradesh, Goa, Orissa, Tamil Nadu, Karnataka and Kerala. In Tamil Nadu, mangroves are well-developed in Pichavaram and Muthupet. The Pichavaram mangrove is a typical swamp, extending between Vellar and Coleroon estuaries.

Along the Indian coastline about 45 species of mangroves have been reported. The most dominant genera to which they belong are *Rhizophora*, *Avicennia*, *Bruguiera*, *Sonneratia*, *Canocarpus*, *Heretiera*, *Xylocarpus*, *Ceriops* and *Excoecaria*.

#### 4. Pichavaram in Tamilnadu

Pichavaram is situated in the southeast coast of India in the Tamil Nadu State. It is located at about 225 km south of Chennai and 5 km north east of Chidambaram, Cuddalore district, Tamil Nadu, between latitude 11°20' to 11°30' north and longitudes 79°45' to 79°55' east (Fig.1). It is an estuarine mangrove situated at the confluence of Uppanar, a tributary of the Coleroon River. Fishing villages, croplands, and Aquaculture ponds surround the area.

The Pichavaram mangrove wetland has 51 islets and the total area of the Vellar-Pichavaram-Coleroon estuarine complex is 2335.5 ha of which only 241 ha. is occupied by dense mangrove vegetation. Nearly 593 ha, of this wetland is occupied by helophytic vegetation like *Suaeda*, 262.5 ha. by barren mud flats and 1238.50 ha., by barren high saline soil. Of this, the mangrove wetland occupies only 1100 ha., comprising the entire mangrove vegetation located in the middle portion of the Vellar-Pichavaram-Coleroon wetland which has been declared on 15<sup>th</sup> December 1987 as a reserved forest by the Department of Forest, Government of Tamil Nadu.

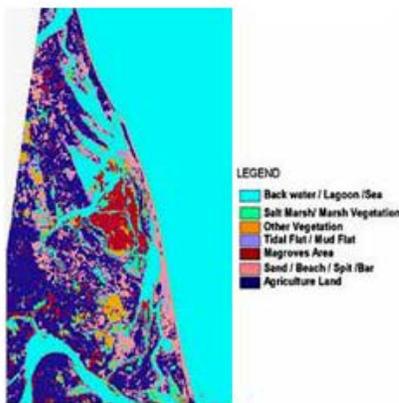
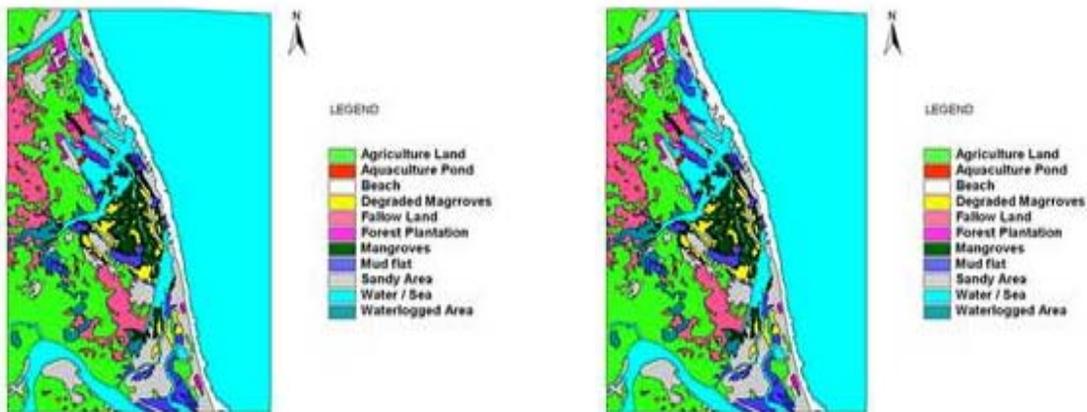


Fig. 1. Wetland Map

Two major rivers viz. Vellar and Coleroon drain into the Bay of Bengal in this area. The area between the two rivers has brackishwater with mangrove vegetation. The area is covered by alluvium in the western part and fluvial marine and beach sands in the eastern part. Based on available satellite data IRS 1C LISS-III (23.5 m spatial resolution) of 1998, the **Pichavaram Mangrove wetland has been demarcated into three zones viz. Agriculture zone, Wetland zone with vegetation and Non-Vegetated wetland (Fig.1-3).**



**Fig.2 Coastal Land use Map (1987)      Fig.3. Coastal Land use Map (1998)**

Agriculture land is present in the northern part of the Pichavaram area. This deltaic region is formed by rapid deposition of stream borne sediments into a still body of water. The river brings sand, silt and other materials which are deposited. This is a very fertile area in the Cauvery delta region. Flood plains are predominant along the rivers which are linear and parallel to the river course. The standing crop of paddy is almost seen through out the year along the Vellar river course in an area of about 116.7 km<sup>2</sup>.

The vegetated wetland can be classified in to two types; Mangroves and tidal swamps. In Pichavaram, the coastal lagoon covers an area of about 8.4 km<sup>2</sup>. The entire mangrove area of 51 islets is separated by a complex network of creeks. Extensive mangrove forest, containing narrow *Rizophora* belt in the frequently inundated areas is followed by a wide belt of *Avicennia* on terrains submerged mostly during equinoctial tides. The area that is generally very saline and sandy and which gets submerged during exceptionally high tides has mostly *Suaeda* vegetation. A long sand bar separates the whole area from the sea. The sand bar is seen to be fast disappearing now.

Non vegetated wetland consists of mudflats, beach spit and sandbars along the lagoon estuaries and deltaic regions. They are divided into high tidal, inter tidal and sub tidal regions. Mudflats are also seen in between mangrove vegetation in the high-tidal, inter-tidal and sub-tidal zones. Mudflats are associated with less wave energy zones. These mud flats are composed of clay and silt and they are exposed during very low tides. Inter-tidal mudflats are made up of fine grained soft mud which is deposited under quiet environment. The substrata are suitable for the growth of mangroves and marsh vegetation. A variety of flora and fauna are present in these areas.

Comparison of 1987 and 1998 landuse cover maps reveal that changes have occurred in both ways viz., (1) healthy mangroves to degraded and mudflats, and (2) degraded and mudflats to healthy mangroves. This means that both degradation and rejuvenation have taken place during these years. Marginal changes have been observed in the mudflat, degraded and mangrove areas. Degraded mangrove areas are less in 1998 than in 1987 indicating increase in mangrove area. However a marginal gain in mangrove area is observed over a 10-year period between 1987 and 1998.

Some of the major changes that have occurred are listed below.

|          |        |             |        |   |       |
|----------|--------|-------------|--------|---|-------|
| MANGROVE | [1987] | TO DEGRADED | [1998] | - | 33 ha |
| DEGRADED | [1987] | TO MANGROVE | [1998] | - | 58 ha |
| MANGROVE | [1987] | TO MUDFLAT  | [1998] | - | 29 ha |
| MUDFLAT  | [1987] | TO MANGROVE | [1998] | - | 24 ha |

*Rhizophora* species are taller than other species (Fig.4). Salt marsh species (*Arthrocnemum indicum*, *Salicornia brachiata*, *Suaeda maritima* and *Suaeda monoica*) are present in core mangroves, indicating nature of soil as hypersaline.

Dense scrub like *Avicennia ilicifolium* and *Cariops roxburghianae* mixed with mangrove scrubs are found near Uppanar riverbank and Vellar River, and other vegetation such as marsh vegetations, grass, thorny plants and scattered mangroves classified as other vegetation inhabit the mudflat. Sparse stunted marsh vegetation and degraded mangroves (Fig.5) are present on hightidal mudflats near the mouth of Vellar river, bank of Uppanar and near Coleroon riverbank.



**Fig 4 – Well developed *Rhizophora* –a predominant mangrove sp. In Pichavaram** **Fig. 5 - Degraded mangrove area**

The marshy vegetation present on the sand bar which separates the lagoon from the sea is dense. Lagoons are found parallel to the coastline and

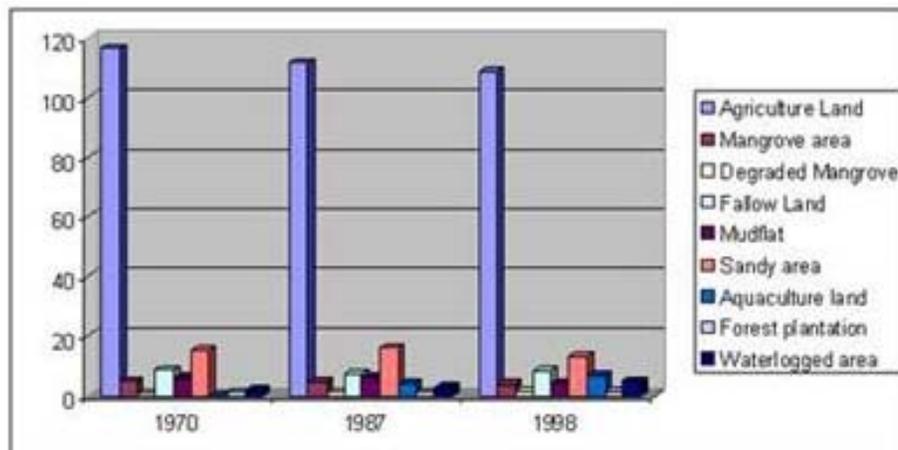
separated from the open sea by barrier of islands. The water level in the lagoon fluctuates and has high concentration of suspended sediments.

Mangrove vegetation is present along the verge of the wetland. In 1998, the waterlogged area along the fringes of Pichavaram wetland was around 4.90 km<sup>2</sup>. Restoration activities are being undertaken by the Tamil Nadu forest department.

**Table 1 and 2** indicate changes in land use in terms of area and percentage during 1970 to 1998 and deposition & Erosion prone areas. Fig.6 shows the change in the Land Use Cover Change in the years 1970 through 1998.

**Table-1:- Land use of Pichavaram wetland**

| Sl. No | Categories        | 1970 in km <sup>2</sup> and in (%) | 1987 in km <sup>2</sup> and in (%) | 1998 in km <sup>2</sup> and in (%) |
|--------|-------------------|------------------------------------|------------------------------------|------------------------------------|
| 1      | Agriculture Land  | 116.55 (74.30)                     | 112.0 (71.35)                      | 108.79 (70.57)                     |
| 2      | Mangrove area     | 4.9 (3.18)                         | 4.62 (3.0)                         | 3.70 (2.40)                        |
| 3      | Degraded Mangrove | 0.9 (0.58)                         | 1.20 (0.78)                        | 1.55 (1.01)                        |
| 4      | Fallow Land       | 8.94 (5.80)                        | 7.45 (4.83)                        | 8.45 (5.48)                        |
| 5      | Mudflat           | 6.0 (3.89)                         | 6.45 (4.18)                        | 4.26 (2.76)                        |
| 6      | Sandy area        | 15.67 (10.16)                      | 16.40 (10.64)                      | 13.37 (8.90)                       |
| 7      | Aquaculture land  | 0.0 (0.0)                          | 3.99 (2.59)                        | 6.99 (2.76)                        |
| 8      | Forest plantation | 1.20 (0.78)                        | 1.25 (0.81)                        | 1.80 (1.17)                        |
| 9      | Waterlogged area  | 2.00 (1.30)                        | 2.80 (1.82)                        | 4.90 (3.18)                        |
|        | <b>Total Area</b> | <b>156.16 (100)</b>                | <b>156.16 (100)</b>                | <b>156.16 (100)</b>                |



**Fig. 6. Change in Land Use Cover during 1970 -1998.**

**Table-2:- Deposition & Erosion prone areas of Pichavaram**

| SI.No | Shoreline         | 1970                         | 1990   | 1997  |
|-------|-------------------|------------------------------|--|---|
| 1     | Depositional Area | Pudupattinam area            | From Killai to Coleroon mouth, Toluvaipattacheri | Killai, Porto-Novo, Vellar mouth, Coleroon mouth and Mudasuodai |
| 2     | Erosional Area    | Proto-Nova to Coleroon mouth | Coleroon to Pudupattinam                         | Pudupattinam to Toluvaipattacheri                               |

*Vegetative Cover at Pichavaram*

Six zones have been demarcated in Pichavaram; *Avicennia marina* is dominant in Zone-I; *Arthrocnemum indicum*, *Excoecaria agallocha*, *Salicornia brachiata*, *Sesuvium portulacastrum* and *Suaeda maritima* are sporadically distributed in the sandy region Zone II which includes the bank of three creeks lying parallel to the shore, the fringe of shoreward belt is occupied by *Salicornia brachiata* and the inward belt has *Avicennia apiculata*, *Rhizophora apiculata* and *R.stylosa*. The inner region is found to have mixed community of *Excoecaria agallocha* and *Salicornia brachiata* and *Arthrocnemum indicum*. Luxuriant mangrove vegetation exists in zone III with maximum number of species. The channels fringes areas are bordered by *Rhizophora apiculata* and *R. mucronata*, *Acanthus illicifolins* and *Derris heterophylla* found in the zone IV and A continuous stretch of *Suaeda maritima* is observed in zone V. *Salicornia brachiata* is dominant exists in zone VI near Coleroon estuary.

Ten (10) species of mangroves representing 6 families and 4 species of salt marshes belonging to a single family have been reported from Pichavaram. According to IUCN categorisation, out of 14 species, 10 are endangered, 3 are vulnerable (*E. agallocha*, *R. mucronata*, *A. indicum*) and 1 species (*S. brachiata*) is at lower risk of nearly threatened. The list of species in the order of relative dominance and the IUCN status is given below (Table 3).

**Table -3: IUCN Species Status**

| Species                      | IUCN Status (Nationally) |
|------------------------------|--------------------------|
| <i>Avicennia marina</i>      | Endangered               |
| <i>Suaeda maritima</i>       | Endangered               |
| <i>Avicennia officinalis</i> | Endangered               |
| <i>Suaeda monoica</i>        | Endangered               |
| <i>Rhizophora mucronata</i>  | Vulnerable               |

|                                   |                               |
|-----------------------------------|-------------------------------|
| <i>Rhizophora apiculata</i>       | Endangered                    |
| <i>Excoecaria agallocha</i>       | Vulnerable                    |
| <i>Bruguiera cylindrica</i>       | Endangered                    |
| <i>Ceriops decandra</i>           | Endangered                    |
| <i>Aegiceras<br/>corniculatum</i> | Endangered                    |
| <i>Acanthus ilicifolius</i>       | Endangered                    |
| <i>Arthrocnemum<br/>indicum</i>   | Vulnerable                    |
| <i>Lumnitzera racemosa</i>        | Endangered                    |
| <i>Salicornia brachiata</i>       | Lower risk-Near<br>Threatened |

## 6. Tourism

In late 1970s, the scenic beauty of Pichavaram mangroves has attracted movie makers to shoot their films in the shallow waterways. Through the movies, Pichavaram has become a tourist place. With the advent of tourist flow, the Tamilnadu Tourism Development Corporation (TTDC) has also announced this place as a tourist spot and listed it in state's tourist map from 1985 onwards. TTDC is maintaining cottages, dormitory and restaurant for tourists. About 500-1000 tourists visit Pichavaram every day.

## 7. Aquaculture

Aquaculture of shrimps is carried out in about 40 ha area, around Pichavaram. Traditional and semi-intensive type of aquaculture is practised. Species of *Penaeus* are cultured in aquafarms. No mangrove area has been converted for aquaculture.

## 8. Causes of degradation / changes in mangrove cover

The areal extent of mangroves has changed over years and human activities continue in the Pichavaram mangrove environment. As detailed in para 4 & 5 above, analysis of changes have been made using GIS. The possible causes of degradation/changes are aqua culture, use as fuel & Fodder and socio-economics as discussed below; -

### *Aquaculture*

Even though area under aquaculture increased significantly in 1998 compared to 1987, the aquaculture areas are far away from the mangroves. It is also noted that no mangrove area has been converted for Aquaculture. Further the discharges from the aqua farms did not

contain biodegrading substance, which affect the water quality of the area.

Use of mangrove for fuelwood and fodder seems to be an important factor causing degradation. Another important factor observed was insufficient tidal flushing to interior / elevated areas, where soils have become hyper saline and devoid of vegetation.

#### *Role of Socio-economics*

Decrease in mangrove area could be attributed to large scale felling by human activity and grazing of cattle. Mangrove vegetation is traditionally known for fodder for the cattle and the trees as timber and fuel for households. Discussion with local people and officials revealed that usage of mangrove for fuel has been greatly reduced. Though large scale felling has been reduced to a great extent, illicit felling is still continuing on a miniscule level in the dense interior areas (**Fig. 7**). Data on population of cattle in villages around Pichavaram mangrove indicate that cattle grazing may be a possible factor for mangrove degradation (**Fig. 8**). Field visits confirmed that grazing by cattle is going on in the peripheral areas of mangroves.



**Fig. 7- Tree felling in Pichavaram**



**Fig. 8- Cattle grazing mangrove areas**

## **8. Biodiversity**

The floral and faunal diversity of the Pichavaram mangrove area is given below:

|  |   |
|--|---|
| <p><b>Flora of Pichavaram Mangroves</b></p> <ol style="list-style-type: none"> <li>1. <i>Excoecaria agallocha</i></li> <li>2. <i>Rhizophora apiculata</i></li> <li>3. <i>Rhizophora mucronata</i></li> <li>4. <i>Rhizophora lamarkhii</i></li> <li>5. <i>Avicennia marina</i></li> <li>6. <i>Avicennia officinalis</i></li> <li>7. <i>Sonneratia spp.</i></li> <li>8. <i>Ceriops decandra</i></li> <li>9. <i>Xylocarpus granatum</i></li> <li>10. <i>Bruguiera cylindrica</i></li> <li>11. <i>Lumnitzera racemosa</i></li> <li>12. <i>Aegiceras comiculatum</i></li> <li>13. <i>Suaeda monoica</i></li> <li>14. <i>Suaeda maritima</i></li> <li>15. <i>Acanthus ilicifolius</i></li> <li>16. <i>Sesuvium portulacastrum</i></li> <li>17. <i>Salicornia brachiata</i></li> </ol> <p><b>Grass</b></p> <p><i>Aeluropus lagapoides</i></p> <p><b>Parasites</b></p> <p>Dendrothoe falcate mainly associated with <i>Rhizophora</i> sps.</p> | <p><b>Lichens</b></p> <p>Crustose lichens</p> <p>Foliose lichens</p> <p><b>Fungus</b></p> <p>About 80 species majority belong to Deuteromycetes</p> <p><b>Algae</b></p> <p><i>Enteromorpha compressa</i></p> <p><i>Ulva lactuca</i></p> <p><i>Ketomorpha</i> sps.</p> <p><b>Fauna</b></p> <ol style="list-style-type: none"> <li>1. Diatoms – 100 Species</li> <li>2. Dinoflagellates – 20 Species</li> <li>3. Tintinnids – 40 Species</li> <li>4. Copepods – 30 Species</li> <li>5. Prawns – 30 Species</li> <li>6. Crabs – 30 Species</li> <li>7. Molluscs – 20 Species</li> <li>8. Fish – 200 Species</li> </ol> |
|  | <p>9. Avian fauna including - more than 100 migratory birds species.</p>  |

### Birds

Pichavaram mangrove ecosystem attracts a number of true migratory and local migratory birds. Favourable season for the visit of birds is from September to April every year and the peak population could be observed between November and January. Shallow water area with high density of macrobenthos serve as excellent feeding grounds for the birds. Macrobenthos form staple diet for shore birds. Common occurrence of piscivorous birds (members of Ardeidae and Laridae) is due to occurrence of many species of fishes in plenty which form their diet. In the food web, egrets, herons, storks, gulls, terns and raptors hold top position owing to their habit of feeding on fishes. As many as 57 species of birds are reported from this area.

### Fishing

About 147 species of fishes are recorded from the Pichavaram area. Of this, 74 species are marine forms and 64 species are brackish water forms. Total catch of fish is around 200 tonnes/year. Mulletts are the dominant fishes captured. *Metapenaeus monoceros*, *M. dobsoni*, *Penaeus indicus* and *P. monodon* are the dominant species among shrimp. Crafts such as catamaran and dugout canoes and gears such as small seine net, push net, scoop net, cast net, crab traps, etc, are used for fishing. Local fishermen report that fish and shrimp catch has been declining since the past few years.

## 9. Measures taken for mangrove afforestation



**Fig.9. Manmade canals as a part of afforestation measure**

Increase in mangrove area between 1987 and 1998 could be due to the efforts taken by Tamil Nadu Forest Department (**Fig. 9**). Trenches were made by Tamil Nadu Forest Department, which enhance flushing of tidal waters to some extent into the interior areas. The Department also took up afforestation measures. Water exchange is required for the growth of mangroves.

Water circulation in the mangrove creeks and swamps is an essential factor for growth of mangroves as well as dispersal of mangrove seeds and larvae of fishes and shrimps and transport of nutrients from mangrove to coastal waters. Therefore, reduced tidal flushing along with gradual siltation of interior mangrove areas may be a causative factor for degradation / further propagation of mangrove areas.

Discussion with the Forest Department officials revealed that the tidal inundation in the mangroves has been decreasing due to frequent bar mouth closure at Chinnavaikkal point (northeast of mangrove connecting to Bay of Bengal) and that there is a decline in fish catch in the recent years.

To contain degradation of mangroves in Pichavaram, Tamilnadu Forest Department and M.S.Swaminathan Research Foundation (a Non Governmental Organisation) have made trenches in some areas to enhance flushing of tidal water.

Before the December 2004 Tsunami, the level of exploitation of Pichavaram mangroves far exceeded sustainable levels, which lead to the rapid degradation of the habitat. The appreciation by locals of the protection provided by the mangroves during the disaster has lead to local acceptance of the need to conserve them. The Tamil Nadu forest department especially the DFO has made efforts to establish a nursery of endangered mangrove species, a first of its kind (Fig.10 - 13). The team suggested documentation of every step of the growth, process, etc., and commended the DFO for the effort. Effort to plant mangroves on the shore line all along the mangrove forest area and in over 50 hectare of marshy areas and 2 ha. of saltpan with

dug out canals replicating the environment of high and low tide has been made with good success.



**Fig. 10** A view of the mangrove nursery developed by the DFO, Villupuram near Pichavaram



**Fig. 11.** Afforestation of mangroves in marshy land



**Fig.12.** Mangrove restoration programme



**Fig.13.** One year old *Rhizophora* plantation in the marshy area

## 10. Recommendations

10.1 The Tamilnadu forest department especially the DFO has made efforts to establish a nursery of endangered mangrove species, a first of its kind. The team suggested documentation of every step of the growth, process etc and commended the DFO for the effort.

10.2 Effort to plant mangroves on the shore line and in over 50 ha. Marshy area and 2 hectare of saltpan with dug out canals replicating the environment of high and low tide has been made with good success. The effort needs to be supported.

10.3 A study of the sand bar, its erosion , effects and possible remediation needs to be taken up.

10.4 To increase water spread area (enhance tidal flushing) detailed hydrodynamic study in the mangroves is required particularly to know the areas having suitable substratum, which do not receive adequate sea/estuarine water. Development of hydrodynamic model based on accurate scientific data such as bathymetry, currents and tides, along with field surveys for elevation are required to be done to identify the areas, that need dredging to increase water flow and trenching to increase access. Such a model when integrated with GIS will provide accurate information on possible extent of water penetration in each area in the mangroves which help in determining exact locations for dredging.

10.5 An Information Centre to create awareness and sustain the interest of the coastal community needs to be set up at the Tamil Nadu Tourism Complex located inside the mangrove area opposite to the boat house, for which adequate funds should be provided, immediately.

10.6 The Forests Department officials working in the Pichavaram mangroves should jointly work with the Faculty of CAS in Marine Biology who are involved in R&D in mangroves in the Vellar estuary. This will be an added advantage in improving and increasing the mangrove cover in the Pichavaram wetland and also in understanding the interaction between the ecological aspects and the growth and survival of the mangrove vegetation and associated flora and fauna.