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Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS

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Pichavaram Mangrove Wetland: Situation Analysis

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2010

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Foreword

One of the earliest activities undertaken by the M S Swaminathan Research Foundation after it started its work in 1990 was the conservation and sustainable management of Mangrove Wetlands. The initial site for this work was the Pichavaram Mangrove Ecosystem. Later this work was extended to the Muthupet Mangrove Wetland of Tamil Nadu wetlands of Andhra Pradesh; Mahanadi and Devi mangroves of Orissa; and the sundarbans of West Bengal. The major objectives of this programme are :

- Conservation and documentation of mangrove ecosystems
- Rehabilitation of degraded mangrove ecosystems
- Monitoring of the state of mangrove wetlands using remoate sensing techniques
- Linking the ecological security of mangrove forests with the livelihood security of mangrove wetland-dependent communities
- Promotion of participatory mangrove forest management and formation of Village Mangrove Concils
- Understanding the role of women and men in the conservation and sustainable and equitable use of mangrove forests
- Ensuring that the children of the mangrove forest communities have opportunities for education and health care
- Spreading mangrove literacy for fostering public understanding of the significance of this unique ecosystem in the context of potential changes in sea level as a result of global warming.

During the last 10 years, this work had been supported by the International Trophical Timber Organisation, the Canadian International Development Agency and the India-Canada Environment Facility, and the Ministry of Environment and Forests, Government of India. The project ended on 31 May 2003.

Some of the significant work done under this project has been written up in a series of manuals under the generic title, "Joint Mangrove Management in Tamil Nadu: Process, Experiences and Prospects".

I am indebted to Dr. V. Selvam, who has been involved in this project right from the beginning, and all the staff of the project for their dedicated and socially and ecologically meaningful work.

I hope these publications will be found useful by the staff of the Forest Department, local communiteis and civil society and academic organisations engaged in the conservation of the unique mangrove ecosystem. In view of the possibilities of sea level rise as a result of global warming, the mangrove ecosystem will grow in importance in the coming decades. I therefore hope that the work inititated by MSSRF will be continued through a joint mangrove management procedure. Joint Mangrove Management will help to maximise the power of partnership among professional and local communities.

M. S. Swaminathan

MSSRF seeks to link the ecological security of mangrove forests with the livelihood security of mangrove communities.

Acknowledgements

We are grateful to Prof. M.S. Swaminathan, Chairman, MSSRF for conceptualising the concept of Joint Mangrove Management and for his inspirational guidance; and to Prof. P.C. Kesavan, Executive Director, MSSRF for his unfailing encouragement and support. We would like to thank Dr. K. Balasubramaniam, Director, Ecotechnology, MSSRF for his active participation, particularly during the initial phase of the project, and his continuous support.

We are thanked to Dr. John Joseph, former PCCF of Tamil Nadu Forest Department for initiating this work and guiding us.

We are thankful to the Tamil Nadu Forest Department, Government of Tamil Nadu, for permitting us to demonstrate Joint Mangrove Management models in Pichavaram and Muthupet mangrove wetlands. We are indebted to Mr. J.C. Kala, Principal Chief Conservator of Forests (PCCF), Mr. V.R. Chitrapu, IFS, and Mr. K.K. Somasundaram, IFS, former PCCFs, for their encouragement. Our thanks are also due to Mr. R.P.S. Katwa, IFS, former Chief Wildlife Warden, for kindly approving the JMM proposals and micro plans.

We are grateful to Mr. C.K. Sreedharan, IFS, Chief Conservator of Forests, for being with us throughout our work. His constant direction and guidance and his contribution to refining the approach of JMM through a mid-term assessment, are thankfully acknowledged.

We are thankful to Dr. G. Kumaravel, IFS, Chief Conservator of Forests (Research), Mr. K. Chidambaram, IFS, Conservator of Forests (Trichy Circle) and Mr. P. Subramanian, IFS, Conservator of Forests (Dharmapuri Circle) for their keen interest and co-operation in implementing JMM activities in the demonstration hamlets.

We are grateful to the India-Canada Environment Facility (ICEF), the Canadian International Development Agency(CIDA), the Government of Canada and the Ministry of Environment and Forests, Government of India, for their continuous financial support.

We express our heartfelt gratitude to Mr. Peter Walton, Mr. Allen Ferguson, and Mr. Bernard Boudreau (former Directors of the ICEF), and Mr. Ujjwal Choudhury (Director, ICEF), New Delhi, for their support and whole-hearted commitment to the cause of mangrove conservation and management, which made our project possible.

Our special thanks to Dr. Jaya Chatterjee, Senior Project Officer, ICEF, New Delhi, for constant interaction with the project team and for timely advice on operationalising the JMM concept.

We are very thankful to Dr. E.V. Mulley, Joint Director, Ministry of Environment and Forests (MoEn), Government of India, and the Sub-Committee of the MoEn, for appraising the JMM models and incorporating them in the National Action Plan for Mangroves.

We are grateful to Mr. S.R. Madhu for his painstaking effort in editing this series of publications.

We are grateful to the International Institute of Development Studies, Sussex, UK, for providing resource materials such as the PRA Tool and Technical Pack which were used extensively to conduct various PRA exercises.

We thank the tradtional village leaders, Panchayat leaders, fishers and farmers and the Presidents of Fishermen Co-operative Societies in Killai and Muthupet villages, for their active participation.

The traditional wisdom of mangrove communities will be invaluable for Joint Mangrove Management.

Contributors to this Publication

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Contents

Introduction

Mangrove wetlands are prominent features of the coastal zone of tropical countries. A mangrove wetland consists of a mangrove forest and its associated water bodies. A mangrove forest harbours a group of plant species that grow well in the estuarine areas – where salinity undergoes constant changes due to freshwater flow and where the substratum is composed of accumulated deposits of river-borne sediment. A mangrove forest is intersected by a number of tidal canals, channels and creeks and large open water bodies, where the water level varies daily due to tidal inflow and outflow, as well as seasonally due to freshwater discharge.

The mangrove wetland is a multiple-use ecosystem that performs a number of protective, productive and economic functions to sustain the ecological and livelihood security of the coastal communities. Mangrove forest and associated wetlands.

i) act as a barrier against cyclones and prevent entry or saline water inland during storm surges.

ii) act as a buffer against floods and prevent coastal erosion.

iii) provide nursery grounds for a number of commercially important fish, prawns, crabs and molluscs.

iv) enhance fishery production of nearby coastal waters by exporting nutrients and detritus.

v) provide habitats for wildlife ranging from migratory birds to estuarine crocodiles.

The economic value of the mangrove wetlands stems from

i) availability of wood products ranging from timber, poles, posts to firewood.

ii) availability of non-wood products such as fodder, honey, waxes, thatching materials etc.

iii) availability of aquatic products such as fish, prawns, crabs, mussels, calms and oysters.

The coastal zone of India's mainland and of the Andaman and Nicobar islands harbours extensive and diverse mangrove wetlands. According to the Forest Survey of India (1999), the total area of the Indian mangrove wetland is about 4,87,100 ha of which 56.7% (2,75,800 ha) is on the east coast, 23.5% (1,14,700 ha) on the west coast and the remaining 19.8% (96,600 ha) on the Andaman and Nicobar islands.

Mangrove wetlands of Tamil Nadu

Tamil Nadu has a coastline of 950 km. Extensive mangrove wetlands are located in two places – in Pichavaram, Cuddalore districts and Muthupet in Thiruvarur and Thanjavur districts. Small patches of mangroves have also been found along the Palk Strait as well as in some of the islands of the Gulf of Mannar Biosphere Reserve. All these mangrove wetlands have been declared as Reserve Forests (absolute property of the government) and are managed by the Tamil Nadu Forest Department.

The Pichavaram mangrove wetland is located in the northern extreme of the Cauvery delta, near the mouth of River Coleroon. Its total area is about 1,350 ha, its many small islands are colonised by 13 true mangrove species. Presence of *Rhizophora* species in large number is one of the important features of this mangrove wetland from the standpoint of biodiversity. The Pichavaram mangrove wetland is also rich in fishery resources. Annually about 245 tons of fishery produce is harvested from this mangrove wetland, of which prawns alone constitute 208 tons (85%) of the catch). The people belonging to 17 hamlets of five revenue villages utilise the fishery and forestry resources of the Pichavaram mangrove wetlands. A total number of 1,900 fishers are annually dependent on the fishery resources for their livelihood; some 1,000 fishers fish seasonally in the mangrove waters. Some 800 to 900 cattle graze the mangrove wetlands seasonally. (Reports at one time indicated that about 3,000 cattle grazed in these mangroves).

The number of cattle has gone down drastically in mangrove user villages of Pichavaram in recent years for various social and economic reasons. According to remote sensing data, nearly 54% of the mangrove forest of Pichavaram (total forested area 700 ha, excluding water bodies, sand dunes etc) was in a degraded state in 1986.

The Muthupet mangrove wetland is located in the southern most end of the Cauvery delta and occupies an area of approximately 12,000 ha, including a 1,700 ha lagoon. Unlike in Pichavaram, the species, *Avicennia marina*. Though five other species have been reported from this mangrove wetland, their population is very limited. A preliminary estimate indicates that about 106 tons of fishery produce is harvested every year from this mangrove wetland. Further detailed study is needed to assess the fishery potential of the Muthupet mangrove wetland.

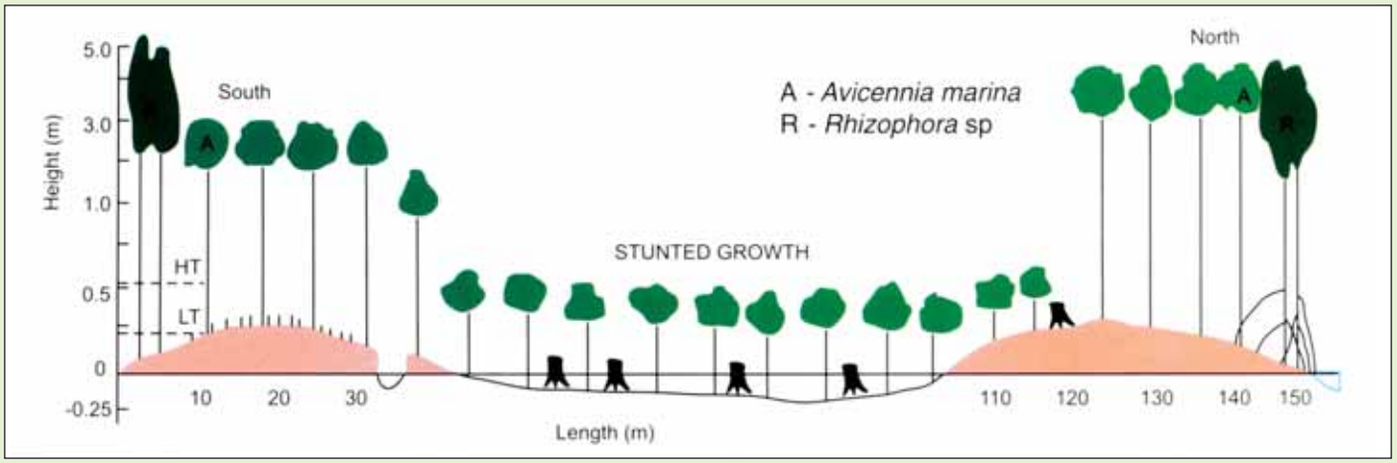
One of the interesting aspects of the Muthupet mangrove wetland is the practice of the traditional fishing method known as canal fishing *(vaaikkal meenpidippu)*, which integrates mangrove and fishery development. This is an example of the traditional wisdom of local communities in sustainable management of mangrove wetlands. The people belonging to 26 hamlets of 16 revenue villages with a total population of about 35,900 depend on the fishery and forestry resources of Muthupet. A benchmark survey indicates that about 53% of this population is dependent on fishing, but most of them fish in the Palk Strait nearby rather than in the mangrove wetland. Fishing in the mangrove waters is only seasonal. The problem of cattle grazing in the mangrove forest is very limited, but about 73 families, mostly headed by women who are widows and destitutes, collect mangrove wood and sell it in the market for livelihood. According to 1996 remote sensing data, out of 9,033 ha of forested area (excluding lagoon and water body and other vegetation), only 1,855 ha (20.5%) had healthy mangroves; the remaining 7,178 ha (79.5%) was degraded.

Causes of degradation

Ecological studies carried out in the Pichavaram and Muthupet mangrove wetlands by MSSRF between 1993 and 1995 show that unscientific management practices followed in the past are the main causes of degradation. In the Pichavaram mangrove wetland, a system of management called "coupe-system" was followed from 1935 to 1970. Under this system of management, healthy mangrove forest was clear-felled in coupes by rotation every 20 to 25 years for revenue generation. This triggered a chain reaction, leading to development of hyper-saline conditions in the coupe-felled area, and preventing natural regeneration of mangroves. Since nearly 80% of the volume of the mangrove surface soil is made up of water, exposure of this soil to the sun due to clear felling caused evaporation of soil water. This in turn led to subsidence of sediment in the clear felled area, on account of which the topography of the coupe-felled area became trough shaped. As a result, tidal water entering into these "troughs" during high tide became stagnant; evaporation of stagnant tidal water led to increase in salinity, which is lethal to any mangrove plant.

An estimate indicates that coupe-felling is responsible for nearly 65% of degradation in the Pichavaram mangroves. Grazing is another important factor. As indicated earlier,

Sketch below illustrates the stunted growth of trees and the coupe system of mangrove forest management.
Above: A canal system has been introduced that restores degraded mangrove areas by facilitating free flow of tidal water.



about 800 to 900 cattle graze in the peripheral areas of mangrove wetland during the rainy season when new seedlings are coming up, and growth of young mangroves is at its peak. Cattle grazing at this time leads to poor regeneration and poor growth of mangrove vegetation in the grazing areas.

As in Pichavaram, coupe-felling is the main cause of degradation of the Muthupet mangrove wetland. The then Raja of Tanjore owned the Muthupet mangrove wetland between 1750 and 1840; British rulers managed this mangrove wetland between 1840 and 1945, During management by the Raja of Tanjore, selected areas of the Muthupet mangrove forest were clear-felled to generate revenue to maintain the rest houses (*Chatrams*) constructed by the king for pilgrims to south India from north India (one of the large beats of the Muthupet mangrove wetland is still known as *Chatram* beat). Later, during the British period, clear-felling was systematised by a rotational coupe-system over 20 to 25 years. This practice continued till the early 1970s. As a result, large areas of mangrove forest were clear-felled and changes in the biophysical condition in these areas (as explained in the case of Pichavaram mangrove wetland) caused nearly 80% of the degradation of the Muthupet mangrove wetland.

Development and demonstration of restoration technique

Development and demonstration of a restoration technique by MSSRF began late 1995 in the Pichavaram mangrove wetlands. A clear-felled area of 8 ha, where topography had become trough-shaped, was selected to demonstrate the restoration technique. This technique is simple. The trough-shaped area was connected to a natural canal nearby, through a long and deep artificial canal from which a number of feeder canals were dug to cover the entire degraded area. This enabled tidal water to freely flow in and out of the degraded area. Result: the salinity of the degraded area fell drastically and soil moisture increased sharply. Propagules of *Rhizophora* sp and Avivennia marina seedlings were planted along main and feeder canals respectively at a distance of 1 × 1m. A total number of about 80,000 seedlings were planted in the demonstration site during December 1995. More than 80% survived as of 2003.

Joint Mangrove Management in Tamil Nadu

Joint Mangrove Management (JMM) was introduced late 1997 in Pichavaram and Muthupet mangrove wetlands and in other mangrove wetlands of Andhra Pradesh, Orissa and West Bengal by MSSRF in partnership with the concerned State Forest Departments and local communities. The main aim of this programme is to enhance the capacity of the local community, Forest Department and other interested

85 self-help groups (above) of both men and women promote self-reliance in the mangrove villages. The active co-operation of local communities is basic to the success of Joint Mangrove Management (JMM).

The JMM approach is process-oriented and people-centred.

parties to restore, conserve and sustain mangrove wetlands through participatory analysis and action. This programme was implemented in eight hamlets of Tamil Nadu (4 in Pichavaram and 4 in Muthupet) till May 2003, covering traditional and non-traditional fishers and farming communities. The following are the major achievements of JMM in Tamil Nadu.

- Eight village-level institutions have been formed with 885 families as members to plan and implement JMM and socio-economic development programmes.
- A total area of 675 ha has been restored, and healthy mangroves in 2,720 ha are being protected by the above village-level institutions.
- A total number of 5.5 million saplings (4.8 million of A. *marina* and 0.7 million of other species) have been planted by the local community; average survival is 68%.

  A total number of 85 self-help groups (50 of women and 35 of men) have been formed with 815 members belonging to the poor and the poorest sections of the mangrove-dependent community. These SHGs mobilised Rs. 16 lakhs through savings as well as through financial assistance under Swarnajayanthi Gram Swarozgar Yajona (SGSY) schemes from the District Rural Development Agency.
- 16 types of micro-enterprises – both group-based and individual-based – covering 402 families, have been initiated.
- Some 560 members of the village-level institutions and SHGs have been trained in leadership and membership qualities, functional aspects of SHGs, mangrove restoration, and in a number of micro-enterprises as well as agriculture and fisheries-related activities.

The Tamil Nadu Forest Department has recognised all the village-level institutions and accorded permission to the Range Officer of the concerned range to function as Secretary of these grassroot institutions. It has also recognized the JMM model; it seeks to replicate the model in other mangrove areas. The Ministry of Environment and Forests (MoEF), Government of India, formed a sub-committee which examined the JMM models implemented in Tamil Nadu and other states and observed that this was the best available model. The MoEF has now included this JMM model as one of the strategies for con servation and sustainable management of mangrove wetlands envisaged in its National Mangrove Action Plan.

Approach of JMM

The process-oriented, people-centred and science-based approach followed in preparation and implementation is the main cause for the success of current JMM programmes. The approach consists of the following steps:

Situation analysis

To understand biophysical conditions, resources available and patterns of resource utilisation by stakeholders

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Selection of project hamlets

To select hamlets based on socio-economic conditions, intensity of use of mangrove resources and willingness to actively participate in JMM

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Participatory Rural Appraisal

To understand the major concerns of the people relating to mangrove conservation and management and socio-economic development as well as to build rapport with the people

↓

Formation of Village-Level Mangrove Council

To provide a forum for stakeholders to discuss and decide on actions to be taken to solve the concerns identified in PRA

↓

Identification of Mangrove Management Unit

To identify the area of the mangrove wetlands which has been traditionally used by the community without any conflict with adjacent villagers, and identify activities to be undertaken to restore and cOnserve this unit

↓

Preparation of annual micro-plan

To prepare a detailed plan of activities to be implemented by the Mangrove Council as well as to mobilise funds from various sources

↓

Implementation, monitoring and evaluation

In order to share the experiences and lessons learned in implementing JMM programmes in Tamil Nadu, MSSRF is bringing out a series of publications under the title "Joint Mangrove Management in Tamil Nadu: Process, Experiences and Prospects". Three different communities – traditional fishers (Veerankoil village in Muthupet), non-traditional fishers (MGR Nagar in Pichavaram) and the farming community (Vadakku Pichavaram in Pichavaram) – are covered in the case studies presented in this series. The series consists of the following publications

Part 1: Situation Analysis: Pichavaram and Muthupet Mangrove Wetlands

Part 2: PRA in Mangrove User Villages

Part 3: Village Mangrove Councils

Part 4: Mangrove Management Units

Part 5: Micro-planning and Implementation

Part 6: Gender and Mangrove Conservation and Management

Part 7: Results, Achievements and Prospects

Part 1, Situation Analysis in Pichavaram and Muthupet Mangrove Wetlands, deals with i) fishery and forestry resources ii) utilisation of these resources by the local community including details of the dependent population, and traditional and improvised methods of utilising these resources iii) land use pattern around these mangrove wetlands and iv) major concerns of the fishing and farming communities living around the Pichavaram and Muthupet mangrove wetlands. It also details the methodology followed in situation analysis.

Communities in Muthupet (above) and Picha varam now help implement Joint Mangrove Management (JMM).

This old couple has seen many changes in mangrove villages. They now look forward to the success of JMM.

Situation Analysis: Pichavaram Mangrove Wetlands

1.0 Process and Methods of Data Collection

1.1 Study team

A study team collected information on fishery and forestry resources of the Pichavaram mangrove wetlands, the user communities, utilisation patterns and related issues; as well as the perceptions of local communities on the mangrove ecosystem and its resources. All these describe in detail the current situation in the Pichavaram mangrove wetland. The study team:

Dr. V. Selvam	–	Team Leader and Mangrove Ecologist
Dr. B. Subramaniam	–	Fishery Scientist
Mr. K.G Mani	–	Agronomist
Mr. K.K. Ravichandran	–	Mangrove Ecologist
Dr. V.M. Karunagaran	–	Mangrove Ecologist
Dr. P. Thamizoli	–	Anthropologist
Mr. R. Anbalagan	–	Social Worker
Mr. Y. Ansari	–	Agronomist

1.2 Identification of user villages and hamlets

Before initiating data collection, the team identified i) the user villages ii) the user hamlets and iii) the population of the hamlets. The field staff of the Forest Department (FD) was first approached to identify the user villages, since they had been managing mangrove resources through a Range Office at Chidambaram. During an informal meeting with the Ranger, Forester, Guard and Watcher, it emerged that the following are the major revenue villages from the standpoint of Pichavaram mangrove resources: 1) Killai 2) Pichavaram 3) Thandavarayan Sozhagan Pettai (T.S. Pettai) and 4) Thillaividangan

The FD field staff also gave the names of the user hamlets in each revenue village. To confirm this, the team visited each village and met its Panchayat and traditional leaders. Several others helped the team to identify, locate and confirm the mangrove user hamlets. These included Mr. R. Arul, Secretary of the Tamil Environment Movement, since renamed the Centre for Peace and Action; the VAOs (Village Administrative Officers) of each village; the Special Officer of the Killai Town Panchayat; leaders of fishermen co-operative societies; and people employed in the MSSRF mangrove nursery and mangrove restoration demonstration work.

1.3 Background information on user villages and hamlets

In order to assess the situation in the mangrove user hamlets, some basic statistical information – such as the number of households, population, community groups (caste groups), and major occupations – was collected. To begin with, VAOs and other revenue officials were approached for data on households and population of mangrove user villages and hamlets. In response, they provided voter lists of each user village, prepared for the Panchayat election, as household information. They advised the team to contact the headmasters of schools in each hamlet for accurate population information. Mr.R. Anbalagan, social worker, suggested that very recent population data could also be got from Baiwadi (child care centre) heads in each hamlet since they collect this information regularly for a monthly report submitted to district authorities.

Consequently, school officials as well as Baiwadi heads in each hamlet were met and information obtained. On the basis of this information, a list was prepared of user villages and hamlets, households, population and major occupations. Information about the fishery and forestry resources of the Pichavaram mangrove wetland, their utilisation patterns and practices, and perceptions of user communities, were collected by the following methods:

i) Rapid Rural Appraisal

ii) Transect boating in the mangrove waters

iii) Literature review

iv) Discussion with field staff of the State Fisheries Department

1.4 Rapid Rural Appraisal (RRA)

Before conducting the RRA, a preparatory workshop was held in which the "golden rules" and methods of RRA were discussed in detail. A checklist of information to be collected was prepared. The roles and responsibilities of each member were decided.

1.4.1 RRA on fishery resources

The study team conducted a RRA on fishery resources and fishing activities and related issues in the following fishing hamlets: i) Chinnavaikkal ii) Killai Fishers' Colony iii) T.S. Pettai and iv) Pillumedu and v) MGR Nagar.

The traditional fishing community lives in the first four hamlets. The residents of the fifth hamlet, MGR Nagar, are non-traditional fishers locally known as *Vedars*. (But when the project team met them, they disowned the *Vedars* label – they said they are *Irulars*.

Women participation was limited in all the hamlets except MGR Nagar. Information was obtained mostly through informal interviews and group discussions with eight to 12 experienced fishers. Interviews were also held with key informants; they were requested to organise a transect in the mangrove wetland by boat.

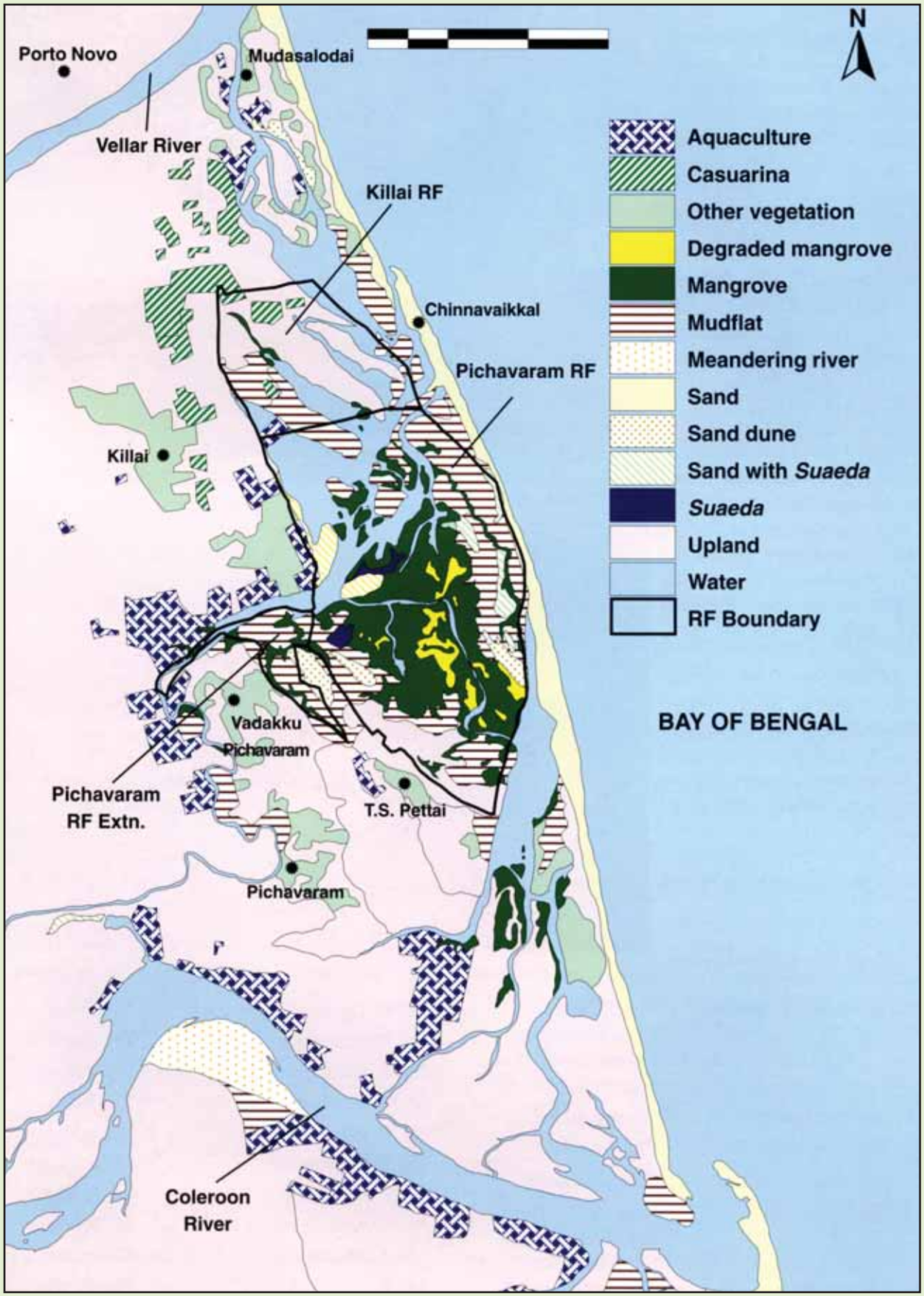
The study team obtained information about non-traditional fishing methods such as bundin...

... and traditional fishing methods such as cast nets to catch fish and prawn.

Key informants from fishing hamlets:

Mr.R.C.Kathavaraya Swamy	-	Vice President, Killai Fishermen Co-operative Society
Mr. M. Sambandam	-	Chinnavaikkal
Mr. N. Kuttiyandiswamy	-	Chinnavaikkal
Mr. T. Dhanapal	-	Chinnavaikkal
Mr. S. Govindan	-	Secretary, Traditional Fishermen Society, T.S .Pettai
Mr. K. Dayalamurthy	-	T.S. Pettai
Mr. P. Arumugam	-	T.S. Pettai
Mr. S. Kaliyaperumal	-	T.S. Pettai
Ms.G Kanakaraj	-	T.S. Pettai
Mr. R. Govindan	-	MGR Nagar
Mr. G Kothandam	-	MGR Nagar
Mr. P. Kannimuthu	-	MGR Nagar
Mr. T. Arumugam	-	MGR Nagar
Mr. A. Mathi	-	Pillumedu
Mr. K. Karuthakannu	-	Pillumedu

Fig. 1.1 Estuarine Complex Showing the Vellar Estuary, the Pichavaram Mangrove and the Coleroon Estuary



Transect boating in the mangrove waters: The first RRA was held in Chinnavaikkal, a hamlet of Killai situated on the seashore near the mouth of the mangrove estuary (Fig. 1.1).

On the first day, interviews were held only for about four hours with a group of eight fishers. The fishes in the mangrove waters in different seasons and localities, changes in species composition, and causes for such changes were discussed. On return to the village by boat, the village leaders and a few elders joined the RRA team. The team used this opportunity to clarify some doubts and collect supplementary information.

On the second day, the team transected the mangrove waters with two active fishermen for about four hours and reached the Chinnavaikal settlement for further discussion. Many fishers on the shore were at that time sewing nets or repairing boats; team members discussed with the fishers the crafts and gears and resources harvested. Some fishermen demonstrated net operations. A group discussion was later held in a temple; traditional management issues and practices and the perceptions of villagers about the mangrove ecosystem were discussed.

Another full day was spent with fishers of T.S. Pettai village on a boat transecting in the mangrove waters. The southern part of the mangrove forest and associated water bodies were covered. In the evening, the RRA team visited the Pillumedu fishing hamlet located on the seashore opposite to T.S. Pettai, and held a group discussion.

A full day was also spent with the *Irulars* (non-traditional fishers) of MGR Nagar in the mangrove waters. The transect started from the boat landing centre located at Killai Fishers' Colony and travelled through Neduodai, the deepest canal found in the Pichavaram mangroves up to Palayar, near the mouth of the Coleroon River. The *Irular* fishers in the boat were fishing crabs. The team discussed with them their lifestyle, when *Irulars* started fishing and why, fishing methods, problems faced by these fishers etc. The next day, the team accompanied two cast net fishers to the mangrove waters close to the settlement, and observed operations. The species caught, the availability of fish, the locations and the catch quantities were noted down.

1.4.2 RRA on forestry resources

The RRA on forestry resources was conducted by the study team in both fishing and farming hamlets. During the RRA, data was collected on the livestock population, its management system, grazing in the mangroves, sources of firewood, and collection of firewood from the mangroves. In addition, problems relating to the above activities and the perceptions of villagers relating to their main occupation were also discussed.

Both men and women, about 15 in all, took part in the RRA. A group discussion was held, also detailed interviews with key individuals. No village transect walk was resorted to for data collection, as was done for fishery resources. In almost all hamlets, traditional leaders and elected Panchayat members helped organise group discussions, and facilitated interviews. Traditional cattle grazers were interviewed in Killai and Radhavilagam in harvested paddy fields. This was done in the evening after the cattle had been driven back into pens. Information was obtained about cattle management during different seasons.

Key informantsfromfishing hamlets:

Mr. K. Mahalingam	–	MGR Thittu
Mr. K. Kuttiyandiswamy		
Mr. C. Sigamani	–	Muzhukkuthurai
Mr. G. Selvaraj		
Mr. G. Gopal		
Mr. A. Ilamaran	–	Killai Fishers' Colony
Mr. N. Vaidhyanatha swamy		
Mr. N. Sivagnanam	–	Mudasaloodai
Mr. K. Palaniswamy		
Mr. M. Muthu		
Mr. D. Kaliyamurthy	–	Ponnanthittu
Mr. Sethumanickam	–	
Mr. S. Govindan	–	T.S.Petta
Mr. G Natarajan		

Key informants from farming hamlets:

Mr. K. Subramaniam	–	Thaaikkal
Ms. N. Seeni Vasaki		
Mr.GM.Usman		
Mr. T. Ramakrishnan	–	Kuchipalayam
Mr. M. Shanmugam		
Mr. K. Kumar	–	C.Manambadi
Mr. S. Kalyan	–	Singarakuppam
Mr. V. Thilagam		
Mr. R. Vairakkannu	–	Therku Pichavaram
Mr. K. Kuppusamy		
Mr. M. Kaliyamurthy		
Mr. G Selvaganapathy	–	Manalmedu

1.5 Review of literature

Only a few publications – popular, academic or scientific – are available about fishery resources and fishing in the backwaters of the Pichavaram mangroves. The following are some of the important publications consulted during this study.

a) *Small-scale fishery of Pichavaram mangrove swamp* by Chandrasekaran and Natarajan (1992) 18

b) *A report on pen culture in the backwaters of Killai, Tamil Nadu* published by the FAO's Bay of Bengal Programme, Chennai, India (1985)

c) *Fishes of Pichavaram waters, Pichavaram man groves as nurseries of fishes and aquaculture potential of the mangrove backwaters* by Krishnamurthy and Prince Jayaseelan (1981)

1.6 Discussion with field staff of Fisheries Department, Tamil Nadu

The State's Fisheries Department has two field officers near the Pichavaram mangrove wetland, at Chidambaram and Porto Novo, just five km north of Pichavaram. Inspectors of Fisheries at both places said they have no data on fishery resources and fishing activities in the Pichavaram mangroves since their job is only to disburse socio-economic loans. However, they advised the project team to meet the Research Assistant of the Fisheries Department stationed at Porto Novo. But the team could not meet him even after several attempts.

Fisherman discusses fishing nets, operations and catches with Dr V Se/yam, leader of the study team.

2.0 Mangrove Resources

Fishery resources tapped from the Pichavaram mangrove wetland support the livelihood of hundreds of fishers.

The renewable natural resources available in the Pichavaram mangrove wetlands can be divided into i) fishery resources and ii) forestry resources. The forestry resources can be further divided into i) resources associated with the mangrove forest and ii) resources associated with sand dunes and other dry lands found within the administrative forest boundary.

2.1 Forest Resources

2.1.1 True mangrove species

As shown below a total number of 12 true mangrove species are present in the Pichavaram mangrove wetland.

Botanical name	**Family**
Acanthus illicifolius	*Acanthaceae*
Agiceras corniculatum	*Myrsinaceae*
Avicennia marina	*Avicenniaceae*
Avicennia officinalis	*Avicenniaceae*
Bruguiera cylindrica	*Rhizophoraceae*
Ceriops decandra	*Rhizophoraceae*
Excoecaria agallocha	*Euphorbiaceae*
Luminitzera racemosa	*Combretaceae*
Rhizophora mucronata	*Rhizophoraceae*
Rhizophora apiculata	*Rhizophoraceae*
Rhizophora natural hybrid sp	*Rhizophoraceae*
Xylocarpus mekongensis	*Meliaceae*

Among the above species, Avicennia marina alone constitutes 74% of the tree population and it is distributed everywhere except the banks of tidal canals and creeks.

Common species of finfish, prawns and crabs in Pichavaram mangrove wetland

Finfish		
Local name	Common name	Scientific name
Madava	Mullet	Mugil cephalus
Kendai	Mullet	Liza dussumeri
Kendai	Mullet	Liza macrolepis
Motta kendai	Mullet	Liza tade
Vishakedutha	Catfish	Tachysurus thassinus
Vishakedutha	Catfish	Tachysurus anus
Panni (kalava)	Reef cod	Epinephelus malabanicus
Keluthi	Catfish	Mystus gulio
Kuralfkodava	Seabass	Lates calcarifer
Setha kutty	Pearl spot	Etroplus suratensis
Selanthan	–	Ambassis sp
Sankarah	Threadfin bream	Nemipterus sp
Kilangan	Silver sillago	Sillago sihama
Prawns		
Vella ral	White prawn	Peneaus indicus
Karunvandu ral	Tiger prawn	Peneaus monodon
Vellicha ral	Brown shrimp	Metapeneaus monoceras
Chemaka ral	Brown shrimp	Metapeneaus sp
Vazumphu ral	Flower prawn	Peneaus semisulcatus
Mottu ral	Scampi (freshwater prawn	Macrobrachium sp
Crabs		
Kal or Kali nandu	Mud crab or Mangrove crab	Scylla serrata, Scylla oceanica
Kadal nandu	Sea crab	Portunus pelagicus
Kadal nandu	Sea crab	Protunus sanguinolantu

Distribution of all the other 11 species including Rhizophora spp is restricted to 10 to 15 m from the banks of tidal canals and creeks. Presence of tall trees of Rhizophora in large numbers is important from the standpoint of biodiversity. The population of Rhizophora in the other mangrove wetlands of India, except in Andaman and Nicobar islands, is very lessAnother interesting point is the presence of natural hybrid of Rhizophora species. This hybrid species born out of cross-pollination between Rhizophora apiculata and Rhizophora mucronata. This hybrid is highly vigor in growth and tall trees of this species are found all along boarder of the tidal creeks and canals.

2.1.2 Timber and Non-Timber Forest Produce (NTFP)

No timber and NTFP are available in the Pichavaram mangrove wetlands. The local people said that at one time, the wood of a tree called maramamaram (Sonneratia apetala) was used as timber. However, this tree has become very rare.

2.1.3 Medicinal plants

No medicinal plant species are available in the Pichavaram mangrove wetlands.

2.1.4 Fodder and firewood

Avicennia marina (yen kandal) is considered one the best fodder trees and has been used from time immemorial. The authorities at one time allowed grazing in the mangrove wetlands. But now, both collection of fodder and grazing in the mangrove wetlands have been banned. Likewise, Avicennia spp is regarded as good firewood by the localpeople; but collection of firewood from the mangroves has also been declared illegal.

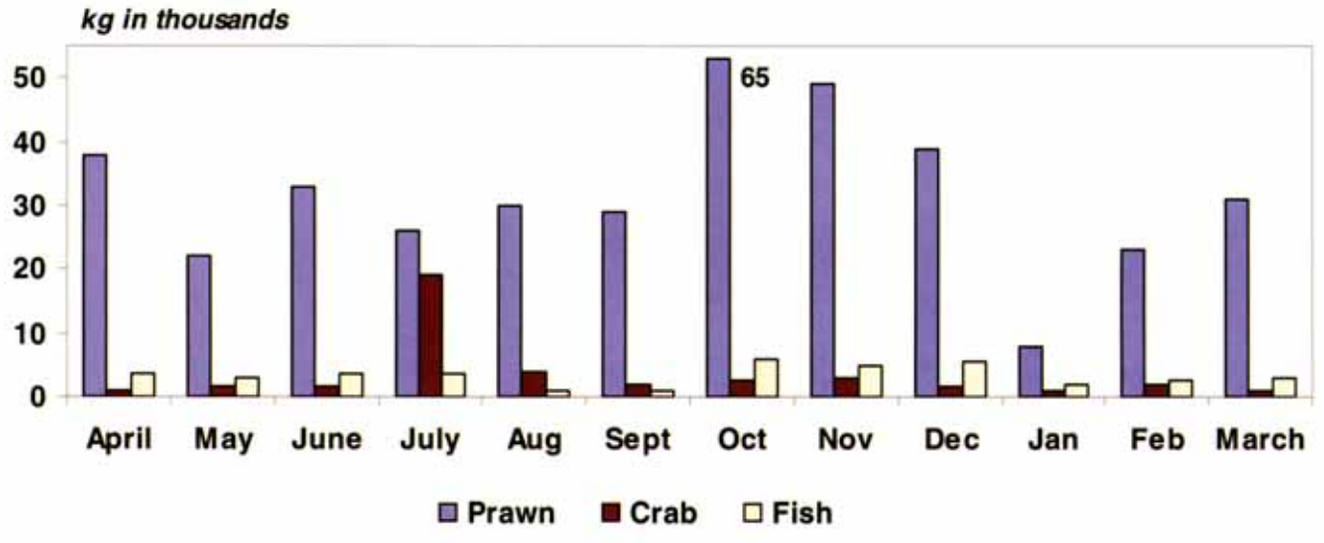
2.2 Fishery resources

The Pichavaram mangrove wetland has vast areas of open but shallow brackishwater bodies and a number of tidal creeks and canals. According to the local people, at one time there were some 3,000 creeks in the mangrove wetland; siltation has reduced this number to barely 100 or 150. The average depth of the open water associated with mangrove forest varies from 0.8 m during summer to about 1.5 m during the peak monsoon season.

The Pichavaram mangrove receives freshwater from the Uppanar River, a irrigation canal originating from Veeranam Lake and Coleroon River, which is one of the major distributories of the Cauvery riverine system. Seawater flows in and drains out of the mangrove ecosystem through a mouth close to the Chinnavaikal hamlet, and also from Coleroon estuary through the backwater system. Water salinity varies from about 8 ppt during the post-monsoon period to 36 ppt (parts/i ,000 or gm/litre) during summer.

During the peak monsoon season, the freshwater condition prevails in the mangrove for about a month. The water bodies of the Pichavaram mangrove wetland receive about 8 tons/ha/year of plant detritus from the mangrove forest (Chandrasekaran and Natarajan, 1992). These detritus (decayed particles of the plant material, microscopic in size) form the basis for the food web. Most fishery resources, especially prawns, depend on the amount of

Fig. 1.2 Monthly Variations in Quantity of Finfish, Prawns and Crabs Harvested in Pichavaram



detritus reaching the mangrove water. Finfish and shellfish (prawns and crabs) form an important renewable aquatic resource for the local population.

2.2.1 Species composition

Although Krishnamurthy and Prince Jayaseelan (1981) recorded about 195 species of finfish in the Pichavaram mangroves, Chandrasekaran and Natarajan (1992) recorded only 22 species as the most common (see box).

In addition to these 22 species, prawns like Metapeneaus affinis, Metapeneaus brevicornis are also found in the mangrove water. Except the scampi, almost all other prawns are found throughout the year.

Among the three species of crabs, the mud crab is the most common, and available throughout the year. Local fishers said that the mud crab is the permanent inhabitant of mangrove waters, where it breeds and feeds.

2.2.2 Other aquatic resources

Apart from fish, prawns and crabs, oysters, locally known as aazhi (Crossostrea madrasensis) are also found in large beds, particularly near the mouth. This species is of an edible oyster, but the local people do not consume it. In addition, green mussels, Perna viridis, are found in small quantities in some localities and are consumed by the Irulars.

2.2.3 Catch per unit effort

Chandrasekaran and Natarajan (1992) conducted a study on the monthly variations in the total amount of fish, prawns and crabs harvested from the Pichavaram mangroves from April 1981 to March 1982. According to their estimate, a total quantity of 245 tons of fish, prawn and crab was harvested from the Pichavaram mangroves within a period 20 of one year, of which prawn alone contributed 208 tons (85%). The amount of fish and crab caught was 19.6 tons (8%) and 9.8 tons (4%) respectively. This clearly indicates that prawns are the most important source of livelihood for the local people. This is not surprising, since prawns are primarily detritivores (detritus eaters) and large quantities of detritus are annually imported into the mangrove waters from adjacent mangrove forest.

The above study also clearly indicates that among the prawns, brown shrimp (Metapeneaus spp.) are the most

Pichavaram fishers say the catches of most fish species have gone down, compared to catches about 25 years ago.

important species – since they alone contributed nearly 47% of the prawn harvested. Of the total fish catch, mullets accounted for nearly 50%.

2.2.4 Monthly variations in total catch

The monthly variations in the quantity of finfish, prawn and crab caught from the Pichavaram mangroves are shown in Fig. 1.2 (redrawn from Chandrasekaran and Natarajan, 1992, with the authors' permission). The figure indicates that the quantity of prawn caught from February to August was more or less similar, ranging from a maximum of 13,950 to a minimum of 9,480 kg/month. However, during the northeast monsoon (October-December), the catch was high. During October alone, the prawn catch was 68,460 kg.

As in the case of prawns, finfish too were available in large quantities only during the monsoon season, but the catch was comparatively low. The maximum and minimum amount of fish caught during 1981-82 was 2,510 and 250 kg/month respectively. The crab catch during the same year varied from 120 to 2,170 kg during the monsoon. All these clearly indicate that the period October to December constitutes the peak season for fishing in the Pichavaram mangrove waters.

2.2.5 Perceptions of local fishers on fish and fishery resources

During the RRA, a wealth of information was collected from local fishers about species composition, seasonal availability of various species, quantitative variations in fish catch between seasons and over a period of time, the catch locations of fish, prawn and crab etc.

According to local fishermen, approximately 26 species of finfish, seven species of prawns and four species of crabs are important for subsistence and marketing (Table 1.1). Of the 25 species, it is only five species that have not showed any reduction in catch over a period. In all other cases, catch has gone down, compared to the amounts harvested 20 to 25 years ago (Fig. 1.3). According to them, the catch of Koduva (sea bass), which is highly priced, has gone down by 80% whereas the catch of fish like Kendai (mullet), Katta kezhuthi (cat fish), Pileecha and Oora has gone down by 50%. In the case of prawn, fishers said that 10 to 15 years ago, one or two boats full of prawn (weighing about 200 kg) were caught by a group of four or five fishermen. But today only 2 to 10 kg is harvested.

The fishers said that the following are the major causes for the decline in catches over a period.

i) Seasonal closure of the mouth of the estuary

Some 25 to 30 years ago, the mouth of the mangrove estuary remained open throughout the year. As a result, large quantities of tidal water along with adult fish and its juveniles and prawn juveniles moved into the mangroves along with the high tide. The large inflow of tidal water ensured high water depth – a factor that favoured growth of fish and prawn juveniles. But today, the mouth of the estuary is open only during the monsoon season (October to December), that too if the rainfall is high. Otherwise it's only partially open, even during the monsoon.

The fisherfolk said that currently the sand bar in the mouth region "grows" (valarnthukonde poguthu) constantly after the monsoon. Around the end of April or early May, it completely closes the mouth of the estuary, and it remains closed till October. Result: the water level in the mangroves falls, and the water temperature goes up sharply (thanni soodu kodhuthu vidum). The overall catch of fish and prawns goes down.

The fishers also said that in summer (particularly April-July), many highly priced marine fish migrate to the mangrove waters. Due to the closure of the mouth, these species are not at all available for capture, barring a small quantity that migrates from the Coleroon estuary into the mangroves via the backwaters.

The villagers explained diagrammatically to the RRA team the condition of the mouth during different seasons (Fig. 1.4).

When the RRA team tried to assess the causes for the closure of the mouth, the fishers said that the sand bar grows very fast only when a wind, known locally as kachchan kaththu – which blows from the sea to the shore – sets in. They said that during this time, the waves are very forceful and deposit a huge quantity of sand on the shore when they break.

ii) Reduced inflow of freshwater

The fishermen said that an inflow of large quantities of fresh water is required to keep the mouth of the estuary open. If the fresh water flow is heavy, it will force the sand back into the sea (uthaithu thalli vidum). They also said that the width of the mouth open during the monsoon season depends on the amount of fresh water inflow into the sea. During October 1996, they said, the mouth opened very

Fig. 1.3 Mangrove Wetland Resources —25 Years Ago and Today — as Seen by Local Fishers

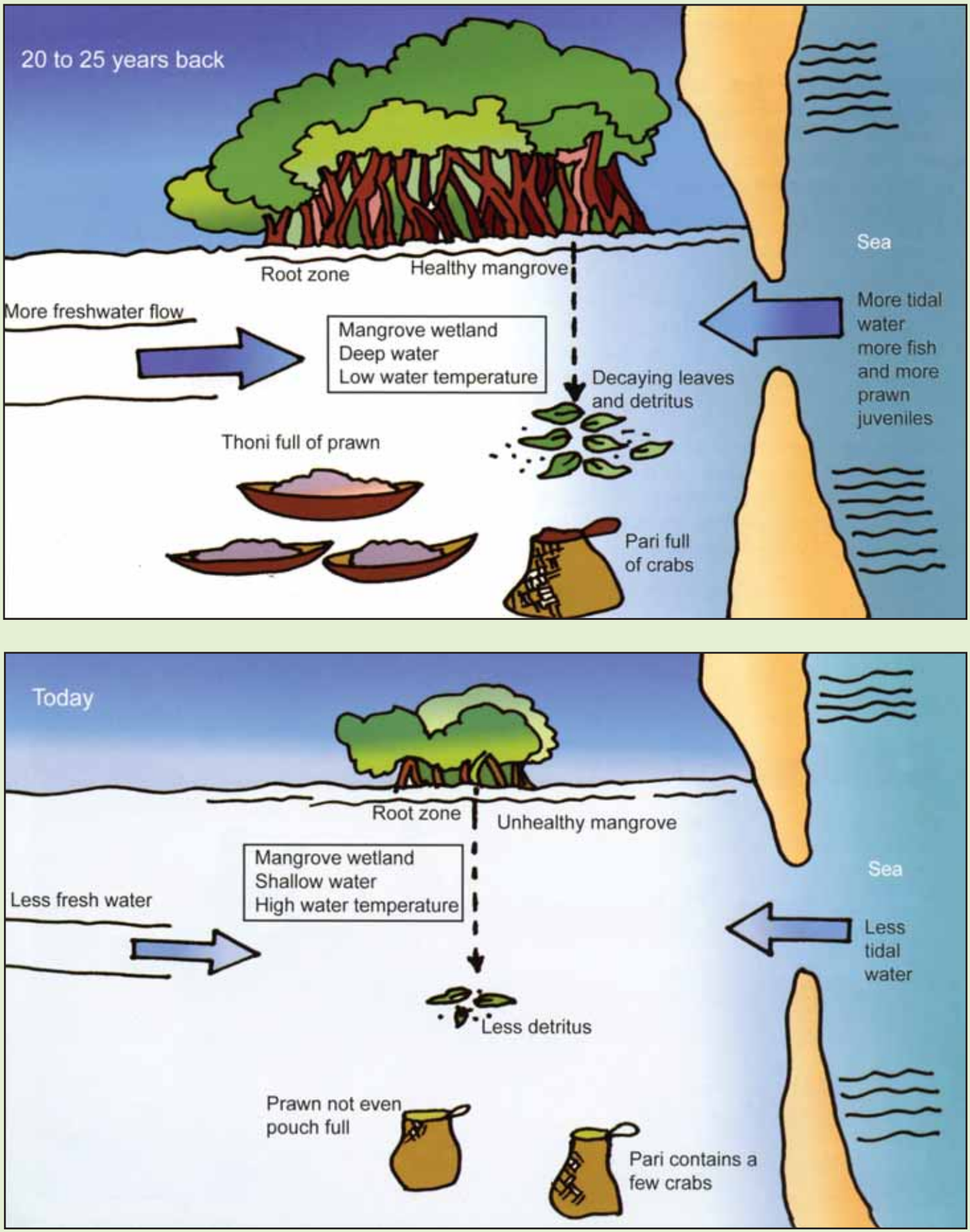


Table 1.1 Local Fishers' Perceptions on Fishery Resources of Pichavaram Mangroves

Finfish

No.	Species (Local name)	Seasonal variation in availability	Quantity	Location	Changes over the years in availability of species, and causes for changes
1	Madava (mullet)	Middle of November to middle of January	Abundant	In all areas of the mangrove wetland	During the monsoon season, species migrates from the sea into the mangroves; if the estuarine mouth is wider, more of this species will be found.
2	Kendai (mullet)	Throughout the year; high during summer	Medium	In all areas of the mangrove wetland	Species moves to forest areas during the monsoon. The catch has declined to half of what it was 10 years ago.
3	Koduva (seabass)	Throughout the year	Rare; at times medium	Around the roots of *Rhizophora* sp. Prefers to stay around mud bunds	Highly priced; today's catch is 80% less than what it was 15 years ago; the species requires deep water. More easily available in Coleroon estuary.
4	Kalava (panni)	Throughout the year	Rare; at times medium	In turbid areas, moves very close to the floor	No decline
5	Sankara	Throughout the year	Always medium	Around the roots of larger mangrove trees	A little decline in the recent past
6	Paranda	Throughout the year. Peak season is mid-April to mid-June	High during the peak season; medium in all other seasons	All areas in mangrove waters, but prefers deep waters	Migration from the sea to mangrove has reduced considerably; but the species is still available in large quantities in the Coleroon estuary (deep water)
7	Vishakezhuthi (kedutha) (cat fish)	Mid-March to mid-June	High during the peak season; medium in all other seasons	Found in mud burrows as well as in areas where seaweeds are abundant	Quantity has reduced drastically in the last 10 years due to increase in water temperature, which in turn is due to shallowness and limited flow of tidal water
8	Kezhuthi (Cat fish)	Throughout the year	High	Found everywhere, but prefers to stay close to seaweeds	Species has low economic value, the catch is now 30% of what it was about 20 years ago
9	Katta kezhuthi	Throughout the year	Medium	sandy soil	Catch has fallen by half during the past five years
10	Pileecha	Throughout the year; peak period from mid-May to mid-September	Medium	The species always moves towards clear water	The catch has halved during the past 10 years; during *Kachchan*, a large quantity moves into the backwaters.
11	Setha Kutty (Pearl spot)	Throughout the year; peak period from mid-March to mid-June	High during the peak season; medium in all other seasons	Abundant around the roots of mangrove trees, seaweeds and oyster beds	At one time, a school of this fish could be seen covering an area of about an acre. During the last 10 years no such school has been noticed, because of high water temperature
12	Oora	Mid-March to mid-June	High during the peak season	Around the roots of *Rhizophora*	The catch has halved during the past 10 years
13	Kilangan	Throughout the year; peak period from mid-March to mid-April	High during the season; rare at all other times	Abundant where the soil is sandy. Moves up to water surface during '*Konda kathu*' season to capture prey	Ten years ago, 10 to 15 kg of fish was easily caught; today catch is limited to one or two kg, because of increase in water temperature, shallow water and narrow estuarine mouth
14	Ootan	Throughout the year	Medium	Around the oyster beds	No decline
15	Udupathi	Throughout the year; peak season during summer	Medium during the season; rare at other times	Abundant close to the shore where the soil is sandy	No decline in quantity, but today's catch has less economic value than it did some years ago

No.	Species (Local name)	Seasonal variation in availability	Quantity	Location	Changes over the years in availability of species, and causes for changes
16	Selanthan	Throughout the year	Rare; just one or two	This species prefers shady areas	Catch has reduced to 25% during the past five years
17	Kuhn (marine eel)	Throughout the year; peak period from mid-April to mid-June	Rare; just one or two	Found in muddy areas, deep water	Catch has fallen to 30% of what it was about 15 years back
18	Cheetta kavala	Mid-April to mid-August	Medium	Found in deep sandy soil, close to the sea	Catch has fallen to 30%, the decline started 10 years back
19	Ullam	Mid-April to mid-August	Rare	All areas	Catch has fallen to 25% of what it was many years ago; decline has been drastic during the past five years
20	Mutlees	Throughout the year; peak period from mid-April to mid-August	Medium	Everywhere	No decline
21	Narikendai	Throughout the year; peak period from mid-April to mid-May	High during the peak period	Around oyster beds	No decline
22	Kaala	Throughout the year; peak period from mid-April to mid-May	Medium during the peak season; just one or two at other times	Deep water	This species migrates into the mangroves during summer. About 20 years ago, huge quantities used to be harvested. Now the catch is poor. Reason: increase in water temperature and narrow mouth.
23	Sena	Throughout the year	Medium	Mud burrows	Catch has fallen to 50% of what it was many years ago. Has more medicinal than food value. Used as a bait
24	Uluva meen	—	No more available in the mangroves	—	Once seen in abundance around the root zone of *Acanthus ilicifolius*, the fish can't be seen today since the population of *A. ilicfolius* has fallen drastically
25	Aathu kathalai	From April to May	Very rare; just one or two	Deep waters	Was abundant about 10 years ago; because of increased water temperature, very rare today
26	Keechan	Throughout the year	Very rare; just one or two	Everywhere in the backwaters	No decline, but the species has poor economic value
			Prawns		
No.	**Species (Local name)**	**Seasonal variation in availability**	**Quantity**	**Location**	**Changes over the years in availability of species, and causes for changes**
1	Karuvandu ral (tiger prawn)	Throughout the year	8 to 10 kg during the monsoon season	Everywhere	In general, the quantity of prawns has been gradually decreasing. At one time, one or two boats full of prawns used to be harvested. Now no one catches such huge quantities. It is weighed only in kilograms. Decline in catch started about 10 years ago.
2	Vella ral (white prawn)	Throughout the year	2 to 5 kg during the monsoon season	Everywhere	
3	Vellicha ral (brown shrimp)	Peak season from mid-October to mid-December	Abundant (20 kg)	Everywhere	
4	Chemakka ral (brown shrimp)	Peak season from mid. October to mid-December	2 to 3 kg during the peak season	Everywhere	
5	Paasi ral	From mid-April to mid-July	4 to 6 kg	Around seaweeds	
6	Mottu ral (scampi)	Only during November	A small quantity	Around the bushes of *Acanthus ilicfolius*	Freshwater availability will improve catch
7	Chennakunni	–	–	–	No more available in the mangroves

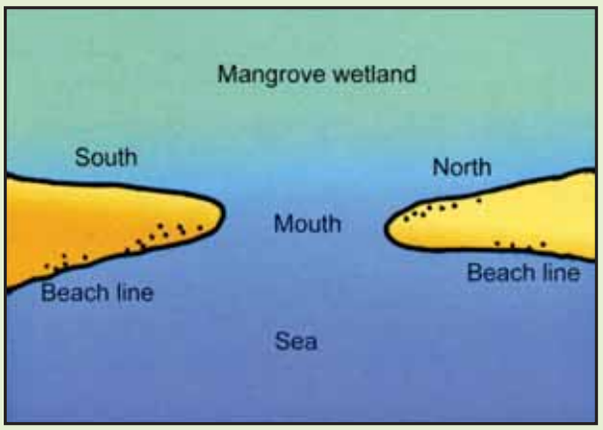
Crabs					
No.	**Species**	**Seasonal variation in availability**	**Quantity**	**Location**	**Changes over the years in availability of species, and causes for changes**
1	Kal nandu (mud crab)	Throughout the year	5 to 10	In deep waters and also among oyster beds	At one time about 40 to 50 were caught per haul. Now the catch is much lower. Higher quantities are available near Pazhaiyar
2	Seevali nandu	From mid-December to mid-August		Everywhere	Available in large numbers in Pazhaiyar
3	Vher nandu	Throughout the year		Everywhere	No decline
4	Thillai nandu	Throughout the year		Land areas, lives in burrows	No decline in catch. Little food value, but some medicinal value

wide because of torrential rain in the surrounding area. By comparison, the mouth opening during the 1997 monsoon was narrow because of the low rainfall. The data available with the Pubic Works Department, Government of Tamil Nadu, clearly shows that the amount of water discharged from the Lower Anicut into the Coleroon River, which supplies freshwater to the mangrove wetland through a backwater canal, has gone down drastically in recent years.

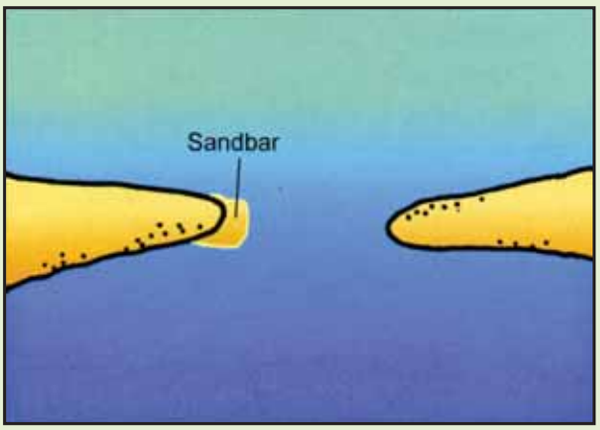
iii) Reduction in the forest cover

The RRA team tried to understand from fishers the relationship between the mangrove forest and fish catch in mangrove-associated waters. During this discussion, five out of seven fishers asserted that it is the reduction in the mangrove forest cover that is mainly responsible for reduced prawn catch, since prawn breeds (puzuthu pa gum) only in decaying mangrove leaves. They said that if a bunch of

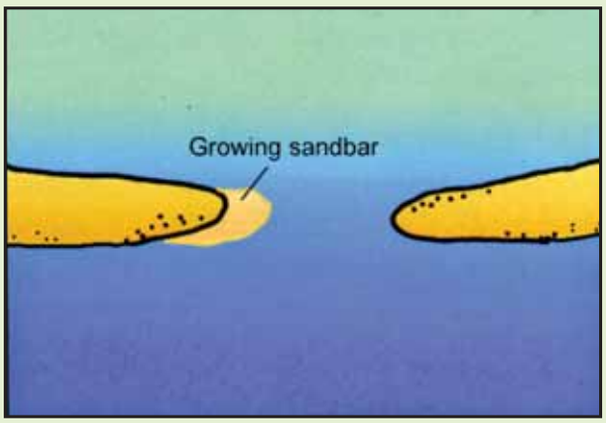
Fig. 1.4 Status of Estuarine Mouth During Different Seasons — as Observed by Local Fishers



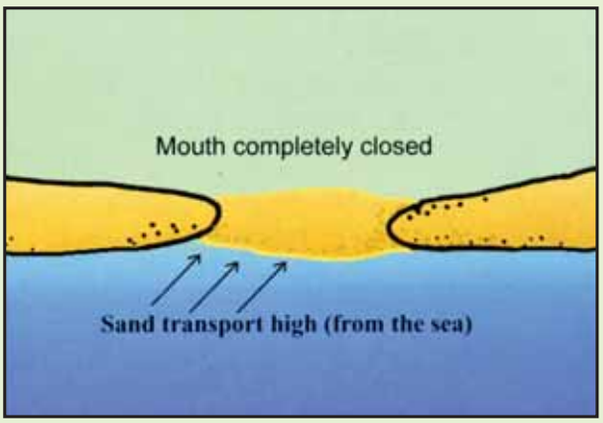
(a) During monsoon season (Oct. - Nov.)



(b) During December



(a) During March



(b) During May

Reduction in mangrove forest cover is mainly responsible for reduced fish and prawn catch, according to fishers.

decaying mangrove leaves is taken out of water, one can see thousands and thousands of young prawns clinging to it. They said that from 1910 to 1970, mangrove forest trees were cut in large numbers by contractors, since the government allowed it. Prawn catch has started declining

ever since. Some of the village elders said that healthy mangrove forests with tall and huge trees were systematically felled in "coupes" identified by government agencies. This practice continued till the early 1970s.

During this conversation, one of the RRA members explained that prawn breeds only in the open sea. Young ones which cannot be seen by the naked eye, migrate to the mangroves where they feed on decaying mangrove leaves

and grow into juveniles. He also explained that when it is

ready for breeding, it would migrate back to the sea. Sensing the fishers' skepticism, the RRA member promised to show them a booklet that explains the life cycle of prawns. A copy of a small pictorial booklet on prawns published by the FAO's Chennai-based Bay of Bengal Programme was given to them the next day.

iv) Increased mechanised fishing along the shore

Some fishers said that during the last five years, the number of mechanised boats fishing in the inshore waters near the Pichavaram mangroves has gone up tremendously.

This might be one reason for the reduction in fish and prawn catch – since these boats prevent the movement of fish from the deep sea to the shoreline and from shoreline to the mangroves.

The perceptions of local fishers about fish and fishery resources in the mangrove wetlands are detailed in Table 1.1. Figure 1.3 illustrates the condition of the mangroves and the mangrove fishery some 20 to 25 years ago and the condition today. The RRA team drew the figure on the basis of these perceptions; it was later shown to the local fishers.

3.0 Mangrove Resource Utilisation Pattern

3.1 Mangrove user hamlets, communities and population

Seventeen hamlets belonging to four revenue villages– Killai, Pichavaram, Thandavarayan Sozhagan Pettai (T.S. Pettai) and Thillaividangan – utilise the resources of the Pichavaram mangrove wetlands. Among the 17 hamlets, nine depend mainly on fishing, eight others mainly on farming. There are about 4,400 households in these hamlets, and their total population is about 16,600. The box below details the household and population break-up in each hamlet.

3.1.1 Fishing community

Some 2,905 fishers depend on the mangrove wetlands for their livelihood (box on next page). Of these, 1,975 (68%) are traditional fishers (belonging to the *Periapattinavar* community) the remaining 930 (32%) belong to the non-traditional fishing community. Among the traditional and non- traditional fishing communities, two groups could be identified

i. fishers who fish in the mangrove waters throughout the year

ii. fishers who fish in the mangrove waters only during the monsoon (peak) season

Of the non traditional fishing community, Irulars constitute 480, the others are landless wage labourers from the Vanniyar community (most backward class) and the Scheduled Castes.

The populations of all groups are detailed below:

Fishers who depend on the mangrove waters

2905

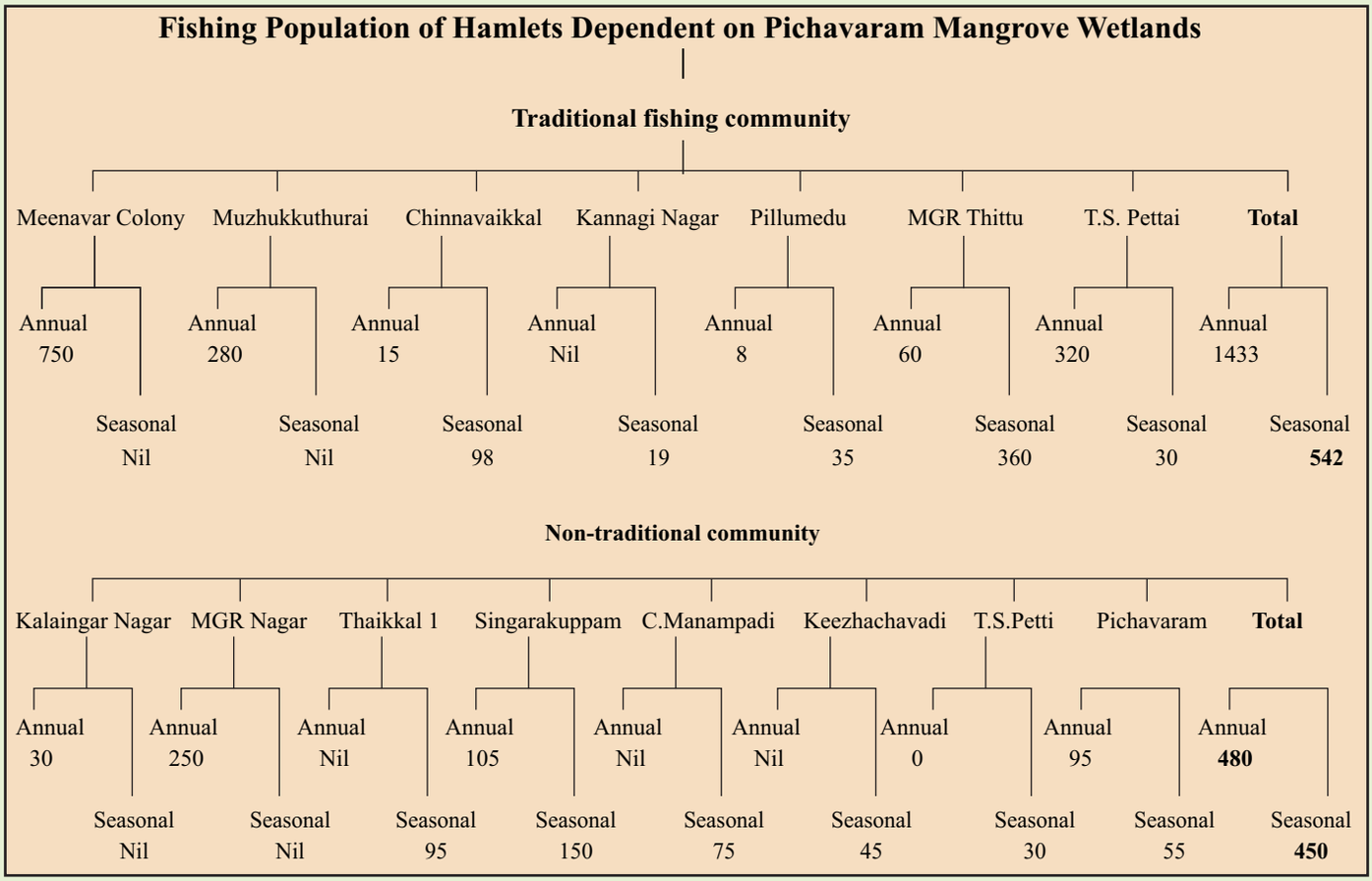
Total no. of traditional fishers 1975		Total no. of non-traditional fishers 930	
Annual	Seasonal	Annual	Seasonal
1433	542	480 (Irular)	450 (Others)

Mangrove User Hamlets, Households and Population around Pichavaram Mangrove Wetlands

Killai		Pichavaram	T.S. Pettai	Thillaividangam
Fishing hamlets	**Farming hamlets**	**Farming hamlets**	**Fishing hamlets**	**Farming hamlets**
Meenavar colony H-24l; P-1439	Thirunalthoppu H-370; P-976	Vadakku Pichavaram H-l96; P-976	T.S. Pettai H-225; P-1124	Keezhachavadi H-l94; P-934
MGR Nagar H-iSO; P-494	Thaikkal H-265; P-945	Therku Pichavaram H-33l; P-2004	**TH-225; TP-1124**	**TH-194; TP-934**
Muzhukkuthurai H-1l4; P-539	Kuchchipalayam H-133; P-550	**T H-527; TP-2980**		
Mudalsalodai H-1500; P-3000	Singarakuppam H-l73; P-920			
Chinnavaikkal H-45; P-200	Ponnanthittu H-306; P-1747			
Kannagi Nagar H-lO; P-50	**TH-1247; TP-513**			
Pillumedu H-40; P-l50				
MGR Thittu H-109; P-561				
TH-2209; TP-6433				

Total household in all the hamlets – 4,402
Total population in all the hamlets – 16,609

H – Household; P – Population;
TH – Total Households; TP – Total Population



3.1.2 Farming Community

Traditionally, the farming community depends on land and cattle, the major resources in any rural area, for subsistence and income generation. Cattle are essential for land preparation and manuring. In addition, cattle are considered a "fixed deposit" that can be cashed at critical times. They are allowed to graze in the mangroves during the agricultural season. Once paddy and other crops are harvested, the cattle are brought out of the mangroves to graze in large herds in cultivable lands and penned in the same fields at night for manuring.

During the monsoon, cattle from all the eight farming hamlets are let into the Pichavaram mangroves for grazing. Details of cattle grazing and management systems are found in Section 3.3 on "Utilisation patterns and practices: forestry resources" (page 35). As for utilization of mangrove wood as firewood, a few landless families do so for sale in the local market. Otherwise, only twigs and dead trees from the mangrove forests are collected as firewood by a small number of families from seashore hamlets.

3.2 Utilisation patterns and practices: Fishery resources

3.2.1 Traditional fishing community

Traditional fishers have been fishing in the water bodies associated with the mangrove wetlands since time immemorial, both for subsistence and marketing. Traditional fishing is still a family enterprise. All adults in the family take part in fishing. They have also developed a traditional management system, which ensures sustainability of fishery resources and an equitable share of available fish catch. Besides traditional fishers, the *Irulars* (who are non-traditional fishers) also fish intensively in the mangrove waters. The *Irulars* started intensive fishing only recently; before that, they were hunters and gatherers. The fishing methods of *Irulars* are different from those of traditional fishers.

3.2.2 Fishing methods of traditional fishers

Traditional fishermen harvest the fishery resources of the Pichavaram mangroves using various crafts and gears. None of these fishing methods affect the health of the mangrove ecosystem.

Fishing crafts and gears

Crafts: The main fishing craft used in the Pichavaram mangrove waters is a small boat, the *thoni* (canoe). There are three types of canoes, depending on length and breadth. Local fishers say that at one time these boats were bought from Kerala, but since such boats are no longer made there, it's difficult to acquire new *thonis*. The price of these boats varies with the size and quality of the wood. Some time ago, the *thonis* were made with inexpensive Eucalyptus

wood, but hardly lasted a year or two. A few *Irular* fishers fish in the backwaters with *kattumarams* (catamarans).

\Fishermen who do not own a boat sometimes fish with a borrowed boat; this is a common practice. No fee or rent is charged for this boat. However, if the boat suffers damage, it has to be set right or paid for. Usually, carpenters from the neighbouring town of Parangipettai (Porto Novo) are hired for boat repair. No borrowing or lending is done with nets. But everyone pitches in to help repair a neighbour's net when that's necessary.

Gears: The following types of gears are used commonly by traditional fishers for fishing in the mangrove waters (Table 1.2).

i) cast net (*veechu valai*)

ii) stake net (*oonu valai*)

iii) drag net (*ko valai*)

iv) gill net (*mithapu valai*)

v) crab trap (*nandu kachcha*)

The size, structure, weight of the net and mesh size vary. Different mesh sizes are meant for catching different species of fish. Hook and line and scoop nets are also in use, but less frequently than the five gears listed above

Cast net (Veechu valai): It is widely used in mangrove waters by traditional fishers (and sometimes by non-traditional fishers). There are three types of cast net, based on net size and operations. The first type is huge in size, about 7 kg in weight, and thrown into the water by a fisherman standing in his boat; the second type is relatively smaller (4 kg in weight) and operated by adults standing in the water; the third type of cast net is the smallest, normally handled by children. The net is thrown in such a way as to form a bell-like structure that plunges into the water. The yarn is normally of nylon. A chain of small cast-lead rings act as weights on the outer margin of the net. The catch normally consists of prawns and small fishes.

Stake net (Oonu valai): Stake nets are used only to fish prawns in traditionally demarcated areas. In these areas, four wooden poles are driven into the mud in a straight line across

Cast nets (above) are used widely by traditional fishers in mangrove waters. Stake nets (below) are used to capture prawns in traditionally demarcated areas.

Gill nets (below) are used to capture mullet and catfish.

Nandu kachcha, *used by non-traditional fishe rwomen, are effective in trapping crabs.*

the middle portion of tidal creeks and canals. The net is operated during low tide when the prawn moves along the tidal water to the sea, and removed with catch just before high tide. The stake net is used only during the night. During community fishing (*Paadu*), a series of stake nets are tied across the waterways one after the other, leaving a narrow gap on either side of the net close to the canal banks for boats to move. The local fishers say that stake nets can trap a large number of prawns. Non-traditional fishers are not allowed to use a stake net.

Drag net (Kovalai): Drag nets are used mainly to catch prawns during low tide. They are operated only in shallow water. Each drag net is about 10 m in length, supported by five poles, and periodically dragged by its cod ends by two men for about 60 to 80 m till the deep portion emerges.

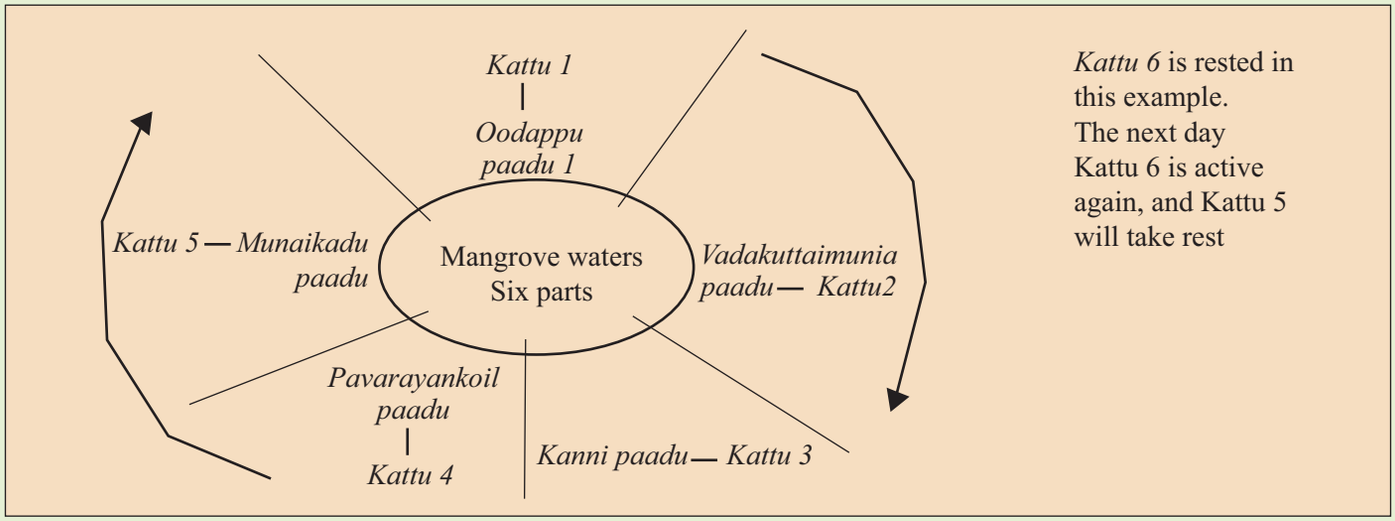
Gill net (Mithapu valai): Gill nets of different mesh sizes are used in the Pichavaram mangrove waters mainly to catch mullet and catfish. Each gill net measures about 100 m in length and is suspended in the waters with float and sinkers. Gill nets are operated either from a boat or by standing in waist-deep water. An aged fisherman pointed out that before plastic floats, only the root of a mangrove tree called *maramamaram* (*Sonneratia apetala*) was used as a float. At one time, the population of this species was very high and huge trees were seen, but mostly in places where fresh water flows.

Crab trap (Nandu kachcha): Each crab trap consists normally of 36 traps at intervals of about 2 m, tied together by a single long nylon rope. The trap is made of a circular ring, around which a coarse net is meshed. Preserved eel meat (*Kuliri*) is fixed to the centre of the net as bait.

Table 1.2 Different Types of Nets Used by the Traditional Fishing Community in the Mangrove Waters

No	Type of net	Fish caught	Mesh size	Weight	Remarks
1.	**Cast net** Peria valai Irangiu valai Iral valai	 Prawn and fish Prawn and fish Prawn	 15 to 16 points 28 points 28 points	 Net 5kg; lead – 5kg Net 2kg; lead – 2kg	 Used from the boat by well-built fishers Used by standing in the water at waist height Used by children to learn fishing
2	**Gill net** Poodu valai Sala valai Kendal valai	 Prawn Mullet and cat fish Mullet (large size	 28 points 50 points 70 points	 Weight varies Weight varies Weight varies	 Used across the tidal canal Used across the tidal canal Used across the tidal canal after watching the fish movement
3	Drag net Izzuphu to valai Nattu to valai Salangai valai	 Prawn and fish Prawn and fish Prawn and fish	 15 to 20 15 to 20 15 to 20	 Net 2kg;lead–4kg Net 2kg;lead–4kg Net 2kg;lead–4kg	 Dragged along the floor; more catch during the night
4	Stake net Oonu valai	 Prawn	 15 to 20	 Net 2kg; lead–4kg	 Used during the low tide across the canal, only at night; catch per unit effort very high

Fig. 1.5 Community-based Traditional Fisheries Management System: An example of how a particular portion of the mangrove wetland is divided into different parts, and how the fishing community utilises the fishery resources by rotation.



The traps are suspended serially in the water with floats and pulled out after two or three hours; the crabs trapped in are collected. Two persons deploy the traps from the boat – sometimes two traps are joined together and operated. Crab capture is usually undertaken as the tide rises, and ceases just when the low tide begins. Large-sized crabs are available near the root zone of mangrove trees and in the deep waters. Crab traps are also normally used by Irular fishers who are considered experts in crab fishing.

Table 1.2 shows different types of nets (cast, stake, drag and gill nets), the size and weight of each, the use of these nets and the types of species caught with different nets.

3.2.3 Traditional community-based fishery management

The Paadu system

A very flexible and dynamic traditional system of community fishing is practised by traditional fishers in Pichavaram mangroves (Fig. 1.5). The system ensures resource access to all and equal benefits to all households, and is a collective and co-operative effort that ensures sound fishery resource management. This community-based fishery resource management system is known locally as Oonuvalai kattu (oonu – stake, valai – net, kattu – group).

Fishing intensity in the Pichavaram mangroves is related to the seasons. The traditional fishers refer to fishing during summer (mid-February to September) as Kodainaal (kodai – summer, naal – days). Summer is the lean fishing season, when catch per unit effort is low. There are no community – based restrictions on fishing during summer, and any fisherman can fish anywhere in the mangroves. Fishing during the northeast monsoon is referred to as *Vadainaal* fishing. During this season, prawns are available in abundance; fishers are expected to adhere strictly to management procedures.

Every fishing village in Pichavaram has its own traditional system of management. In this system, an area of the Pichavaram mangrove water is allotted to a particular fishing village, which is further divided into smaller areas or zones known as *paadu*. Similarly, the fishing population of that village is divided into many groups, each of which is called a *kattu*.

Traditionally, members of a single group descend from the same ancestors. Each *kattu* goes to fish in a particular *paadu* on one day and moves on to the next *paadu* the following day. The cycle has a fixed direction; once a kattu exhausts all *paadus,* it returns to the first *paadu* after taking a day's rest. The cycle continues.

This system can be explained by the following example. The fishing population of the Killai village is divided into six groups (*kattus*): *1. Mania kattu, 2. Karaiporukki kattu, 3. Najathani kattu, 4. MGR thittu kattu, 5. Keelatheru kattu and 6. Nedungkalvai kattu.*

The area of the mangrove water allotted to this Killai village is divided into five zones (paadu): 1. Odappu paadu, 2. Vadakuttaimunai paadu, 3. Kanm paadu, 4. Pavarayan koil paadu and 5. Munaikaadu paadu.

On the first day of a fishing season, *kattu* 6 will be rested. The other five *kattus* will go for fishing in the five *paadus*. On the second day *kattu* 5 will be rested, while *kattu* 6 will go fishing in *paadu* 1.

In this way, on a given day, five *kattus* will engage in fishing on five *paadus* and one *kattu* will be rested.

Middlewomen give loans to traditional fishers; marketing offish through them is not always mandatory.

This practice of rotation is strictly adhered to by all the *kattus*. The following schematic diagram shows the fishing *paadus* and *kattus* in a day of fishing for fishermen belonging to Killai *village*.

In each *paadu*, members of a *kattu* should fish together and the catch divided equally among the fishers. If an adolescent boy also participates, he gets three fourths of the adult share provided he carries a net. This system is followed to avoid overcrowding of prawn areas and avert over-exploitation. Second, this system ensures equitable sharing of the fishery resources of the mangrove waters.

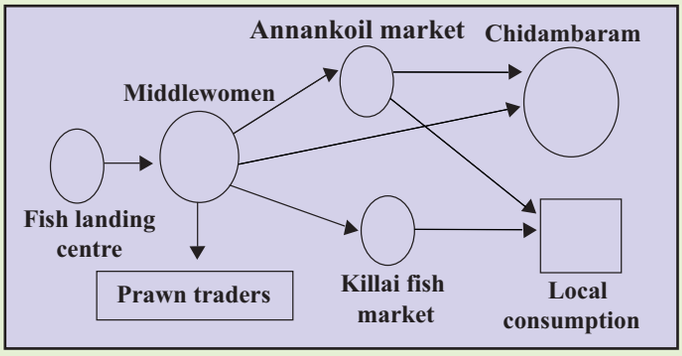
Nowadays, the *kattu* is no longer restricted to descendants of a single ancestor. Entry into the *kattu* is not very difficult. To become a member of a group or a *kattu*, an aspirant has to buy a net and two poles and persuade the seniors of the group – through a drink and meal sponsored by him, an expenditure of approximately Rs.3,000. A member is suspended from the group if he misbehaves with other members or cheats on catch. The mischief-maker gets punished in the local Panchayat. If a member is ousted from a *kattu*, it is not easy to get admitted into some other *kattu*. In this management system, if the speed of the water current declines and depth falls, that *paadu* is no more considered suitable for community fishing. It would be converted into a secondary *paadu*. It would get cancelled from the list in due course.

3.2.4 Fishing timings

People fish in the mangroves throughout the year, including monsoon days. Individual fishers or a husband-wife pair go fishing in the mangrove waters both day and night, but traditional community fishing (*Paadu*) is done only at night. The starting time for community fishing depends entirely on the tidal movement. 'Slack' water is considered the most appropriate time for both individual and community fishing. During this time, more fish enters the mangroves from the sea, and operating the crafts and gears is also easy.

Normally the fishing duration varies from six to eight hours but sometimes it gets reduced to three or four hours. The sharpness of the flood and ebb tide is directly linked to the

Fig. 1.6 Marketing Channels



waxing and waning of the lunar month; so is the quantity of fish entering the mouth of the estuary. The fishers have a rich knowledge of the timing of the flood and ebb tide, season by season.

3.2.5 Fish preservation

The fish catch is normally sold the next morning itself. To preserve the catch, small ice boxes are used. All households own such boxes, whose capacity ranges from 15 to 20 kg. A box lasts two years. On very rare occasions, if the catch exceeds the capacity of the box, the households use a small bamboo basket to store and preserve the fish. Ice is bought from the Killai fish market itself. A portion of the ice cut from a huge bar is offered for Rs. 10. The other traditional method of preservation is to dry fish. In the past, almost all the catch was dried and sold in weekly markets. But nowadays it's very rare to find dried fish in the market.

Non-traditional fisherwomen make a living by "groping" for prawns (above) in the mangrove waters. A husband-wife team (below)resorts to another non-traditional fishing method, "bunding".

3.2.6 Marketing (Fig. 1.6)

Women are mainly responsible for marketing fish catch in traditional fishing communities. Prawns are normally sold to big traders who buy them for export. Finfish catch on the other hand is marketed at two places — the Killai fish market and Annan koil, a place nearby. Normally, Annan koil is preferred for larger quantities. Fish traders-cum-middlemen fix the price; sellers attempt to increase it through bargaining; if the price is not suitable, the seller is free to approach some other buyer. If the price is very low, the women hire a van and carry the fish to the Chidambaram market. AtAnnan koil, the price is fixed through auction; merchants from Chidambaram and other places visit the market to buy the catch.

Taking a small loan from a middlewoman is a common practice among traditional fishers; selling the catch to the same middlewoman is fortunately not mandatory. The proximity of the market renders dried fish superfluous. But fisherfolk remember and recall the days not so long ago, when their fathers organised dried fish in large quantities and marketed them every week in Bhuvanagiri, Sethiathoppu and Mayiladuthurai.

3.2.7 Credit sources

For fishers, fish merchants from the same village are the main source of credit, middlemen from Porto Novo and Chidambaram are other major sources. Loans are taken mainly to buy or repair fishing craft or gear; loan amounts range from Rs. 2,000 to 10,000; the rate of interest varies from a minimum of 5% to a maximum of 10% per month.

3.2.8 Non-traditional fishing community

The Irulars tap the fishery resources of the Pichavaram mangroves. Historians tell us that the ancestors of the Irulars migrated from Andhra Pradesh and engaged mainly in rat hunting and gathering of paddy from rat burrows. Later, some of them served in the casuarina and coconut plantations of local farmers — almost functioning as bonded labour. They then gradually developed their own method of fishing — which they now use to harvest fishery resources of the Pichavaram mangrove wetlands.

3.2.9 Fishing methods of the *Irulars*

Most fishers from the *Irular* community suffer from very low incomes; they may be described as poverty-stricken. Few of them own any fishing craft or gear – which should be regarded as the basic economic asset of fishers. Their main fishing methods are groping for prawns, trenching (groping for prawns in narrow, shallow man-made trenches), and bunding.

"Groping" is the unique fishing method of the *Irular* community – almost the entire *Irular* population pursues this difficult and unconventional method of fishing. Only a few families who own a second-hand boat/catamaran and net practise the bunding method.

i) Groping for prawns

Both men and women capture prawns by "groping," a method of fishing that aims at capture of prawns in shallow water during low tide when the water level is low.

Sitting on their knees in the mud in the shallow mangrove backwaters, they keep their head above the water level. Their teeth hold a small pouch made of palm leaves. The pouch has to be kept submerged in the water so that the catch isn't spoiled through exposure to the sun while the fishers grope for prawns. The catch is thus preserved in a very unconventional fashion till it is marketed.

How do the Irular fishers grope for prawn? They stretch their hands in the water at right angles to their body, bring them down to the floor, and slowly move their hands on the surface of the mud from the sides to the front. If they feel they have made contact with the prawn, they hold it tightly, bring it to the surface, wash it and deposit in the pouch between their teeth.

Repeating this action steadily, the fishers move forward till they are in the deep water. Thus sitting on their knees, they grope for prawns for five to six hours till the end of the low tide period (usually six hours), with a break in the middle. They cannot grope for prawn during the high tide because of the high water level then. Almost all Irulars living in MGR Nagar and surrounding areas apply the groping method to catch prawn. Children do the same in areas close to the shore.

ii) Groping in the trench

This method of prawn fishing is also practised in shallow mangrove waters during low tide. But only skilled Irular practitioners do it. They fix a pole into the mud, keeping the top of the pole out of water, and tie a dhoti (waist cloth) around the top. Starting from one side of the pole, they drag their feet around in the soft mud to make a small trench of rough circular shape. They repeat the exercise two or three times till a trench about 5 to 6 inches deep is formed. The exercise takes about 45 minutes to complete. Prawn in surrounding waters like to settle in the trench to rest and feed. After a short while, the fishers catch the prawns by groping for them.

The groping method of prawn capture – both in the open waters and in the trench – causes various health problems. The *Irulars* complain of severe neck and back pain, numbness in hands and feet. Holding the pouch in between the teeth causes tooth decay. Women say they are the worst sufferers since after fishing for 5 to 6 hours every day, they come ashore and spend nearly 2 to 3 hours to collect firewood for cooking. Apart from this, both men and women suffer cuts in hands and feet due to sharp-edged oyster shells.

Unfortunately, fishers who suffer oyster shell cuts do not realize it until they come out of the water, and lose a lot of blood. To describe their suffering from such wounds, one of the *Irular* women said, "We are eating our own blood." Another major occupational hazard from the groping method of fishing is stings by marine catfish. This is described as the "ultimate pain" which can last a whole month. There's no antidote for catfish sting poison; no known medicine can reduce the pain.

iii) Bunding method of fishing

This method of fishing is practised by the *Irulars* in the mangrove forest to catch both fish and prawns. In the past it was done for subsistence, now the catch is marketed and sold. In this method, mud embankments of about 30 to 40 cm height, covering an area of about two or three acres, are constructed within the mangrove forest around the tidal creek, normally 6 to 10 m inside from the edge. Small openings to the embankment are made at three or four places. The tidal water, along with fish and prawns, enters the embankment during the high tide. When the water begins to recede during the low tide, openings in the embankments are closed with a traditional (*Padal*) net or thin cloth, which allows only the water to pass through.

All the fish and prawns that entered the embankment are thus trapped and later handpicked. This method is normally practised during the late monsoon when the water level in the backwaters is high. During summer, when the water level is low, the method is not practised. The Forest Department feels that the bunding method affects mangrove forest growth by obstructing free flushing of mangrove forest.

The *Irulars* say they always sell their catch to traditional fisherwomen from whom they take an advance. These middlewomen take this opportunity to exploit the *Irulars* by paying them only half of the price for their catch. The middlewomen grab their pound of flesh (the catch) on the shore as soon as the Irulars emerge from the water. If the Irulars manage to catch large-size crabs, they take them to Chidambaram town without the knowledge of the middlewomen, and sell them there at a higher price.

The Irular fishers said during discussion that their catch per day is too meagre for any practical or profitable self- marketing effort.

3.3 Utilisation patterns and practices: Forestry resources

The local farming community that lives in eight hamlets around the Pichavaram mangrove wetlands rears livestock for various purposes such as milking, manuring, and ploughing as well as for pulling carts. Besides, cattle are a "fixed deposit," an important and reliable source of hard cash at critical times. Cattle growers utilise the mangrove forest mainly for livestock grazing. The user hamlets have some 6,460 heads of livestock, of which 45% (2,924) are cattle, 41% (2,653) are goats and 14% (879) are sheep. Figure 1.7 shows their distribution in the 8 hamlets.

Cattle grazing in the mangrove peripheral zone stunts the growth of mangrove plants.

3.3.1 Cattle grazing

The villagers said during group interviews that they manage their livestock in the following way:

1. They keep much and plough animals with them throughout the year. For about seven months (February to August), these animals graze in harvested agriculture fields. Family members take charge of grazing, or a person is hired for the purpose, depending on the number of cattle. During September, when the agriculture season starts, the livestock are either stall-fed or let to graze around paddy fields and common lands if any. In October, when the agriculture fields are flush with seedlings, the cattle are let into the mangroves every morning – to graze in the peripheral areas – and taken back in the evening. Daily grazing is continued till the following February.
2. Dry and less productive animals (varattu maadu) and aged ones are given to traditional cattle gatherers for grazing and maintenance. The animals graze in harvested fields from February to August; and in mangrove wetlands during the September-January agriculture season. While grazing in the mangroves, the cattle are left pretty much to themselves, except for occasional visits by cattle gatherers. The cattle reach the core area of the mangroves where they graze during the day, and move toward the seashore at night to rest. In February, they are picked up again by cattle gatherers and taken to the harvested paddy fields.

Fig. 1.7 Population of Cattle, Goats and Sheep of Mangrove-Dependent Hamlets in Pichavaram

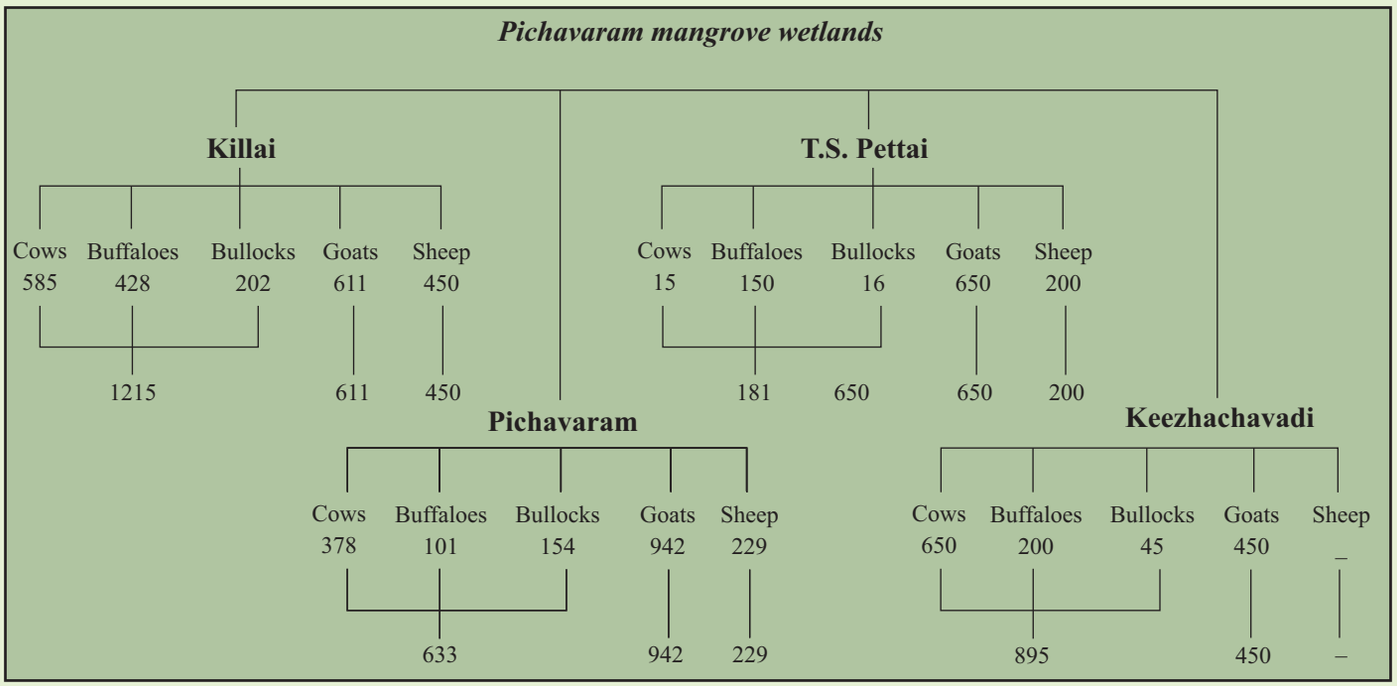
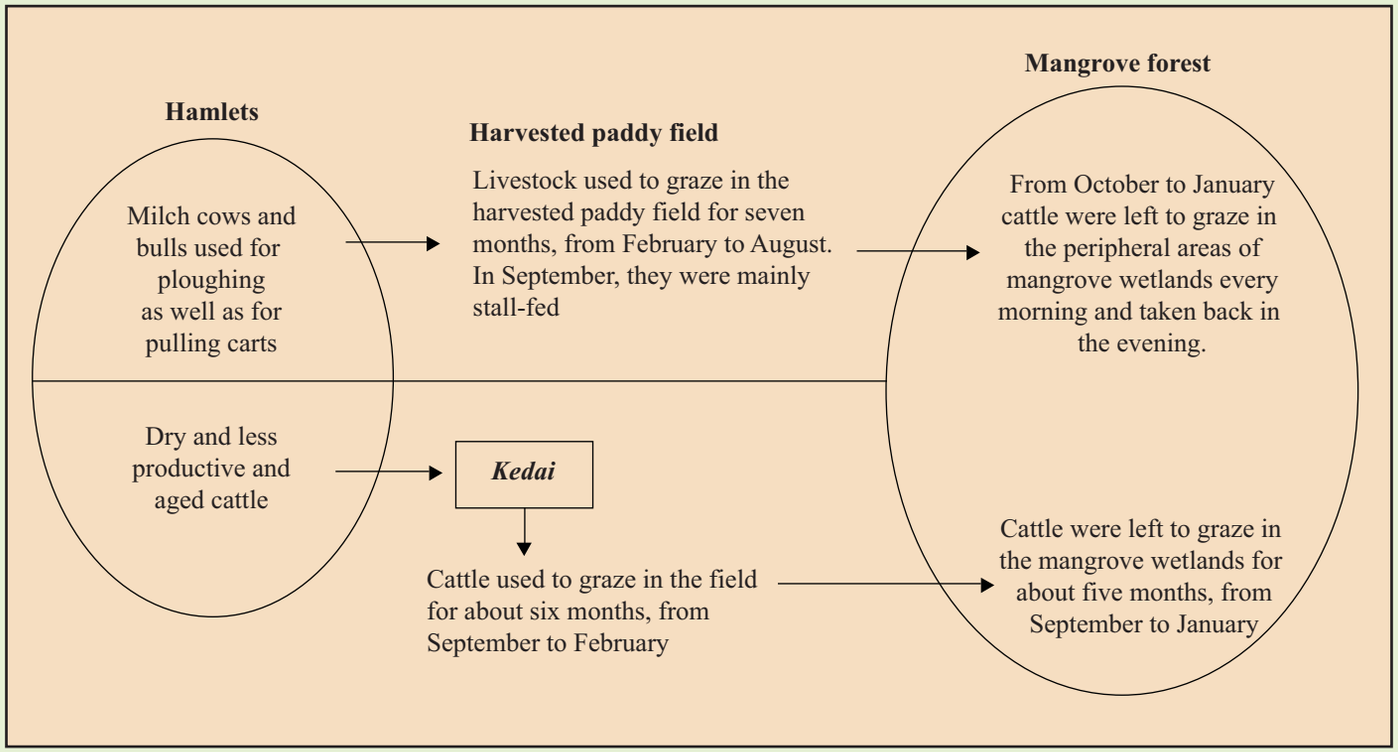


Fig. 1.8 Grazing System in Traditional Method of Cattle Management Followed in the Past in Mangrove User Hamlets



This system of cattle management and grazing is explained diagrammatically in Fig. 1.8.

Interviews with these cattle gatherers led to the following points:

- Cattle gathering, locally termed kedai kattutha4 is an age-old practice for effective cattle management. It helps manure agriculture fields, avoids damage to agricultural crops, and provides incomes to the cattle-gathering families.
- The cattle are let into the mangroves only during the rainy season. Reason: During summer, the salt content of the water goes up, and the cattle will have no fresh water to drink.
- In the mangrove forest, what the cattle most relish are the leaves and fruits of Avicennia marina, which is found in large numbers in the forest.
- The dung left in the mangrove forest helps the trees grow better.
- Till 1982-83, the Forest Department followed a "token" system to permit cattle grazing in the mangroves.

Grazing within the hamlet: Livestock in all the hamlets are allowed to graze under the direct care of the cattle owner. To avoid any damage to agriculture plantations, the villagers had for a long time followed the Patti system under which every hamlet had a Patti (enclosed area) in the common village land. Any cattle or goats damaging the plantations were caught and detained in the patti. They were released only when the cattle owner paid a fine ranging from Rs. 5 to 10.

Because of this system, the owners took care of their cattle. Damage to plantations within the hamlet was avoided. The villagers said that in the past this system was controlled by a Maniyakkarar (a native villager who looked after the village administration on behalf of government). He supervised this system of cattle management with great and meticulous care. But after the appointment of VAOs who belong to other villages, the patti system has suffered. Farmers from Killai, Vadakku and Therku Pichavaram, Ponnanthittu and Keezhachavadi said that reviving this system would help them raise new plantations.

3.3.2 Perceptions of local people on cattle management

1) Reduced availability of fodder: In the past, a large quantity of fodder, particularly paddy straw, was available since paddy was cultivated twice a year. Now, because of erratic water supply through irrigation canals, paddy is cultivated only once. Result: the availability of paddy straw has gone down sharply. In addition, in recent years, large areas of paddy fields have been converted into prawn farms. This has further reduced grazing ground in the non-agricultural season.

2) Lack of a common grazing ground: In the past, all common lands available in a village were used as grazing grounds. But now, almost all these lands have been encroached upon. Hence, animals have to graze only along the roadside or in the mangrove forest.

3) Increased cost of cattle rearing: In the past, expenditure on cattle rearing was minimal and the cost of many supplementary feeds very low. But today the costs of supplementary feed as well as of paddy straw are steep.

4) Poor quantity of milk: The present cattle breedstock yields just a small quantity of milk, sufficient only for the consumption of the family.

5) Mechanisation of agriculture practices: In the past, bulls were used for ploughing and pulling carts for agricultural activities. But nowadays tractors do most of the work; hence, interest in rearing cattle is waning.

6) Non-availability of labour: In the past, each family had a labourer (maattukkaaran) who was appointed exclusively for cattle care; in recent times no one is ready to work as a maattukkaaran. Cattle rearing have therefore become a tough task, especially for women.

7) Reduced forest cover: In the past, fodder, especially grass, was freely available in drylands associated with the Killai Reserve Forest area. Now these areas are under casuarina cultivation; cattle grazing is strictly prohibited.

8) Lack of a veterinary hospital: The lack of a veterinary hospital is another problem in the area. Recently some 500 goats died in the village of Vadakku Pichavaram because of the "blue tongue disease."

9) Fewer cattle: In the past, every family had a large number of cattle. In fact, the number of cattle indicated the status of a family. But because of the problems cited above, the livestock population has over the past 15 years gone down drastically in all the villages surrounding the Pichavaram mangrove wetlands.

3.3.3 Ethno-ecology of the Pichavaram mangrove wetlands

Communities living close to and interacting with the Pichavaram mangrove wetlands have gained their unique cognitive understanding of the ecosystem from the resource utilisation pattern. Experiences have led to a rich knowledge system that is reflected in the native classifications of mangrove wetlands.

The cognitive understanding has also enabled an understanding of changes over a period – to the resources as well as the ecosystem as a whole. Consequently, local communities have developed their own traditional system of management to ensure sustainable harvest of mangrove resources and equitable sharing of harvested products. However, these management systems are losing their value because of various factors. Any assistance to protect these traditional systems will win the confidence of the local people; this in turn will be the first step toward the success of community-based mangrove conservation and management.

"When we are children, mother milk saves us from starvation.
When we grow up, it's mother mangrove that feeds us."

4.0 Major concerns of traditional and non-traditional fishers

4.1 Major concerns of traditional fishers

1. Declining fish catch in the mangrove water due to

i) seasonal closure of the mouth of the Pichavaram estuary

ii) siltation in the mangrove water bodies

iii) siltation in the backwater region connecting the Pichavaram mangrove wetlands and the Coleroon estuary

These issues are explained in detail elsewhere.

2. Erosion of traditional fishing rights in the mangrove waters: Till 50 years ago, local fishers had free access to the fishery resources of the Pichavaram mangrove waters. After independence, the scenario has completely changed. Local fishers say that about 50 years ago, a rich trader who was not a traditional fisher, acquired fishing rights in the fresh water area of the Coleroon River. Grabbing this opportunity, he started collecting taxes from fishers who fish in the Pichavaram mangroves and connected backwaters. When traditional fishers took the issue to court, the Revenue Department was directed to take over control of fishing rights in the mangrove areas and offer a lease to the traditional fishing community for a nominal fee.

This procedure was followed until the Forest Department took control of fishing in the mangrove waters. In 1997, the Forest Department leased fishing rights to local fishers for a fee of Rs. 5,000 for three years, and said the lease amount would be increased by 20% every three years. The local fishers are apprehensive that in future the Forest Department could impose curbs that affect their income.

4.2 Major concerns of non-traditional fishers The major concerns of the Irulars relating to utilising the resources of the Pichavaram mangrove wetland:

1. Lack of crafts and gears for fishing in the mangrove waters: Hardly any of the Irulars own boats or nets for fishing in the mangrove waters because they lack capital. Catching prawns by groping gives them very low income, not enough to meet their daily food needs. Further, not having a boat or a net means a tragic inability to fish during the rich three-month rainy season when fish, prawn, and crab are available in abundance. Result: Villagers are pushed into a debt trap and aggravated misery.

2. Indebtedness: The perpetual indebtedness of the Irulars, mainly to middlewomen of the traditional fishing community, is another major concern. This state derives from the poor incomes of Irulars, which in turn is connected to the lack of boats and nets. Every year, most of the Irulars borrow Rs.7,000 to 10,000 from the middlewomen. To pay back the loan and interest, the Irulars are constrained to sell their fish and prawn catch to the middlewomen at half the price.

3. Lack of firewood resources: The residents of MGR Nagar own no land or plantations. They do not collect any firewood from the mangroves since they consider it illegal.

Result: after the hellish chore of groping for fish in the mangrove waters for five to six hours, the women can't sit or stretch their legs but have to grope around for something else – for collecting dead twigs and palm residues in land nearby. The problem gets more severe during the rainy season.

4. Lack of legal entitlement for fishing in the mangrove waters: The residents of MGR Nagar fish in the mangrove waters only at the mercy of traditional fishers. Every year a fish lease is given only to traditional fishers since they are entitled to it. For many reasons they allow the residents of MGR Nagar to fish in the mangrove waters; but they have the right to prevent them from fishing.

5. Degradation of the mangrove wetland: The Irulars feel that the catch of fish and prawn in the Pichavaram mangrove waters is fast declining. They attribute this to the degraded condition of the mangrove forest. The Irulars have strong emotional ties with the mangrove wetland. Says a young Irular: "When we are children, mother's milk saves us from starvation. When we grow up, it's mother mangrove that feeds us."

Degradation of mangrove wetlands hits the livelihoods of mangrove communities

Non-traditional fishers of Pichavaram say, "We are good at using gears like nandu kachcha (above). But we need fishing crafts to use these gears well. We do not have them."

5.0 Restoration of Pichavaram mangrove wetland: an assessment by remote sensing

As indicated in Introduction MSSRF and Forest Department of Tamil Nadu developed simple technique to restore degraded mangrove area. It was demonstrated in a small area of about 8 ha in Pichavaram mangrove wetland during 1993 to1995. The success of this effort let to development of a community based mangrove restoration and conservation programme called Joint Mangrove Management programme, which was implemented in Pichavaram and Muthupet mangroves of Tamil Nadu, Krishna and Godavari mangroves of Andhra Pradesh, Mahanadi and Devi mangroves of Orissa and Sunderbans of West Bengal..

In Pichavaram mangrove wetland Joint Mangrove Management was implemented jointly by the State Forest Department, MSSRF and local community from 1997 to 2003 and five villages namely, MGR Nagar, Kalaingar Nagar, Vadakku Pichavaram and Thandavarayanchozan Pettai actively participated. In each of these villages a village level institution was established to plan and implement mangrove restoration and conservation activities.

5.1.1 Methodology

Landsat 5 TM digital data of 23 May 1986 and IRS 1D LISS III digital data of 27 June 2002 and Survey of India toposheet No.58 M/15 were used to assess changes in mangrove forest cover. Since the present study is restricted only to the Pichavaram reserve forest, reserve forest boundaries were traced from the toposheet, digitized and transformed to the coordinates of TM and LISS III digital data using ARC/ INFO 3.5-GIS package. Following the transfer of reserve forest boundaries, False Colour Composite (FCC) print of the Pichavaram mangrove wetland was generated with the band combinations of 5,4,3 and 3,2,1 in Red Green Blue in TM and LISS III data, respectively (Figure 1 a and b). The displayed image with the above classes was spectrally enhanced by histogram equalization method.

Mangrove wetland map of 1986 and 2002 was then prepared by on-screen visual interpretation method using ERDAS IMAGINE 8.4. Different classes of mangrove wetland such as dense mangroves, degraded mangroves, young mangrove stands, barren sand dune associated with mangrove wetlands, vegetation associated with sand dunes, water body and dry land were then identified using visual interpretation keys such as colour, tone, texture, pattern, size and shape. Mangrove wetland map, with the above classes then transferred to base map of 1:50,000 scale, which was used for ground truth collection.

Ground truth data were collected in 60 check points, which were randomly selected and distributed all over the mangrove wetland. The number of check points and their location for ground truth were decided based on the visual separability between classes. More number of degraded areas was verified since in some places these degraded areas appeared similar to young mangrove plantations. Since sandy area and sand dune vegetation are distinctly interpretable from other classes of the wetlands, these were not checked in the ground. During ground truth data collection, it was observed that young mangrove plantation could be classified into two classes namely, i) young mangroves plantation more than 3 years old and ii) young mangrove plantations less than 3 years old. The age of these plantations were derived from the records of the Tamil Nadu Forest Department and village mangrove councils that undertook restoration along with the Forest Department and M.S.Swaminathan Research Foundation. In accuracy assessment, the overall accuracy has reduced to 82% due to this introduction of new class, i.e. young mangrove less than 3 years old, after ground truth collection. The geographic coordinates of these points were noted from the classified digital image and checked in the field with Megellan GPS 2000 XL. Data collected from the checkpoints were used for accuracy assessment following the method described by Congalton7 and the confusion matrix for accuracy of different classes identified through visual interpretation is given in Table 1. The overall accuracy of the mapping is 82%. Based on the ground truth data, maps of 1986 and 2002 were corrected and finalized. The two finalized maps were overlaid in ARC INFO (3.5) GIS package by UNION command to find out the area of newly formed mangroves and other classes between 1986 and 2002

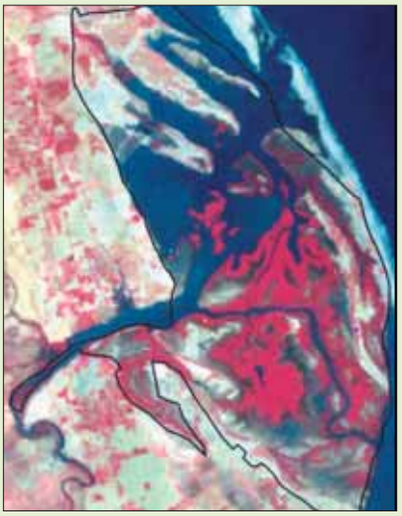
5.1.2 Changes in mangrove forest cover due to community led restoration

The changes occurred in different classes of mangrove wetland of the Pichavaram between the years 1986 and 2002 are shown in figure and Table 2. Compared to 1986, the mangrove forest cover in 2002 has increased by 293 ha (90% increase). Out of this 293 ha, 86 ha can be classified as dense mangrove forest whose canopy cover is more than 40% which is normally attained in about 7 year old trees. Young mangrove stands in the restored area can be classified in two types, above 3 years old plantation and below 3 years old plantation, which together occupy an area of about 200 ha. In mangrove plantation, which is below three years old canopy is very less and as a result, it was first classified as mudflat during visual interpretation and corrected after ground truth verification as young mangroves of less than 3 years old as indicated in the confusion matrix given in Table 3. This is one of the reasons for decrease in the overall accuracy assessment to 82%. The results also show that the vegetation associated with the sand dune has increased by 23 ha (95% increase). This is mainly due to casuarina plantation undertaken in the sand dune. An increase of 28 ha has also been noticed in the water-spread area. Consequent to restoration, degraded area has reduced from 375 ha in 1986 to 65 ha in 2002.

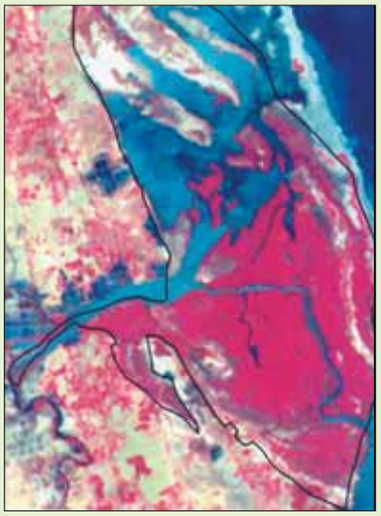
Table 1. 3. Changes in wetland classes in Pichavaram mangroves before and after restoration

Classes	Area in 1986 (ha)	Area in 2002 (ha)	Changes (ha)
Dense mangroves	325	411	+86
Young mangroves > 3 years old	0	117	+117
Young mangroves < 3 years old	0	90	+90
Degraded areas	375	65	-310
Sand dune	83	54	-29
Sand dune vegetation	24	47	+23
Upland (not suitable for mangrove plantation	287	280	-7
Water spread	380	408	+28

As the above results indicate, most of the degraded areas of the Pichavaram mangrove wetland have now been restored. Identification of the real causes of degradation, development and demonstration of restoration technique and extension of the restoration activities with the collaboration of the Tamil Nadu Forest Department and participation of the local user communities are the main reasons for the success of the present efforts to restore the Pichavaram mangrove wetland.

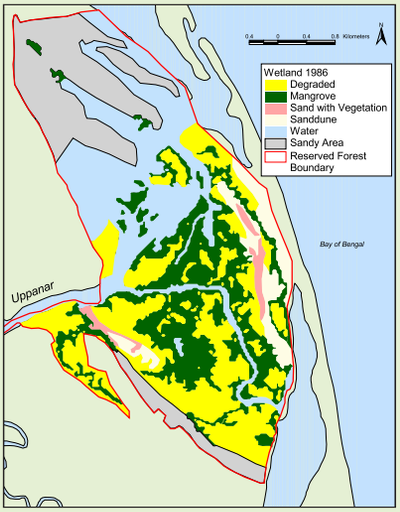


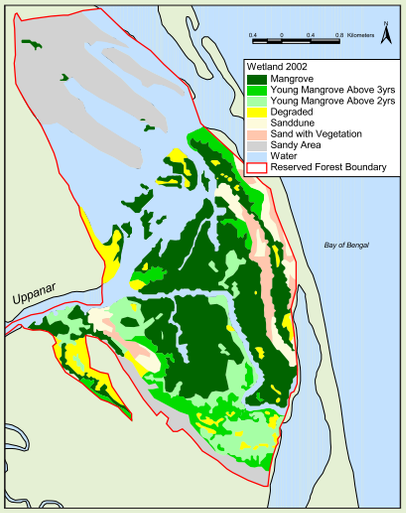
a) Landsat 5 TM of 1986



b) IRS ID LISS III of 1992

Remote sensing imageries (False Colour Composite)of Pichavaram mangrove wetland showing increase in forest cover in 1992 due to community let restoration





Classified map of Pitchavaram mangrove wetland : (a) 1986 and (b) 2002 showing increase in area of dense and young mangrove forest in 2002 due to restoration

M.S.Swaminathan Research Foundation

M.S.Swaminathan Research Foundation (MSSRF) was established as a non-profit scientific Trust in 1988 with the funds associated with the first World Food Prize awarded to Prof M S Swaminathan in 1987. MSSRF is recognized by the Department of Scientific and Industrial Research, Government of India as a premier research and development institution. The Ministry of Home Affairs, Government of India, has recognized the Foundation under the provisions of Foreign Contribution (Regulation) Act, 1976. The mandate of MSSRF is to undertake and disseminate strategic, applied, anticipatory and participatory research, based on a pro-nature, pro-poor, pro-women and pro-livelihood orientation to technology development. MSSRF is undertaking research and developmental activities in six thematic areas namely, Coastal Systems Research, Biodiversity, Biotechnology, Ecotechnology, Food Security and Information, Education and Communication. MSSRF received number of awards for its contribution in natural resource management and sustainable development including the Blue Planet Prize; so far MSSRF is the only institution in the developing world which has received this prestigious award. Since its establishment 22 years ago, MSSRF has been supported by a wide range of national, bilateral and international agencies.

Mangroves for the Future

Mangroves for the Future (MFF) is a joint partnership-based regional initiative with UN and donor agencies, NGOs, local communities and the private sector to promote investment in coastal ecosystems. It focuses on eight focal countries (India, Indonesia, Maldives, Pakistan Seychelles, Sri Lanka, Thailand and Vietnam), plus several outreach countries. MFF provides a unique regional platform for Integrated Coastal Management (ICM), using mangroves as the entry point

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