

ISSN 0254-380 X



# **MARINE FISHERIES INFORMATION SERVICE**

No. 183

January, February, March 2005



**TECHNICAL AND EXTENSION SERIES**

**CENTRAL MARINE FISHERIES RESEARCH INSTITUTE**

**COCHIN, INDIA**

**(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)**

1113

## Mangroves of India : Biodiversity, Conservation and Management

Mangroves are the most productive ecosystems and considered as national wealth of maritime countries. The marine and brackish water zones between high and low tide level are the fond homes of a unique environment with a heterogeneous assemblage of biocoenosis acclimatized to life in a very inhospitable and un-predictable environment; mainly in the tropical inter-tidal zone spreading about 10 million ha. in 30 countries. The flora comprises macro and microphytic communities which exhibit heterogeneity in its distribution in different formative zones. They vary from haline grasses, herbs, twines, climbers, shrubs to tall trees and phytoplankton to pheophyton. The ecosystem is evergreen throughout the year; self sustaining and renewable, if otherwise not disturbed from external sources. The network of root system of plants help in binding the nutrient laden soil thereby trapping the nutrients drained of from uplands which otherwise would have found their way into the sea.

The fauna include resident and migrant arboreal, terrestrial, aquatic and semi aquatic species. Mangroves serve as breeding, nursery and feeding grounds for a large number of terrestrial and aquatic organisms. It also provides protection from predation and refuge for juveniles of many species. Mangroves and estuaries are a migratory path for catadromous and anadromous fishes.

The wetland ecosystems especially "Mangals" are the most productive and diverse in the world and more than 80% of the marine

catches are directly or indirectly dependent on mangroves and other coastal ecosystems. Traditionally wetlands have been viewed as environments associated with disease, difficulty and danger, but ecologists realize that these are amazingly productive areas and just waiting to be tapped.

### Present Status of Mangroves in India

In 1960's the total area of the Indian mangroves was about 6,81,976 ha in which 45% occurs in Sundarban in West Bengal and 17% in Andaman and Nicobar Islands and the rest distributed in maritime states of India. In 1983, the recorded total area of Indian mangroves was 3,56,500 ha. Deforestation and overexploitation of the mangrove resources have resulted into the formation of open marshy land of approximately 100,000 ha. The coastal areas like Gulf of Kutch (Gujarat), Mumbai (Maharashtra) and Cochin (Kerala) are the glaring examples of deforestation, reclamation, conversion and pollution due to population pressure.

A survey of mangroves has been conducted in the maritime districts of Kerala during 2001-2003. It has been observed that mangroves South of Cochin are in highly degraded condition both in the case topography/morphology and biodiversity.

Coastal areas of Kerala are thickly populated and hence encroachments into the mangroves are rampant, besides overexploitation of forest and aquatic resources. Over and above, reclamation of land for agriculture, aquaculture

and other construction purposes resulted in the fragmentation and shrinkage of mangroves of Kerala. Approximately 3-5 crore post larvae of *Penaeus indicus* and *Metapenaeus dobsoni* are collected annually from Kerala mangroves in addition to fry and fingerlings of *Chanos*, *Etroplus*, *Lates* and *Mugil* sp., for aquaculture. The seed collection from wild has adversely affected the brackish water capture fisheries of Kerala.

The Sundarban mangroves also have been surveyed. The establishment of villages in the periphery and dependence of population on mangroves increased many fold compared to 1980's which is attributed to the migration of people towards coastal area for livelihood. Mangrove products especially forest resources are indiscriminately exploited and it has reached almost a point in certain areas where chances of regeneration of mangrove forest is remote. Extensive deforestation adversely affected the productivity by the reduction of litter fall, and nutrient level in the mangrove soils and adjacent water bodies.

The over exploitation of fishery resources, especially the seeds of fin fishes and shell fish for aquaculture have affected the capture fishery resources of coastal area of Wet Bengal. It has been estimated that to collect one *Penaeus monodon* post larva, about 24 seeds of different stages of other species are destroyed which has been reflected in the fish landing from Bay of Bengal.

Since Sundarban is a vast area with more than 8 m tidal amplitude commercially important true marine species also enter into the mangroves as occasional visitors. The juveniles of such species are also destroyed

in the process of seed collection. Altogether the extensive anthropogenic activities resulted in the swindling of Sundarban mangrove resources and shrinking of this important wetland ecosystem.

The Andaman & Nicobar mangroves constitute about 17% of the total mangroves of the country. These coastal ecosystems are fringing mangroves since in most of the places, the island land mass are steep towards the sea and hence areas of submergence and emergence are not extensive as in the case of Sundarbans. The water level vertically rises depending upon the tidal intensity and beyond this level, only dense true terrestrial forest exists. Nevertheless in some areas the mangroves are vast where the terrain is gradually sloping with shallow areas. Because of the special nature of topography, true marine species also enter into the mangroves of Andaman & Nicobar Islands.

### **Biodiversity of Indian Mangroves**

Flora: The macrophytic vegetation of Indian Mangroves belong to helophilous halophytes which comprises littoral swamp forest and considered as true mangrove plants.

Altogether about 153 species including 36 true mangroves and rest mangrove associates were identified. Based on the height of vegetation the forest plants have been classified into three groups. 1. The widest trunk with the spreading crown in species, *Sonneratia* and *Avicennia* and less spreading crown found in the species of *Bruguiera* and *Rhizophora* which covers the top canopy of the mangrove forest. 2. Shrubs and small trees represented by *Aegiceris*, *Excoecaria* and *Ceriops*. 3. The

shrubs and ferns such as *Acanthus*, *Aegilotis* and *Acrostichum*. The distribution and density of these species depends on variations in the salinity and tidal amplitude. The network of root systems help in binding the nutrient laden soil. The rich productivity is due to huge amount of litter fall in the mangroves. The annual litter fall normally ranges from 10,000- 14,000 Kg./ha and it is estimated that insects consumes about 20 – 25 % of available leaf tissues.

The Micro algae comprised about 77 species which were dominated by diatoms in which only 40 are found to be true mangrove species. Although, the species of *Myxophyceae*, *Chlorophyceae* and *Bacillariophyceae* are most frequently occurring in the mangroves, species of *Chrysophytes*, followed by Chlorophyta and Pyrrophytes dominate the flora.

The zooplankton consisted of 75 species, which include larvae/spawn fry of ichthyofauna. Based on the occurrence and abundance of zooplankton, the major groups encountered are Copepods, Amphipods, Decapods, Cladocera and fish larvae. Mysids, Brachyura larvae, Tanaeids are regarded as minor groups. Zooplanktons, which occur in very small quantity such as Actinarians, Tanaeids, Halobetes, Aplysia and flat fish larvae are also observed in mangrove ecosystem. The zooplankton biomass and species diversity usually differ sharply between mangrove ecosystems according to temperature, salinity, nutrient and phytoplankton distribution. Salinity controls the distribution of marine forms of zooplankton.

Benthic faunal assemblage is an essential tool for assessing the fishery potential of an area. The common macrobenthic species reported

from mangroves are Ploychaetes, Crustaceans, Nemertines, Actinarians, Molluscs and Gobiids. Among the groups decapods are normally higher which could tolerate wide variations of salinity since they are euryhaline organisms. During high tide they enter the mangroves due to their burrowing habits and nocturnal behaviours help them to settle at the benthic area of mangrove. Filter feeders such as species of gastropods and bivalves are also common in the ecosystems. Polychaetes were the dominant group among benthos. The rich benthic fauna supports fishery in the mangrove ecosystems.

Mangrove ecosystems are favourable environments for a number of economically important species on which the artisanal fishery thrives in the coastal areas. Altogether 24 species of fin-fish were recorded from Indian mangroves, mainly from Andaman & Nicobar Islands. While brackish water species such as *Etroplus suratensis*, *Mugil cephalus*, *Lates calcarifer* and *Sillago sihama* dominated Kerala mangroves, true marine and migratory fauna were inhabitants and visitors of Sunderban and Andaman and Nicobar Islands mangroves. The local fishermen usually collect the brackish water fish seeds from the mangroves and adjacent areas for aquaculture.

According to the earlier reports the occurrence and collection of milkfish, *Chanos chanos* juveniles in India are from April – July whereas *Liza parsia*, tade are abundant from October – February. The fry and fingerlings of pearl spot, *Etroplus suratensis* occur throughout the year with a peak from April – July. The fry and fingerlings of sand whiting *Sillago sihama* are available in good numbers throughout the year with a maximum

availability from January – May. The fry and fingerlings of grouper (*Epinephelus*) and sea breams are available from January – April. The crustacean fishery comprised altogether 98 species. The commercially important species were *Penaeus monodon*, *P.indicus*, *Metaperaus dobsoni* and *Scylla serrata*. Mangroves are prime refuge for burrowing shy animals such as crabs and shrimps. The area is also a conducive environment for crustacea since it is a shallow, rich in silt and nutrients.

Altogether 70 species of shell fish were identified which comprised edible oysters and clams, *Crassostrea madrasensis*, *Perna verdis*, *Villorita cyprinoides* are extensively collected for consumption and lime manufacturing. The reptilian fauna of Indian mangroves comprised 10 species, which include permanent residents, migrants and occasional visitors for feeding and breeding. The Amphibia was poorly represented with only 4 species.

The Avian fauna consisted of 57 species including residents and migrants. The common species were *Phalacrocorax niger* (Little cormorant), *Phalacrocorax carbo* (Large cormorant), *Ardea cinerea* (Grey heron), *Bubulcus ibis coromandus* (Cattle egret), *Egretta intermedia* (Smaller or median egret), *E.garzetta garzetta* (Little egret), *Nycticorax* (Night heron). These species enter the mangroves for feeding, breeding and nesting purposes.

The mammals represented with 30 species and only a few were permanent residents. The common arboreal species were *Pteropus giganteus giganteus* (Indian flying fox) *Cyropteurs sphinx sphinx* (short nosed fruitbat) *Rhinolophus lepidus lepidus* (Little

Indian horse shoe bat) and *Macaca mulatta mulatta* (Rhesus macoque). Among the terrestrial forms *Cais aureus indicus* ( Asiatic jackal) *Herperstes palustris* (Marsh mangoose) and *Herpestes auropunctatus* (Small Indian mangoose) were common. *Pantera tigris tigris* (Tiger) was a unique species observed in Sunderban Mangrove Tiger Reserve area in West Bengal. True terrestrial animals were also found occasionally in the mangroves. They enter mainly for feeding.

The Andaman & Nicobar Island mangroves are rich in the biodiversity of flora especially macrophytic vegetation. True mangrove plants are dense in the fringe areas, while associates, and true forest plants are abundant beyond the high tide level. Since terrestrial forest plants and woods are available, dependence on mangrove vegetation is less in Andaman. The ichthyoo fauna comprises commercially important species of fin fish and crustacea such as *Mugil cephalus*, *Lates calcarifer*, *Chanos chanos*, *Sillago sihama*, *Epinephelus malabaricus*, *Penaeus monodon*, *P. merguensis*, *Scylla serrata* etc. In Andaman & Nicobar, natural mangrove ponds are utilized for aquaculture without altering the topography, which has been found to be economically viable units.

It has been observed that the propagation, growth, distribution and population dynamics of the mangrove biota largely depended on the variations of aqua-edaphic parameters, topography and anthropogenic activities. In Kerala and West Bengal human interventions and transformation of topography / morphology and over exploitation of resources resulted not only in the shrinking of the mangroves but also deteriorated the general environment

considerably which are evidenced by the disappearance or rare occurrence of certain commercially important species of flora and fauna with very low population.

### Major Survey / Research Findings

1. The flora of the mangroves belong to littoral swamp forest – under helophilous halophytes which implies that the forest in general is heterogeneous type with the following groups.
  - a) True mangroves b) Mangrove Associates
  - c) Back mangroves /mangrove bioinvasive d) Coastal/Beach flora
  - e) Parasites / Epiphytes / Mistletoes.
2. The fauna is represented by
  - a) Arboreal species b) Avian species
  - c) Amphibia
  - d) Reptiles e) Mammals f) Aquatic species.
3. All the mangroves are associated with estuaries and creeks except the Andaman and Nicobar Islands where most of them are fringing mangroves.
4. All the mangroves except Kerala have rich forest potential with renewable and regeneration possibilities.
5. All three mangroves can substantially contribute towards the capture fishery resources of Arabian Sea and Bay of Bengal, if fish seed collection and overexploitation are minimized.
6. The overexploitation of ichthyofauna especially the seed collection of commercially important species for aquaculture and fish based byproduct development resulted in the dwindling of natural recruitment and thereby the coastal capture fisheries especially

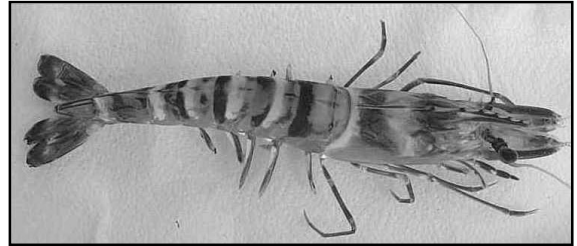
artisanal fishery has been adversely affected which has reflected in the socio economic condition of artisanal fishermen in the south west and north east coast of India.

7. The coastal population / local people depend on these fragile ecosystems for their livelihood and for various other purposes.
8. The rate of conversion/reclamation of mangrove land is very high in Kerala for other purposes.
9. In Sunderbans new villages especially fishing villages are established and dependence on mangroves have increased
10. Despite of the awareness campaign by Government Organizations, NGOs, Voluntary Agencies, etc for the conservation and management of mangroves overexploitation and conversion of land for other purposes are continued.
11. This has destroyed the possibilities of the mangroves to regenerate and rejuvenate in certain parts of the country besides the opportunities for artificial restoration by Participatory afforestation.
12. All the mangroves studied are dumping places directly or indirectly or act as sink for pollutants.
13. To sum up, exploitation of mangrove resources and dependence on this wet land ecosystems are at an alarming rate in India.
14. Among the three mangroves investigated Sundarbans in West Bengal is the single largest mangrove in the World with the following unique characters:

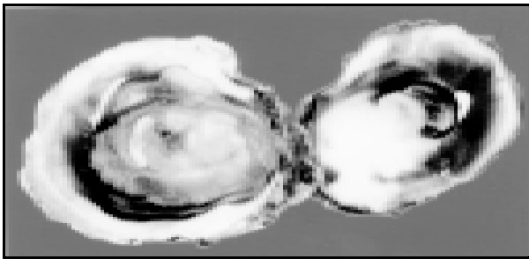
**Some common flora and fauna of mangroves**



*Charybdis cruciata*



*P. monodon*



*Crassostrea* sp.



*Rhizophora nueronata*



*Acanthus ilicifoliosus*



*Acrostichum aureum*

- i. Highest biodiversity
- ii. Maximum tidal amplitude/influence
- iii. Enormous contribution for coastal Fisheries
- iv. Only tiger reserve in the saline marshy mangrove habitat in the World.

“Due to the unique features the Sundarbans mangrove is included in the “World Heritage” category”.

### **Recommendations**

1. Indian mangroves are subjected to considerable exploitation due to the extensive population shift to costal areas for livelihood. Alternate rehabilitation programmes to reduce the pressure and dependence on mangroves may control this migration.
2. The existing forest rules may also be strictly enforced to mangroves so that unlawful entry/encroachment and indiscriminate exploitation can be regulated.
3. Collection of mangrove products may be regulated by appropriate rules.
4. Conversion of mangrove lands for other purpose must be strictly prohibited.
5. Coastal area development or any activity in the coastal zone must be associated with lost/degraded/degenerated mangrove area’s reclamation/restoration wherever possible.
6. Budgetary provisions may be provided in the maritime states for surveillance, watch and ward of wetland ecosystems.
7. Special task force/squad may be created in the maritime state’s, forest department for surveillance, watch and ward of wetland ecosystems.
8. Regular monitoring of the state of art of mangroves by government organization, Universities and similar agencies for understanding the nature and dynamics of mangrove ecosystems may be done.
9. Methodologies and techniques are to be developed for reliable predictions about the state of mangroves which helps in deciding, if a mangrove area of a certain location has the potential to regenerate or artificial restoration is essential.
10. Afforestation programme may be maintained for transplantation in the appropriate areas.
11. Nursery for mangrove plants may be maintained for transplantation in the appropriate areas.
12. National Policy on mangrove ecosystem management may be strengthened/ formulated for protection of mangroves.
13. Awareness campaign on conservation and management of mangroves among coastal population may be intensified.
14. Mangroves, their importance and other related matters may be included in the curriculum/syllabus of education at various levels for HRD for management of wetland ecosystems of the country.
15. Seminars, symposium, etc may be conducted in the local language itself with the participation of local people to address issues related with mangroves conservation and sustainable management.