

# Impact of Conversion of Mangrove Ecosystem for Aquaculture Purposes

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## Abstract

Mangroves, one of the highly productive ecosystems are considered as nature's own aquaculture systems because species of marine fishes, molluscs and crustaceans use them as nursery grounds. Thus the mangrove ecosystem sustains tremendous fishery resources. In India the yield of mangrove cum estuarine dependent fisheries is 30,000 tonnes of fish and about 15,000 tonnes of crabs and prawns per year. Crustaceans like *Penaeus monodon*, *P. indicus* and fishes like *Etroplus* sp., mullets, etc are common in Indian mangroves.

Conversion of mangroves for coconut and paddy cultivation along with setting of fish ponds is an age old practice in coastal India and is called as 'filtration' or 'trapping'. The brackish water aquaculture covers an area of 45,000 hectares where about 200 kg of prawns and fish per hectare are produced. The species cultivated are *mugil cephalus*, *Chanos-Chanos*, *Penaeus Monodon*, *P. indicus*, *Macrobrachium*, etc. About 32.13% of this area is along west coast and the yield rate is about 500-600 kg/ha/yr.

Large scale damages have already been caused due to rapid industrialization, urbanization and population pressures. Besides large scale conversion of mangroves areas for construction of fish ponds in Tamil Nadu, Andhra Pradesh have reached to such an extent that capture fishery resources are getting adversely affected.

Some of the impacts of conversion of mangrove ecosystem for aquaculture purposes are dis-

cussed in the present paper. Finally, it is suggested to strictly implement some legislation, recently introduced by Ministry of Environment and Forest for the conservation of coastal zones like mangroves.

## Introduction

Mangroves are highly specialized and productive ecosystems, known for high productivity and for ecological significance in trapping and accreting the sediment by which coastal erosion is controlled. On an average 12.00 tonnes of mangroves litter enters an area of one square hectare in mangrove ecosystem annually, releasing carbon amounting to  $500 \text{ mgc m}^2 \text{ yr}^{-1}$ , which is much more higher than the phytoplankton production i.e  $60 \text{ mgc m}^2 \text{ yr}^{-1}$  (Wafar, 1989). As grazing on mangrove litter is of insignificant importance, the major portion enters the food web within the mangrove ecosystem and a part is exported to the neighbouring ecosystems.

## Mangroves: Nature's Aquaculture Farms

Because of this high production rate, mangroves are considered as nature's own aquaculture farms. Many species of marine fishes, molluscs, crustaceans depend on mangroves for atleast a part of their lifecycle. The extensive proproot system and pneumatophores of mangroves provide shelter to the juveniles of fish and protect them from predators. The fishes lay their eggs in the tangled roots of mangrove trees and later they hatch and grow with needed nutrients available. Many species of penaeid shrimps spawn offshore using mangroves as refuge and feeding grounds during later stages. Lower salinity of the estuaries has been

reported to be one of the main factors influencing the migration of the larvae of the penaeid prawns to this specialized ecosystem (Pearse and Gunter, 1957). Thus, penaeid prawns spend the early juvenile life in the mangrove areas of the estuaries and thus use them as nursery grounds (Achutankutty and Nair, 1983).

The residence period of prawns however vary from species to species. In Goa mangroves, studies by Achutankutty and Nair (1983), indicate the abundance of juveniles of some commercially important spp. such as *Mentapenaeus doobsoni*, *M. monoceros*, *Penaeus merguensis* in mangrove waters. More than 85% of juvenile population in Goa mangroves was < 40 mm in size which is a rare case in open estuaries (Achutankutty, 1988). This clearly indicates the significance of healthy mangroves in the life cycle of marine prawns. Similarly MacNae (1974) reviewed the situation around Indian ocean and by comparing shrimp landings with mangrove areas came to the same conclusion that *P.indicus*, *P. monodon* and *P. merguensis* depend on mangroves for shelter during their juvenile stages. According to Odum and Heald (1975), at least 1/3 of the faunal community is from mangroves waters. Though this ecosystem sustains a tremendous fishery, still it is not possible to generalize the statement "No man-

groves - No prawns". In some areas the correlation between prawn landing and mangrove areas is good but the ratio does not hold good in all the regions. In fact, it is difficult to study the importance of mangroves for fisheries by means of fishery statistics, as these are often incomplete and also level of accuracy varies. In spite of these drawbacks, a correlation between shrimp landing and mangrove areas has been found in Indonesia (Martosubroto and Naamin, 1977). Turner (1977) correlated landings of penaeid shrimps and areas of intertidal vegetation for 27 locations around the world and obtained linear relationship between these two variables indicating that shrimp production increases with the size of mangrove vegetation.

Similarly, in Malaysia too, the nutrient rich waters of mangroves support a diverse community of fish and prawns (Leh and Sasekumar, 1984). The demersal fishery-mulletts, siganids, snappers, prawns and cockles-constituting 15.02% caught off the southern Malacca straits (Gedney *et al*, 1989, Latiff *et al*, 1976) and a statistical correlation was demonstrated between mangrove areas and shrimp landing in peninsular Malaysia (Gedney *et al*, 1982). In Sundarbans too, the mangrove forests in the delta formed by river Ganges and river Brahmaputra in India and Bangla Desh support a

**Table 1 : Mangrove areas and shrimp landing for some countries**

Country	Mangrove area In hectares	Penaeus sps in tonnes	Total Shrimp in tonnes
India	355,500	-	24,789
Thailand	317,700	14,164	116,403
E. Malaysia	539,134	-	15,633
W. Malaysia	149,500	-	54,584
Indonesia	3000,000	41,080	117,311
Philippines	251,577	19,026	24,984
Vietnam	300,000	-	62,000
PNG	250,000	653	1,490
Australia	1,161,700	-	21,565
<b>Total</b>	<b>6,325,111</b>	<b>0.07 tonnes</b> -1 - 1 ha yr	<b>438,759</b>

large commercial fishery (Ahmad, 1966).

In India, the yield of mangrove cum estuarine dependent fisheries is about 30,000 tonnes of fish and about 130,000 tonnes of prawns per year. Crustaceans like *P. indicus*, *P. monodon* and fishes like *Mulletts*, *Hilsa* are common in Indian mangrove waters. Jeyeseelan and Krishnamurthy (1980) have recorded 133 species of fishes from waters of Pitchavaram mangrove along east coast of India. Table 1 shows the mangrove areas and shrimp landings for some countries.

Since mangrove areas are rich in nutrients and in larvae, these mangrove areas are used for aquaculture purposes. Asia leads the world in aquaculture, contributing nearly 80% of the total production.

### **Adverse Effect on Mangroves**

The aquaculture developments are recently becoming the more fashionable land use of mangroves. More and more mangrove areas are acquired for this purpose in Tamil Nadu, Orissa, Sundarbans, etc.

There is no doubt that aquaculture or fish farming is rapidly gaining importance over the conventional method of capture fishery. In the tropical and subtropical coastal countries, millions of people earn their livelihood from fishery resources of mangrove areas. It is in this context one has to think about the consequences to be met by disturbing and destroying the ecosystem for aquaculture purposes.

Aquaculture has a tremendous prospects but it also has the greatest limitation for area expansion, which will further lead to mangrove destruction adversely affecting the entire fisheries. Risk of area expansion has been already demonstrated in countries like Philippines, Thailand, Malaysia, Indonesia, etc. Conversion of mangroves into brackish water farms is very severe in Philippines where 1.25 million hectares, representing over 45% of original

mangroves have reportedly been reclaimed for milkfish and shrimp farming between 1967-1977 for construction of aqua farm (Librero 1984). About 0.5 million hectares of mangrove areas have been reclaimed for aquaculture purposes in Thailand (de la Cruz, 1984). In India too, mangrove ecosystems are degenerated for shrimp farming

There is no intention to undermine the economic importance of aquaculture. Besides aquaculture, mangroves are also reclaimed for agriculture, urban developments and industrialization which would automatically result in the reduction of total organic input, affecting the aquatic productivity which in turn will have a negative impact on the fisheries of our country.

There are few precautions to be taken while planning for aquaculture:

1. Mangrove areas which are already denuded or were previously reclaimed should be selected for aquaculture purposes.
2. Site should be selected after careful studies and Environment Impact Assessment.
3. Benefit/cost analysis to be carried out.
4. Socio-economic impact of reclamation, particularly on the lives of people should be studied.

### **Measures for Saving Mangroves**

Hence, one has to think seriously about alternate proposal, by which neither mangrove ecosystem will be harmed nor prawn farming will be affected. The best alternative would be to select some flat lands along the estuaries having sparse or no mangrove vegetation with direct opening to the estuary and area suitable for prawn culture, rather than mangrove area itself; especially in the upper reaches of estuaries, which will require minimum conversion. In order to save the mangroves from reclamation it is necessary that future aquaculture

programmes should be planned with care and with full support of people. People should be made aware of the importance of mangrove ecosystem and the dangerous consequences of its destruction.

There is a need for protecting the coastal areas and for ensuring that the use and activities in the coastal areas are consistent with principles and requirements of environmental conservation. According to the Gazette Notification (New Delhi) of Ministry of Environment & Forests, Govt. of India, some of the important prohibited activities in the coastal regulations are:

1. Setting up of industries except those directly related to seafront.
2. Disposal of hazardous substances.
3. Setting up of mechanisms for disposal of wastes and effluents.
4. Dumping of wastes
5. Bunding or disturbing the natural coast except those required for control of coastal erosion.
6. Land reclamation.
7. Construction activities in ecologically sensitive areas.

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