

MANAGEMENT OF COASTAL RESOURCES IN PUTTALAM LAGOON, SRI LANKA

by

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ABSTRACT

Puttalam Lagoon is one of the productive estuaries in the Northwest coast of Sri Lanka with a surface area of 32,700 ha (see Figure1). The lagoon receives fresh water from two rivers, Kala Oya and Mee Oya whose average discharges were estimated to be about 2.2 m³/s and 8.1 m³/s respectively. The lagoon is very rich in natural resources such as fish, shellfish, coral reefs, sand dunes, mangroves, sea grass beds, salt marshes and beaches. The main occupations of the people living in the area are fishing, trading fish products and agriculture. Human activities within and outside the system have resulted in the degradation of these valuable resources. Rapid and uncontrolled development of shrimp farming by converting mangrove forests and salt marshes has resulted in severe degradation of the valuable ecological habitats. Use of harmful and unsustainable fishing methods has led to the reduction of fish varieties in the lagoon and in the degradation of the sea grass beds. This paper presents the results of the study that was carried out to investigate the present degradation levels of coastal resources in Puttalam lagoon and to review the effectiveness of existing management plans. A number of sustainable management options that can be implemented were also identified during the study.

1. INTRODUCTION

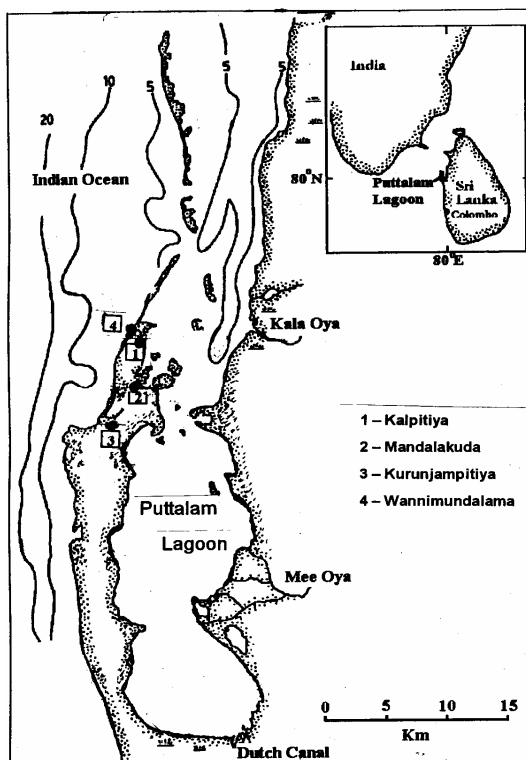


Figure 1: Map of Puttalam lagoon

Puttalam Lagoon is one of the productive estuaries in the Northwest coast of Sri Lanka with a surface area of 32,700 ha (see Figure1). The water depth in the lagoon is less than 1-2 m, except in the central part of the lagoon where depth of 4.5 m has been recorded. The tides on the west coast of Sri Lanka are predominantly semidiurnal and relatively weak. At Kalpitiya, the spring tidal range is 0.5 m, slightly less than in the open ocean, but in the southern part of the lagoon, the range is about 0.25 m. The Puttalam lagoon receives fresh water from two rivers, namely Kala Oya and Mee Oya whose average discharges were estimated to be about 2.2 m³/s and 8.1 m³/s respectively. Surface water salinities vary between 0 ppt at the river discharge point to 55.0 ppt at the points away from the river discharge [3]. The surface temperature of the estuarine water varies from 28.5 °C to 31.5 °C [1]. The average temperature of the area is around 27 to 30 °C [3]. The climatic variation with in the region is determined by south west and north east monsoons. The average monthly rainfall is 120 mm [1].

The area has a population of 168,106 persons in 2002 [2] and this population comprises of three major categories of people. They are permanent residents, seasonal migrants primarily involved in fishing and refugees. There are three major ethnic groups and four

religious groups in the study area. The main occupations of the people living in the area are fishing, trading fish products and agriculture. Most of the people depend on fishing directly or indirectly for their livelihood.

Agriculture is the second most important economic activity in the area. The main crops cultivated in the area include coconut, cashew and onion. Fruits such as banana and mango and vegetables such as potato and chilli are also grown on a fairly large scale. As there is no irrigation facility available in the area, people depend solely in ground water for their agricultural activities.

The lagoon environment is very rich in natural resources such as fish, shellfish, coral reef, sand dune, mangroves, sea grass bed, salt marsh and beach.

1.1 Objective

The main objective of the study was to investigate the present degradation levels of coastal resources in Puttalam Lagoon and to review the effectiveness of existing management plans. A number of management options that can be implemented for the sustainable management of the coastal resources were also identified.

2. METHODOLOGY

An extensive literature survey on coastal resources available in Puttalam Lagoon and the present management plans available in the region was carried out. Various organizations such as National Aquatic Resources Research and Development Agency (NARA), National Aquaculture Resource Development Authority (NAQDA), District Meteorological Department – Puttalam, Divisional Secretariat – Puttalam, District Fisheries Office – Puttalam, CRMP Project Office – Kandakkuliya were contacted for necessary data. In addition, socio-economic surveys and focus group discussions were conducted at four different places around Puttalam lagoon (Kurinchampitiya Anawasala, Wannimundalama, and Mandalakuda) meeting various categories of people for collecting details on economic activities, resource use patterns, resource use conflicts, stakeholder characteristics, marketing, major environmental issues prevailing and the current status of coastal resources in the study area. Socio-economic data were collected from Ninety families. Meetings with Grama Niladaries, Government and Non Governmental Organizations and Community Based Organizations were also held.

3. LAGOON RESOURCES

3.1 Ecological Habitats

Mangroves

Mangroves in the Puttalam lagoon are widely extracted for both subsistence and commercial purposes. In the mid 1980s, fifty five percent of the people living in the near shore areas of Puttalam used mangroves for fire wood purposes [1] and this increased by a large amount during 1990s due to the influx of refugees to the region. Another major threat faced by the mangroves ecosystem is from the recent uncontrolled development of shrimp farms in the study area. Large extent of mangroves wetlands were converted into shrimp farms. Figure 2 shows the extent of damage caused to the mangroves ecosystem according to the surveys conducted in 1981 and 1992 using aerial photographs [3].

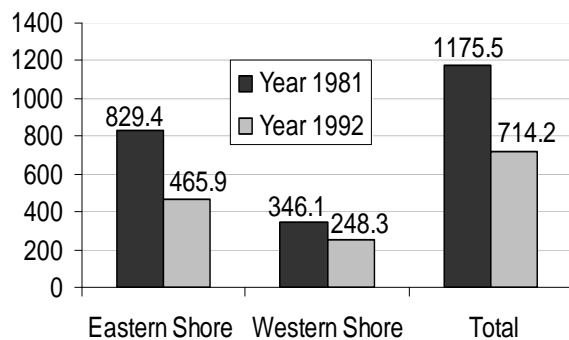


Figure 2: Extent of mangroves in Puttalam lagoon in 1981 & 1992

Salt Marsh

Very little attention has been given to protect the salt marshes compared with mangroves, as a component in the coastal eco-system. The importance of this valuable resource is not understood by the people living in the region as the output is not direct, as in the case of mangroves. The extent of salt marshes has been continuously degraded due to the shrimp farm activities in the area and due to the influx of refugees. During 1990s, large no of shrimp farm developers acquired state land, mainly consisting of salt marshes around the Puttalam lagoon to develop shrimp farms. And most of the state lands consisting of salt marshes were allocated among refugees to build their houses. Figure 3 gives the extent of damages caused to salt marshes in the region [3].

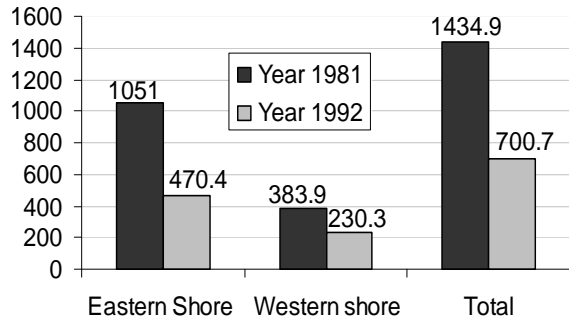


Figure 3: Extent of Salt marsh in Puttalam lagoon in 1981 & 1992

Sea Grass

Sea grasses provide a substantial amount of nourishment, nutrients and habitat and vital places of refuge not found in the open ocean. Sea grass beds are also known to trap and bind sediment which otherwise would move freely with water as particulate pollutions. Figure 4 shows the distribution of sea grass around the Puttalam estuarine system in 1995.

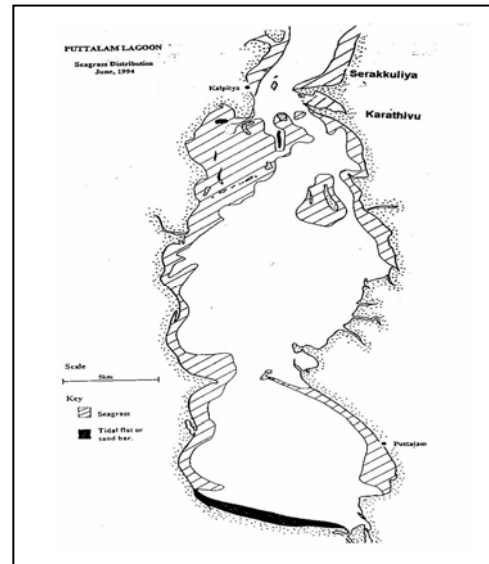


Figure 4: Distribution of Sea grass in Puttalam lagoon in 1995

Mudflats

During low tide seasons the mudflats are exposed as the sea is very shallow. These mud flats are important in processing nutrients for the ecosystem and providing feeding areas for fish at high tide and for birds at low tide. The mudflats serve to catch the departing nutrients and hold them until the returning tide can sweep them back into the wetlands. Figure 5 shows a typical view of the mudflats

present in the Puttalam lagoon during low tides.



Figure 5: Mudflats



Figure 6: Sand Dunes

Sand Dunes

Sand dunes are the ridges of sand that often lie behind the active part of the beach. Sand dunes are the integral part of the beach system. It protects the shore land from the action of waves. The people who live in the shore lands and the vegetation present are also protected. The best developed dunes

occur around Mampuri in the Kalpitiya peninsula. Figure 6 shows a typical view of the sand dunes available in the study area.

But during the recent past large amount of sand dunes have been removed due to sand mining, erosion and dune migration.

3.2 Fishing in Puttalam Lagoon

Being an estuarine ecosystem, habitats of Puttalam lagoon are occupied by marine and brackish water species of fish and shellfish which are the most important resources of the estuarine system because the main occupation of the people living in the area is fishing.

According to the data Collected from NARA, there were about 2500 fishermen operating 2200 crafts with traditional and mechanized crafts in equal numbers. Gillnets and trammel nets are the common gears. Other than this various types of push nets, pull nets and dragnets are used at a large extent targeting the shallow water areas. The predominant combination of craft and gear is the FRP (Fibre Reinforced Plastic) boat with gillnet and trammel-net made of nylon. People in the region also use a kind of a trap targeting mainly the crab fish. Fishing in the Puttalam lagoon is carried out through out the year, but an intensively increased fishing activity is seen during the south-west monsoon period (May to September) during which the open seas is too rough for fishing activity. Due to this rough situation in the sea, the fishermen who normally operate in the sea shift their activities to the lagoon which results in an increased fishing effort in the lagoon.

In addition to finfish, several invertebrates and sea horses are also collected for the profitable export oriented trade for ornamental and medical purposes (Dayaratne et. al., 1997).

The maximum sustainable yield for the Puttalam lagoon fishery was estimated at 5536 MT (Dayaratne et.al., 1995). It is reported that fish productivity has been decreased in terms of fish yield (from 4,800 MT to 3,800 MT) within the last 10 years. The drastic variations in catch figures for different species indicate over fishing.

The average catch per craft has decreased considerably during the past few decades due to the increased fishing activity in the region. A considerable increase is seen in the usage of motorized crafts in the lagoon system during the past few years. It has also been noticed that dragnets, pull-nets and push-nets used in Puttalam lagoon causes considerable environmental damage. Gillnets, trammel nets and crab nets are operated in the entire lagoon area.

Fishing Craft	Non Mechanized	Mechanized
Wallam	455	109
Theppam	478	0
Oru	109	16
LR	0	
Beach seine craft	46	
FRP		993
Total	1088	1118

Table 1: Details of fishing crafts operating in Puttalam Lagoon (Source: S.S.K. Haputhantri, Marine Biology Resources Division, NARA, January/February 2006)

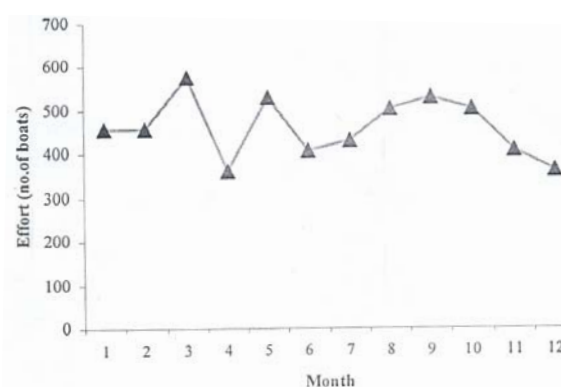


Figure 7: Variation of fishing effort (total number of boats) in Kalpitiya peninsula

Figure 7 shows the variation of fishing effort (total number of boats) in Kalpitiya Peninsula (Dissanayake, 2005). But, fish and shellfish resources of the Puttalam lagoon are under considerable threat.

3.3 Aquaculture

It has been estimated that at present there are about 1434 shrimp farms with a total extent of 4539 ha in the region of which more than 90 percent is around the Puttalam Lagoon (see Table 2 for details).

Farm Category	Nos
No. of farms under 2 ha	1099
No. of farms over 2ha	335
No. of authorized farms	530
No. of unauthorized farms	904
Total No. of Farms	1434
Total Area (ha)	4539

Table 2: Number of shrimp farms and their details (Source: NAQDA, 2006)

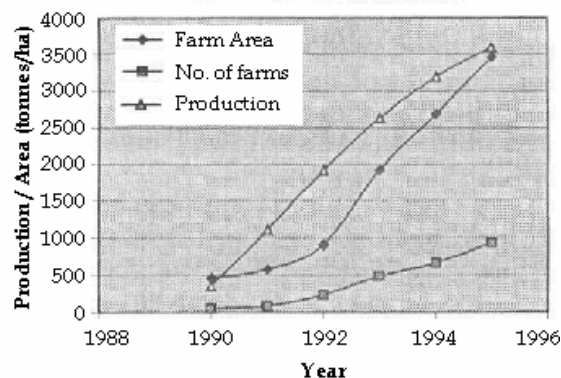


Figure 8: Annual increases in shrimp farm area between 1990 and 1995

According to the data collected from NAQDA, prior to 1995, the shrimp farmed area was 2000 ha and after 1995, with the advent of the unauthorized farms the areas has increased to 4539 ha. Most of the farms which were developed by converting the mangroves patches and salt marshes have been given up now as the developers incurred losses due to a rapid spreading of a disease among the shrimps. At present, it has been estimated that about 75% of the farms are not operating. Figure 8 shows the annual increase in farm area, number of farms and production between 1990 and 1995.

Authorization of aquaculture projects and issuance of licenses are carried out by the Department of Fisheries and Aquatic Resources with the recommendation of the National Aquaculture Development Authority (NAQDA) of Sri Lanka.

4. IDENTIFIED ISSUES AND SUSTAINABLE MANAGEMENT OPTIONS

The study has identified a number of important issues contributing to the degradation of coastal resources in the Puttalam estuarine system. The major issues affecting the degradation of coastal resources have been discussed under four categories such as fishing and lagoon resources, aquaculture, ecological habitats and lagoon water quality. The issues related to these four categories are closely inter-related and there are considerable overlaps. In addition, some of the general issues that are directly influencing the sustainable use of coastal ecosystem in Puttalam lagoon were also identified.

4.1. General Issues

Key issues contributing to the degradation of lagoon resources, in terms of social, economical and legal dimensions can be summarized as follows.

- Increased pressure on lagoon resources due to poverty and increasing population in the area
- Lack of alternatives ways for fishing
- Lack of awareness
- Paucity of funds
- Non-compliance with the laws

- Political interferences
- Legal/institutional constraints
- Constraints in implementing existing laws
- Poor coordination among different institutions and agencies.
- Lack of people's participation in decision making process

4.2 Fishing and lagoon resources

Major issues related to fishing and lagoon resources are identified as follows.

- Use of harmful & unsustainable fishing methods & gears types
- Catching & discarding trash fish
- Most of the fishermen do not adhere to the regulations
- Over fishing
- Increased pressure on lagoon due to increase in number of fishermen
- Destruction of ecological habitats which leads to reduction of the yield of the estuary
- Shrimp farm effluent containing excessive amounts of sulphide, nitrite and ammonia act as toxic to any living organism in the lagoon.

Other than these, fish traders and wealthy fishermen use highly efficient fishing methods with improved technologies to get the maximum yield and to increase profit. This ultimately results in over exploitation and leaves only a small amount of fish available to the poor fishermen using inefficient fishing techniques. So the poor fishermen use destructive methods to increase their yield which leads to the degradation of valuable estuarine system resources.

Fishing practices prevalent among the fishing communities depend on several factors such as their ability to invest in the fishing gear, their involvement with organized fishing communities and their acceptance within the social order, etc. The livelihood of the poor is at stake when organized fishermen operate intensively in the lagoon, using mechanized boats.

Fishing with the use of push nets is considered detrimental to the resource base and looked down upon by the society as an illegal activity. Nevertheless a considerable number of families depend on fishing with push nets. It enables a subsistence income for the household, although the damage to the resource base is high. Though use of push nets is banned and socially unacceptable, there is a widespread sympathy towards those who use push nets, in view of the level of poverty that exists amongst the users. It was learnt that push nets are locally made at a very low cost.

Even though the harmful fishing methods have been banned, the fisheries authorities do not strictly enforce it, in view of the extreme poverty among those who use push nets to catch fish and prawns, as well as due to political intervention.

4.3 Aquaculture

The major issues related to aquaculture in Puttalam estuarine system are;

- Conversion of mangrove forest & salt marsh for shrimp farm development
- Unauthorized farm development
- Water source pollution & sedimentation due to untreated farm effluent
- Abandoning of shrimp farms
- Institutional constraints



Figure 9: A canal leading to a shrimp farm through mangrove forest



Figure 10: An abandoned shrimp farm

Although the authorities state that the suitability of land for aquaculture and the environmental impacts are considered in issuing license, most of the developments especially the small scale development are unauthorized and are situated in private land or encroached government property. The back up of the politicians has also resulted in the development of unauthorized farms in the region. Small scale farms (<2 ha) are the great threat to the environment because this develops over 90% of the lands into ponds whereas the large scale farms (>20ha) only develops 60% - 70% of the land allocation into ponds.

The spread of illegal farming is facilitated by political patronage. Individual politicians with influence in the area undermine the control and management attempts made by Governmental organizations and back the encroachment of potential prawn farming land.

4.4 Ecological Habitats

The most vulnerable resources in the Puttalam Estuarine system are the Ecological habitats. The issues related to them are listed below.

- Destruction of ecological habitats for livelihood & commercial activities
- Increased threat to ecological habitats due to influx of refugees
- Increase in aquaculture development which results in degradation of mangroves, salt marsh & sea grass
- Usage of illegal fishing methods which damage the sea grass beds
- Destruction of habitats which leads to reduction of fish varieties & affects wild life
- Lack of alternative livelihood activities which lead to the destruction of ecological habitats

During the discussion with the community and various categories of people, it was revealed that extent of mangroves, salt marshes and sea grasses has been reduced significantly when comparing to the level of extent that existed in 1990s.

Mangroves are utilized by the community for own purposes, such as for firewood and house construction while prawn farmers have destroyed them for establishing prawn farms, in most cases, illegally.

The study revealed that the salt marshes are under severe threat as they are converted significantly for shrimp farms and for development and resettlement activities.



Figure 11: Land acquisition for resettlement

The removal of salt marshes and mangroves has resulted in increased sedimentation in the sea grass beds, which have buried considerable amount of sea grass. The effluent from the shrimp farms are also being discharged to the lagoon with out treatment, which contain considerable amount of

suspended solid matters, which is also account for the destruction of sea grass. Other than this, usage of destructive fishing methods, have also resulted in the degradation of this valuable resource.

4.5 Lagoon Water Quality

Key issues related to lagoon water quality are;

- Discharge of shrimp farm effluent without treatment
- Dumping of garbage into the lagoon
- Pollution caused by the chemical usage in the agricultural sector
- Water pollution in the lagoon, due to the increased number of motorboats.
- Large-scale lagoon sedimentation.



Figure 12: A garbage dumping site near the Puttalam lagoon

4.6 Review of Existing Management system

Traditionally, there has been a top down approach in Sri Lanka, which has had limited success in managing natural resources in relation to the needs of the people in local level. Puttalam lagoon is no exception as nationally prescribed policies have not been well coordination focused on the problems of the communities in the area. A national law for the management of the Puttalam Lagoon coastal resources is the Coast Conservation Act of 1981 which mandates the Coastal Zone Management Plan implemented by the Coastal Conservation Department (CCD). In addition, The Special Area Management approach (SAM), a resource management strategy for Sri Lanka's coastal region was firmly proposed in 2000. This document which was endorsed in 1994 by the Cabinet of Ministers has significant implication for locally – based coastal management.

The study reveals that, the existing laws are poorly implemented due to several reasons and some laws and the management plans have their own weakness as they have failed to stop the degradation of the valuable natural resources in the Puttalam lagoon. It is evident that, when comparing with the present status of the existing resources, there will be a significant degradation of lagoon resources in future if the resources are managed in the present style. This gives a clear indication about the short falls of the present management plans suggesting a critical review of the same.

4.7 Sustainable Management Options

The possible actions that have to be taken to mitigate the identified issues, for the sustainable management of coastal resources in the Puttalam lagoon are listed below.

Fishing and lagoon resources

- Immediate licensing of all fishing crafts/gears
- Limit the number of Fiber Reinforced Plastic (FRP) boats
- Immediate halting of FRP license issuing
- Control harmful fishing practices
- Support from the government to setup fisheries committees
- Restriction of the minimum mesh size to 20mm

Ecological Habitats

- Zoning mangrove patches
- Compulsory EIA for all developments in or near ecological habitats
- Restriction of utilization of ecological habitats for livelihood & commercial activities
- Resettlement of refugees from eco-resources rich areas
- Amendment of the procedure of issuing permits
- Introduce environmental friendly alternatives for livelihood activities
- Establish dune protection lines for important sand dune areas

Aquaculture

- Mandatory EIA for shrimp farm development
- A regular water-quality monitoring program
- Desiltation of the most crucially silted areas
- New methods of effluent treatment
- A land-use master plan for aquaculture
- Allow a portion of pond area for stabilization of effluent

Lagoon Water Quality

- Proper treatment of shrimp farm effluent before discharging into the lagoon
- Introduce well organized, effective garbage collection method
- Relocation of existing garbage dumping sites near the lagoon

5. CONCLUSIONS

The study has clearly indicated that the degradation level of coastal resources in the Puttalam lagoon is significant and has led to many environmental and socio-economic problems in the area. The survey revealed that resources in the lagoon have been a primary source of livelihood amongst a large number of households and for people living around the lagoon. For the average poor, utilization of resources from the lagoon provides a coping mechanism at all times.

Socio-economic condition of the people living around Puttalam lagoon has made the resource use pattern so complicated, leading to severe degradation of the resources. The implementation of existing management plans also appears to be not effective in managing the resources in a sustainable manner due to various shortfalls and constraints as discussed in the previous sections. Poverty and lack of alternatives for livelihood are the key points to be addressed in order to sustain the Puttalam Estuarine system. The study has identified a number of actions needed for an improved management of the estuary. Government supports and community participation are the important factors which determine the implementation of these management plans in a sustainable manner.

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