THE USE OF MANGROVES FOR AQUACULTURE: CAMBODIA

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INTRODUCTION

Natural conditions of the coastal and ecosystems of Cambodia have made this country rich of biodiversity resources. Cambodia's 435 km coastline is covered with large estuaries with about 85,100 ha of mangrove forests (Nelson 1999). Even the coastline disadvantageously compares to that of other countries of the Southeast China Sea region, but its natural creations such as large and small bays, number of big and small inshore and off-shore islands, sea floor, oceanic current, freshwater rivers and streams, weather etc., support the diversification of all bio-resources. Fortunately, due to the fact that most Cambodians are interested in inland rather than coastal aquaculture, as well as suitable development management and conservation policies of the Government in the past, these natural habitats remained pristine until 1970. However, the habitats have been disturbed because of the various exploitation and development works for several decades during the wartime and even after, due to lack of managerial strategy.

Cambodia had joined the Biodiversity Convention since February 1994, but until now, due to economic depression and poverty, the national awareness on the importance of biodiversity conservation is very limited. The crowded competition on exploitation of nature including coastal and marine resources, have been very aggressive in recent years that degraded the natural environment faster. Currently, many efforts and attempts by NGOs and international organizations have been made in collaboration with the Ministry of Environment and the Ministry of Agriculture, Forestry and Fisheries, to alleviate the marine and coastal resources pressures.

MANGROVE FOREST AND ITS EXPLOITATION PRESSURE

The mangrove vegetation of Cambodia spreads almost all along the coastline, but large and dense forests are found at the main estuarine areas of Peam Krasob, Andong Tuk, Sre Ambel, Chak Sre Cham and at the delta of Prek Kompot. ADB (1996) and Nelson (1999) showed that in 1992/93 the mangrove area covered about 85,100 ha of which about 63,700 ha is located in Koh Kong Province; 13,500 ha in Sihanouk Ville; and 7900 ha in both Kompot Province and Kep Resort City (Table 1).

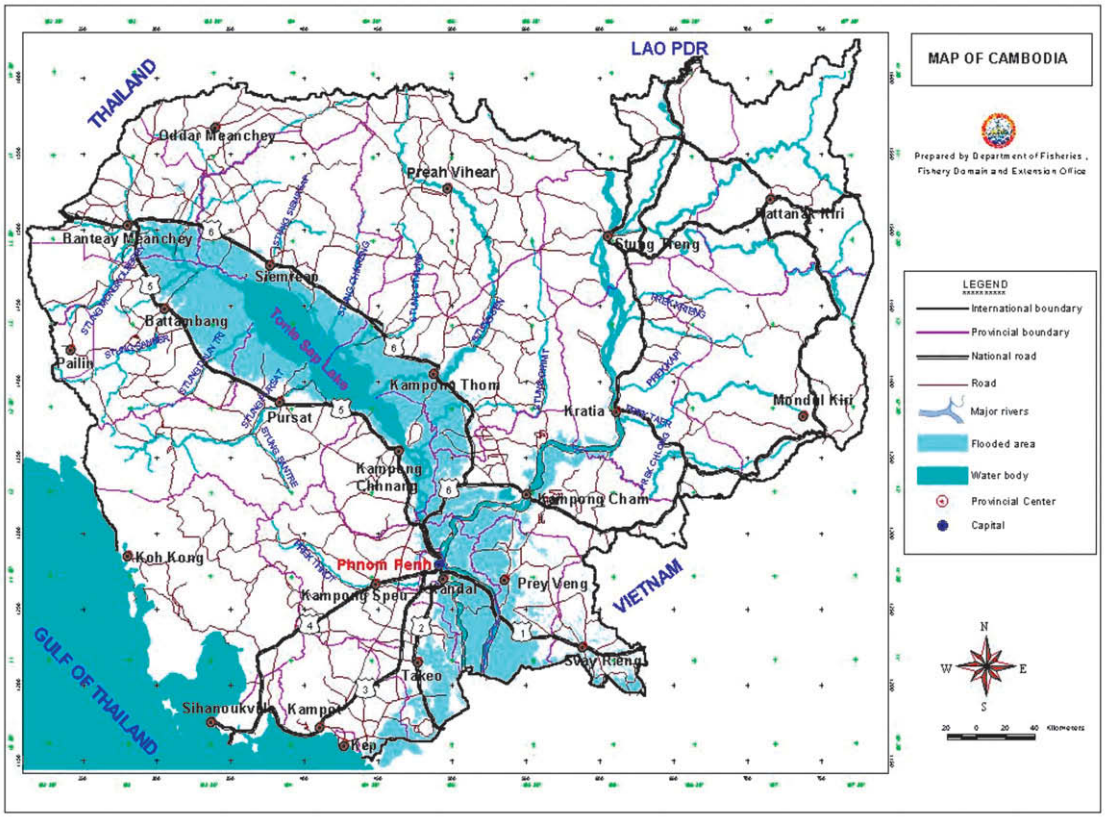
The mangrove flora of Cambodia belongs to 35 families, 53 genera and 74 species including plants that occur even with limited salinity influence (Chun Sareth, 1993). *Rhizophora mucronata* and *Rhizophora conjugata* are significantly important. However, this mangrove resource is now under threat of:

1. anarchy exploitation for charcoal production, firewood and export;
2. being claimed for establishment of shrimp farms;
3. being claimed for establishment of salt pans;
4. being claimed for establishment of rice fields; and
5. anarchy exploitation for construction materials.

Reportedly, this resource had also been exploited since the French Protected Period under strict control and reforestation program especially in Koh Kong Province (Pers.com). Anarchy exploitation of mangrove for firewood and charcoal took place during wartime and after 1979, due to poor management. This was intensified since 1990s and strongly intensified after the mid of 1994.

Table 1: Published data on mangrove forest coverage (ha) in Cambodia

Province			Total in Cambodia	Source
Koh Kong	Sihanouk Ville	Kampot		
			83.600	Landsat 1988-89
63.200	7.300	17.400	83.600	MRC, Landsat 1992
63.700	13.500	7.900	85.100	MRC/UNDP/FAO, 1994
63.700	13.500	7.900	85.100	ADB, 1996, Nelson 1999



AQUACULTURE IN MANGROVE AREAS

Intensive shrimp culture activities along the coastline of Cambodia are carried out mainly in Koh Kong Province near Thailand. Information on the intensive shrimp farming in 1994, showed an area of 850 ha with production of 731 mt/year (DOF, 1995), but now only about 20% of that area is under operation adopting the extensive system, due to diseases outbreak. The main cultured species is *Penaeus monodon* with pond yield, which is reported to be high, up to 7-8 mt/ha/year for the new starting farms and its good profit has attracted further investment.

However, the industry in Koh Kong is increasingly affected by the serious negative side effects common in intensive shrimp farming. Economic losses due to shrimp disease outbreak and self-pollution of the culture areas caused by indiscriminate discharge of pond effluents and resource conflicts have been experienced, particularly with farms located in or near mangrove areas.

A survey on sustainable shrimp farming management conducted by NACA in early 1996 concluded that the intensive shrimp farms had an average production of 7545 kg/ha/year, with a national sale value of US$ 42 million/year. Although the intensive shrimp farm has a high sale value, the farmers also faced significant environmental problems (especially in the sites located in the acid sulphate and/or acidic sandy soil), indicating estimate national losses of US$ 28.6 million/year. These high losses suggested that urgent actions are required to improve the environmental sustainability of shrimp farming in Cambodia.

Table 2: Fish production of Cambodia

Year	Inland	Marine Capture (t)	Fish	Shrimp Aquaculture (t)	Total
1988	61,200	21,000	4,600	-	86,800
1989	50,500	26,050	5,538	-	82,088
1990	65,100	39,900	6,400	-	111,400
1991	74,700	36,400	6,700	-	117,800
1992	68,900	33,700	8,550	-	111,150
1993	67,900	33,100	7,400	500	108,900
1994	65,000	30,000	7,640	560	103,200
1995	72,505	30,500	8,773	731	112,510
1996	63,510	31,200	9,000	600	104,310
1997	73,000	29,800	11,534	266	114,600
1998	75,700	32,200	13,903	197	122,000
1999	231,000*	38,100	14,938	62	128,100
2000	245,600*	36,000	14,410	20	296,030
2001	385,000*	42,000	17,357	143	444,500
2002	360,300*	45,850	18,197	53	424,400

Source: Fisheries Department, Cambodia (2002); Ministry of Economic and Finance (1999); So Nam et al. (1999); Limsong S. at al. (2003)

* Total production, including rice-field fisheries, small scale, medium scale and large-scale fishing. Before 1999 the rice-field fisheries and small-scale fishing were not included.

MANAGEMENT OF SHRIMP FARM

In order to save the industry, the Department of Fisheries of Cambodia has placed the following restrictions on shrimp farming:

- no encroachment of mangrove forest by shrimp farms;
- treatment of shrimp pond water waste before these are discharged into the sea; and
- construction of shrimp farms 150 m beyond the shoreline.

However, these guidelines are poorly respected and enforced, even though the shrimp farmers are aware of the negative impact of shrimp farming on the environment. The Department of Fisheries in collaboration with the NGOs try to reduce the threat of mangrove forest by conducting a series of training-workshops attended by a large number of people from 26 villages, where guidelines on the conservation and sustainable use of mangrove resources were formulated. Through the designation of reserved and protected areas providing benefits to the environment, the local communities fear losing such benefits from the daily use of the mangrove resources.

IMPORTANCE OF MANGROVE RESOURCES

Mangrove trees provide a variety of valuable products such as timber, fuel-wood, charcoal, construction materials, etc. Mangrove swamps are nursery areas for a large number of marine species such as penaeid shrimps, mud crab, fish and mollusks, etc. In general, mangrove forests play a very important role in coastal protection and land reclamation, serving as buffer against the impact of wave action and slow down erosion along the coastline.

Mangroves also provide natural protection of sea dikes, along the stretches of coastline where accretion takes place mangroves colonize the newly formed mud flats, and trap and stabilize sediments. The large amount of leaf litter produced by the mangrove trees provides the base of natural food chains in the estuarine and coastal waters. During decomposition, litters are enriched with proteins from the microorganisms that break down the leaves. This protein-enriched plant detritus provide the main food for juveniles of commercially important penaeid shrimps that spend part of their life cycle in brackish tidal swamps.

Plant detritus are transported seaward by the current and the nutrients released from the mineralization process support primary productivity in estuarine and coastal waters. Besides, many estuarine organisms feed directly on detritus (Luu, 2000). Moreover, a huge number of reptiles, birds and mammals made up the terrestrial wildlife fauna in mangrove forests. Thus, the rehabilitation of mangrove forests can increase the population of such animals, including wild boars, crocodiles, monkeys, water birds, fishes and shrimps, etc.

STRATEGIC PLAN TO IMPROVE MANGROVE AREAS

Shrimp culture may have led to the destruction of mangrove forests however it is one of the effective ways to upgrade the livelihood of the poor. The best recommendation therefore is to adopt mangrove-friendly aquaculture models to ensure sustainable development, in order that a number of strategic plans could be considered. Among these are:

- controlling human population in mangrove forest areas;
- conducting research on critical areas for sustainable management;
- creating awareness through providing education and training;
- establishing community development for each zone and areas;
- improving credit system serving the poor with low interest;
- providing alternative jobs to reduce pressure on mangrove destruction;
- replanting the mangrove forests;
- setting up the effective extension network for the local communities; and
- zoning of protected and conserved mangrove areas.

POLICY ON FISHERIES MANAGEMENT

In general, according to the recent Socio-economic Development Plan of Cambodia, the national fisheries management policy aims to:

- improve fisheries products for home consumption and export;
- manage, conserve, protect and develop sustainable fisheries resources; and
- emphasize on inland aquaculture in rural areas as a protein source and supplementary food produce.

RECOMMENDATIONS

The strategic plan for coastal development and management and conservation need to be systematically done through the basic objective of sustainability, equity and efficiency of all related sectors of the targeted provinces along the Cambodian coastline.

Therefore, the recommendations of the development program on appropriate mangrove management in Cambodia, includes:

- having a strong support from the provincial government;
- promoting capacity building for development management;
- strengthening the productive capacity, infrastructure and services;
- having a master plan for coastal zone management;
- promoting people participation in development management of natural resources; and
- establishing international/regional cooperation.

REFERENCES

CZM, 2002. Initial Mangrove Resource Management Plan in Peam Krosaop Wildlife Sanctuary Koh Kong, Cambodia;

So S. and Limsong S, 2000. Cambodia: Mangrove-Friendly Aquaculture, Iloilo, Philippines, p141-144;

Luu T. T., 2000. SEAFDEC, Mangrove Friendly Aquaculture, Iloilo, Philippines, p67-77;

Limsong S., 1998. Mission Report on Fisheries in Kompot province and Sihanouk Ville, Department of Fisheries;

Dara C. et al, 1998. Case Study on Management of Fisheries, Coastal Resources and the Coastal Environment in Kampot Province, Ministry of Environment;

Cambodian Working Group, 1998. Draft Synthesis Report on Management of Fisheries, Coastal Resources and Coastal Environment in Cambodia: Institutional, Legal and Policy Perspectives, Ministry of Environment;

Kosal M., 1996. Mangrove Resource Management With an Emphasis on Cambodia, Ministry of Environment;

Tana T. S., 1996. The Implication of Local Communities and Coastal Resources Exploitation in Koh Kong Province, Constraints and Opportunities for Sustainable Human Settlement Development Management and Natural Resources Conservation, Department of Fisheries;

Tana T.S., 1996. The Marine and Coastal Biodiversity Resources of Cambodia, Its habitats Under Pressure, Department of Fisheries.