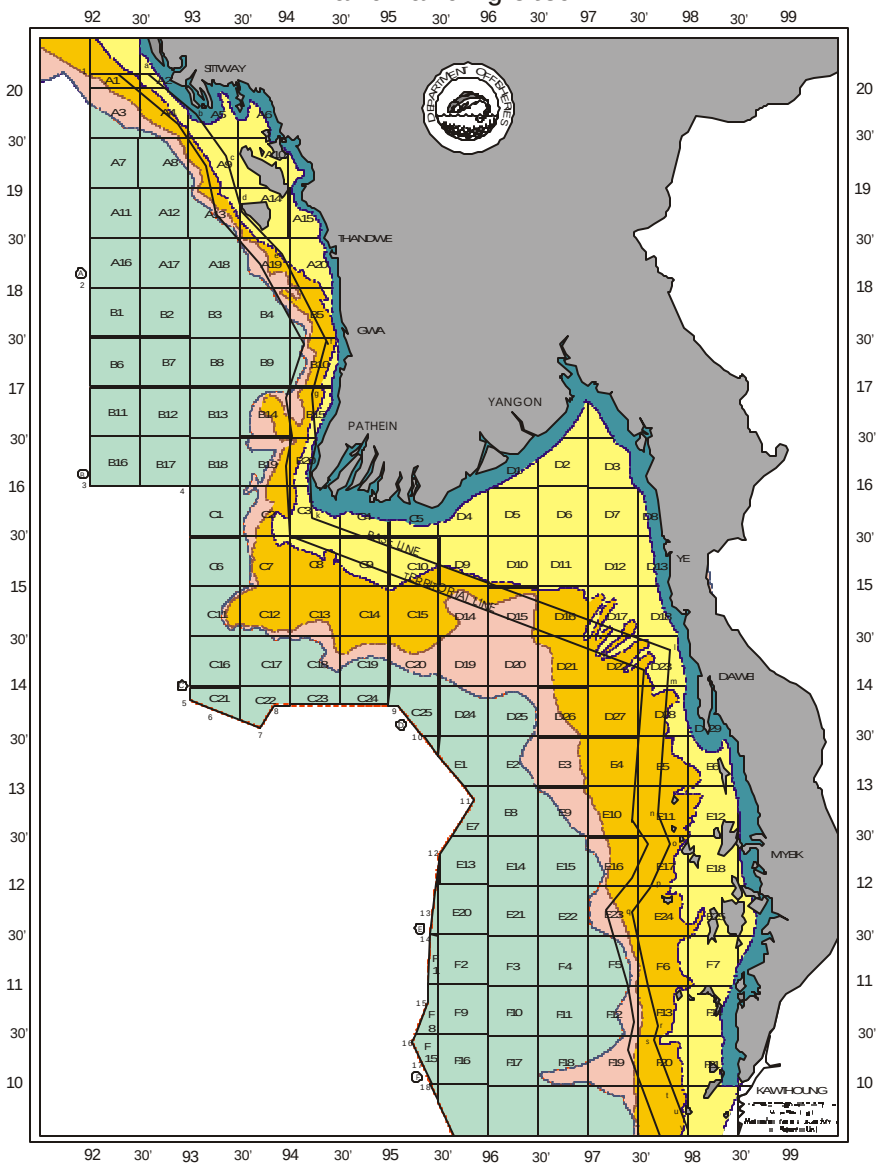
NATIONAL REPORT OF MYANMAR
On the
Sustainable Management of The Bay of Bengal Large Marine Ecosystem (BOBLME)
GCP/RAS/179/WBG

Department of Fisheries
Fishing Grounds of Myanmar
and Landing Sites



Prepared

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1. INTRODUCTION

Myanmar as coastal country of the Bay of Bengal is fully aware of the transboundary effects on the health of the coastal and marine environment, its living resources and realizes that the problem must be solved by a regional cooperation effort. To show the willingness of Myanmar's participation in such a program, National Report is being developed.

The aim of this national report is to identify and rank the threats to the coastal and marine environment in Myanmar as a whole, with example from concrete location and activities to justify the action plan for sustainable development of Myanmar's marine living resources. Information from published reports, in-house documents and interviews had been compiled according to the out line given by the First Meeting of National Coordinators for Sustainable Management of the Bay of Bengal Large Marine Ecosystem (BOBLME), which was held in Thailand. However, much of the requirement outline could not be fulfilled due to the lack of information and time constraint. Myanmar had some adverse effects on environmental degradation because of localized activities rather than transboundary. Information concerning economic aspect and cost analysis of issues are also substantially lacking.

2. STATUS AND DEVELOPMENT POTENTIAL OF THE COASTAL AND MARINE ENVIRONMENT AND ITS LIVING MARINE RESOURCES.

2.1 General Description of Coastal Area.

Myanmar is the largest country in main land Southeast Asia comprising a land area of over 676,577 square kilometers and geographically located between 9º 32' and 28º 31' N latitude and 92º 10' and 101º 11' E longitude stretching over 2280 kilometers. It share common maritime boundaries with Bangladesh in the north-east of the Bay of Bengal and with Thailand and India in the Andaman Sea which is a part of the Bay of Bengal. Myanmar continental shelf covers approximately 230,000 sq.km with a relatively wider portion in the central and southern parts. The Exclusive Economic Zone (EEZ) is about 486,000 sq.km.

The coastal zones of Myanmar can be subdivided into three main areas, namely Rakhine Coast, Ayeyarwady Delta and Tanintharyi Coast. Many rivers flow into the coastal zones such as the "Mayu" and " Kaladan" rivers in the Rakhine Coastal area: the "Ayeyarwady", " Sittaung "and " Thanlwin " rivers in Delta coastal area and the "Ye", "Dawai", " Tanintharyi" and " Lenya" rivers in the Tanintharyi coastal area.

The Rakhine Coastal Zone

The Rakhine Coastal Zone is bounded by the Bay of Bengal in the west and has a total land area of 367,780 sq.km. The mountain ranges within the state, stretches from Bangladesh to the Chin State and slope downwards from north to south having average elevations of about 900 meter. The northern valley area is narrower than southern valley; better known as the Sittwe valley is considerably wide. The Rakhine Coast stretches 740 km. from the Naff River to Mawdin Point. The upper part of the coastline is shallow and deltaic. The southern part is more or less rocky. Continental shelf down to 200 - meter depth is narrow compared to other areas. Two big islands namely "Yan-bye Kyune"(Ramee Island) and "Man-aung Kyune"(Cheduba Island), exist near the Sittwey valley off the Rakhine coast.

A hydrographic condition of the Rakhine Coast is heavily influenced by the monsoon. During the rainy season, the surface waters are extensively mixed with freshwater, poured down from runoffs by the rivers. The southward flow of diluted seawater reduces the salinity to 18 ppt. in the near shore areas whereas in the dry season a northward flow of high salinity water 34 ppt. was recorded. Indications of local upwelling were frequently recorded near Mun Aung Island during Northeast Winds. Organic production, including fish, is relatively higher during this upwelling period.

The Deltaic Coastal Zone

The Deltaic Coastal Zone consists of the entire river - mouth areas of three major rivers, Ayeyarwady, Sittaung and Thanlwin. Administratively, this coastal zone lies within Ayeyarwady Division, Yangon Division and Mon State . The Ayeyarwady Division lies at the central part of the coastal area comprising land area of 35,138 square kilometers. It is bounded by the southern waters of the Adman Sea of the BOB. Apart from the western part of the zone, which is adjacent to Rakhine Yoma, the region is a flat alluvial plain with a network of tributaries of the Ayeyarwady River. These rivers together with the Sittaung and Thanlwin deposited enormous quantities of sediments. The annual sediment discharge of the Ayeyarwady River has been estimated at 250 million tons. The delta is enlarging seaward at the rate of 5 km every hundred years and the seaward advance of the Gulf of Mottama at its 40m depth contours is estimated at 55 km. every hundred years. For this reasons we can find a very wide continental shelf in this areas.

The coastal area of Yangon Division remains highly important for Myanmar's port facilities. Thilawar, a newly built port is crucial for the development of the nation's expanding trade under the market-oriented economic system. The total area of Yangon Division bounded by the Gulf of Mottama(Martaban) is about 10,172 square kilometers.

The Mon State consisting of the smallest portion of the coastal area is also bounded by Gulf of Mottama(Martaban). The Thanlwin river originating in China open into the Gulf in Mon State and "Balu-Kyune"(Giant Island) lies at its mouth. The total area of Mon State is about 12,297 square kilometers.

The Tanintharyi Coastal Zone

The Taninthary Coastal area is the longest coastal zone of Myanmar and is bounded by Andaman Sea in the west. This coastal zone covers south of the Gulf of Mottama upto the mouth of Pakchan River. It's also included Myeik Archipelago and Andaman Sea. Myeik Archipelago extends from Mali Island to Similand Island and contains about 800 islands covering an area of about 34,340 square kilometer and is lying up to 30 km off shore. Coral reef surrounds the outer islands and mangroves cover much of the inner islands. Some islands also exist at the northern part of this coastal area. The length of the mainland coast is about 1,200 km. and the total land area is about 43,344 square kilometer. The coastal plain is narrow and gradually rise towards the east to become the Taninthayi Yoma with 2,073 meter high Myint Moe Let Khat Taung as the highest peak.

The vertical temperature distribution in sea waters showed a maximum at the surface larger and then decreased with depth. However, salinity increased gradually with depth and below the 130 meter became rather constant. The thermocline zone off the Tanintharyi coast was presented at 50-meter depth to 230-meter depth.

The Main Feature in the Hydrographic condition

The surface water off the Ayeyarwady Delta Coast and Rakhine Coasts are usually extensively mixed with freshwater originating from the runoffs of the large rivers (Ayeyarwady and Thanlwin) after the rainy season (October), and corresponded with the yearly runoff. Low saline surface water with salinities less than 20% was observed over large areas in the Delta region and northward along the Rakhine coast, indicating a west and northward transport of the coastal water masses.

During spring, when the river runoff is a minimum, the conditions were quite different. The highest surface layer salinities (>33%) were observed in near shore just off the Thanlwin river delta (Mawlamyaine). This large seasonal variation of salinity depends on the freshwater inflow to the Delta region. Significant change in the hydrographic conditions of intermediate and deeper water masses from autumn to spring were also observed along the Myanmar coast. The main features of these distribution appear to be similar for all the three section. In autumn the transition layer between the upper homogenous water masses in deep water was found at depths between 70 and 150 meters, while in spring the transition layer occurred much closer to the surface at depth from 20 to 100 meters all along the coast. Large areas of the shelf, which in autumn showed layer of temperature and oxygen content higher than 26º C and 3 ml/l at the bottom were during spring covered with water of lower temperature (<23ºC) and less oxygen content (<2ml/l). The slope of the iso-lines may indicate a shore ward movement of the bottom waters on the shelf with corresponding upwelling in the near shore areas during spring. In particular, this seems to be pronounced off Rakhine and in the Delta region.

It is observed that large seasonal variations in hydrographic conditions occur both in the surface and bottom layers in the continental shelf: a variation which in turn may cause

fluctuation in fish distribution patterns horizontally. In deeper waters, at depth greater than 150 – 200 meters below the transition layer zone, the hydrographic conditions were more stable. It should, however be noted that oxygen content of the deep water were lower in the Bay of Bengal (Rakhine), less than 0.2 ml/l, than in the Andaman Sea (Delta and Tanintharyi), not less than 0.8 ml/l.

2.2 Marine Ecosystem

Coastal and marine ecosystems, such as mangroves, coral reefs, seagrass beds, estuaries, upwelling areas, and migratory route areas for marine organisms, play a prominent role in the productivity of coastal and marine waters, biogeochemical cycling, and geomorphological stability of the coastal zone.

More then 2000 kilometers of Southwestern land boundary of Myanmar interacts with seas and thereby creates very complex ecological and socio-economic systems, which make administration and resource management relatively more difficult than proper mainland areas. Coral reefs, seagrass beds and mangrove flourish mainly in the Myeik archipalago. Estauries and mud flats are common at the Ayeyarwady delta while beach and dunes occur throughout the coastline.

2.2.1 Mangrove Resources

Status of Mangrove forest

Myanmar has more than 2,000 kilo meters coastline on the Bay of Bengal. Generally, it is divided into three regions, namely Rakhine, Ayeyawady Delta and Tanintharyi. The pattern of land in the coastal areas consist of mangroves, coral reefs, sea-grass beds, evergreen forest, wetlands and various type of agriculture land. Apart from the last two the rest ecosystems contribute to maintain a biological resources which is not only significant for the conservation of biological diversity but also of direct economic significant to Myanmar. Mangroves are found in whole regions. The delta formation is the most extensive one, which is situated at the southern most portions in the Ayeyawady Delta. The other two formations are found along the sheltered coasts in Rakhine and Tanintharyi region. The original area of mangrove forest in Myanmar was 790,981 acres (320,106 ha) in early 1900.

The role of mangrove ecosystems

In the tropics, mangrove play a particularly significant roles as environments and home for many wild life and fisheries, which are important biological resources for local and foreign exchange earning. Mangroves provide nursery area for numerous fish and crustacean species, a natural form of protection against the surf, supply wood and presumably serve as an important carbon dioxide sink. For example, 24 species of mangrove trees have been recorded from Myanmar coastline (Table 1). Of which ***Rhizophora, Sonneratia, Avicennia, Bruguiera and Xylocarpus*** spp are dominant so as to name mangrove area as ***Rhizophora*** forest. A list of common brackish water animals associated with mangroves and mangrove water ways, inclusive

of 39 species of fish, 11 species of shrimp, 8 species of crab, one ***Squill,*** one ***Thalassina,*** 2 oysters, 2 mussels, 1 cockle and 9 gastropod and one ***Xiphosura*** was recorded by Htay Aung 1982, based on his study at a small mangrove at Thanlwin river mouth. Some seaweeds, ***Catenella, Gracilaria, Ulva, Entermopha*** commonly occur in association with mangrove habitats. Mangroves along Myanmar coast are of immediate value to local populace, particularly as fire wood and charcoal for kitchen, timber for construction and fisheries. A positive correlation between fish and shrimp catches in near shore waters and the extent of mangrove area has been proved by many scientists (Matosobroto & Naamin 1977; Sasekumar & Chong 1987; Comach & Bagariano 1987). Artisanal fisheries along Myanmar coast are largely mangrove dependent. Mangrove forest ecosystems contribute wide range of goods and services from which local people have benefited from the time immemorial. There is a wide range of direct and indirect products from mangrove, which forms the basics for mangrove dependent economic activities vital to many coastal peoples in Myanmar. Firewood and charcoal are the main products extracted from the mangrove forest ecosystem in Myanmar leading to the depletion of mangrove areas.

Some areas of Ayeyarwady mangroves have been improved to some extent by the Forest Department's rehabilitation programmes, including the establishment of the department plantation, implementation of regeneration improvement felling, and introduction of the community forestry and protection of natural mangrove forests. In addition, rural development to the poor community and establishing plantation with UNDP programmes encourage the mangrove forest rehabilitation to cover the whole mangrove are of Myanmar including Ayeyawady.

To improve conservation and the management of Myanmar mangroves, it is urgently needed to establish Mangrove Management Committee and also needed to formulate the Policy on Conservation and Management of Mangrove and related ecosystems and Plan of Action.

Concurrently, awareness generation on wetland ecosystem should be developed among various sectors and community with the assistance of local and international NGO.

Establishment of mangrove plantation programme with suitable mangrove and other forest growing species should be launched in degraded and abandoned land to meet the local and regional needs and environmental conservation. The community forestry activities should be generated, especially in Ayeyawady mangroves by the establishment of plantation and effective protection of natural forests

(Table 1) Status of Mangroves Forests in 2000-2001

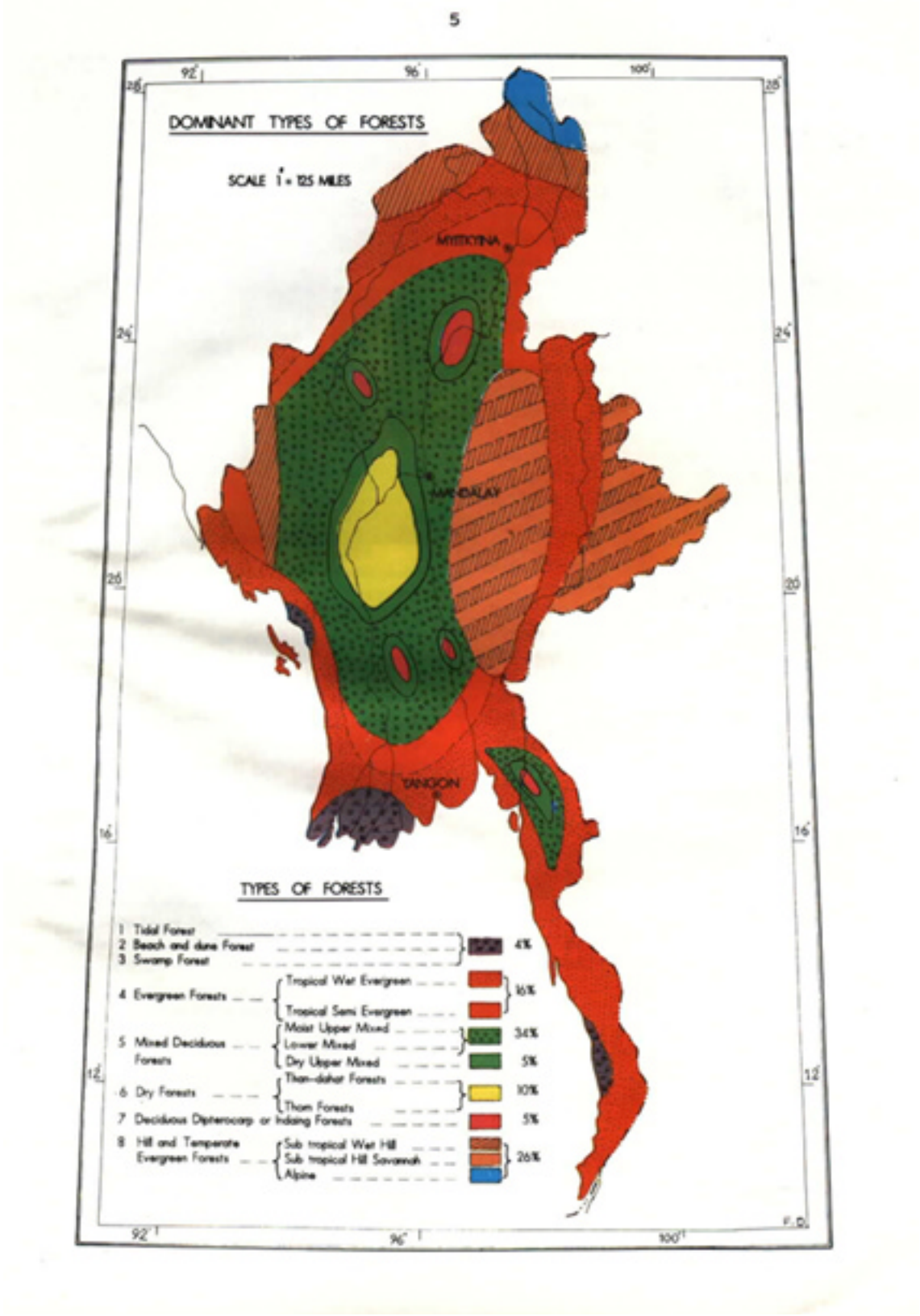
State/ Division	Township	Reserved Forest		Area of Conserved and Planted till 2000			
		Name	Area (ha)	Area Conserved in reserved	Planted Area up to 2000	Established Community Forest (ha)	Total area (ha)
1	2	3	4	5	6	7	8
Rakhine	Yanbye	Wanbike	22,919	-	-	-	-
Tanintharyi	Myeik	Panataung	2,397	-	-	-	-
	Kyunsu	Auklandbay	13,806	-	-	-	-
	Kawthaung	Pakchan	5,899	-	-	-	-
	Yephyu	Heinze	290	-	-	-	-

		Kaleinaung					
		Sub-total	**22,392**	**-**	**-**	**-**	**-**
Ayeyarwady	Bogalay	Kadonkani	60,506	15,673	3,998	538	20,209
		Pyindoye	76,974	-	42	334	376
		Meinmahla	13,748	13,566	182	-	13,748
		Sub-total	**151,228**	**29,239**	**4,222**	**872**	**34.333**
	Laputta	Kakayan	29,398	-	295	966	1,216
		Kya Kan Kwin	28,703	-	5,133	-	5,133
		Pauk					
		Pyinalan	43,518	-	2,122	2,599	4,721
		Sub-total	**101,619**	**0**	**7,550**	**3,565**	**11,115**
	Maulamyeinkyun	Labut Kywe	5,390	-	-	-	-
		Kalayaik	9,573	-	-	-	-
		Nyinaung	6,985	-	162	199	361
		Sub-total	**21,948**	**0**	**162**	**199**	**361**
		TOTAL	**274,795**	**29,239**	**11,934**	**4,636**	**45,809**

Source: Forestry Department

.

Fig: (2) Dominant Types of Forests in Myanmar



2.2.2 Coral Reefs Ecosystem

Status of Coral Reefs

Coral reefs are one of the world's most diverse natural ecosystems and provide a wide variety of food and habitats for a great number of species such as plants, fish and other living things. Globally, there are about 600,00 sq.km of coral reefs; more than half are distributed in the Indian Ocean (Huismans, 1993). As Myanmar is located in the tropical region, undoubtedly enormous varieties of coral species are available spreading across the coastal waters of the country. However, the report on Myanmar corals is scare mainly due to limited funds and tools essential to access present coral status.

In Myanmar, Rakhine, and Tanintharyi coastal areas are favourable grounds for both hard and soft corals. In particular, offshore island of Myeik Archipalago from Tanintharyi coastal areas are most abundantly distributed with diverse coral communities. The reef formation in Ayeyarwady coastal zone is restricted to Coco and Preparis islands which lie far off the influence of river runoff. Coral reefs are resource of immense importance for local populace. It provide many benefits including food from reef fish, recreation for tourists, etc. It is important to realize that healthy coral reefs are vitally important to the sustainability of two industries, fisheries and tourism. In the light of open door market economy, many tourist have been able to visit the southern islands of Myeik Archipelago through Kawthoung border point for the sight of corals and a wealth of marine life. Little known coral reefs Myeik Archipalago has emerged as a potential candidate for tourism industries. A substantial growth in tourist visitation via Phuket of Thailand to southern coral islands make earning more foreign exchange. Some offshore islands, Burma Bank, Western Rocky, Three Islets, High Rock, Black Rock, North Twin, South Twin and Roe Bank are most attractive to tourism. All island reefs are fringing type. It is considered lucky to remain the nature of the coral fringing islands the same today as it was hundreds of year ago due to isolation and uneasy access by coastal populace.

No coral reefs islands in Myanmar has been developed into a resort, except one inshore island, "Tha-Htay-Kyun". With these characteristics, rich culture heritage, sea gypsy (Moken) population, which are attractions of the tourists, coral and wild-life based eco-tourism businessess are economically potential in this region. There are settlement of fishing villages on some islands, and some fishers who are dependent on coral associated invertebrates inhabit on offshore islands on migratory basis. One elongate island, "Lampi", has already been declared as a marine park in this region. It is a challenging site for tourism development. Among anthozoan coral polyps, 51 species belonging to 20 families and 30 genera along Rakhine coast, 3 species belonging to 2 families and 2 genera from Delta areas (Maw-tin, Heingyi-Kyun, Pyin-kha-yaing) and 93 species belonging to 21 families and 47 genera from Tanintharyi coast have been recorded by Aung Kyi (1982), San San Win (1993), Mya Than Tun (2000) and Mya Than Tun and Tint Tun (2002)

(Table 2) Systematic List of Corals Collected from the Myeik Archipalago area
(65 Species tentatively identified by Marine Science Department)

Phylum	Class	Subclass	Order	Family	
Coelenterata	Hydrozoa	-	Hydeocorallina	Milleporina	***Millepora platyphylla***
	Anthozoa (Sea anemones, Corals etc)	Alcyonaria or Octocorallia (Soft Coral)	Stolonifera	Tubiporidae (Organ pipe corals)	***Tubipora musica***
			Coenothecalia	Helioporidae (Indo-Pacific blue coral)	***Heliopora coerulea***
		Zoantharia or Hexcorallia	Madreporaria or Scleractinia (all stony corals, reef building corals)	Acroporidae (branching, stag horn corals)	***Acropora pharaonis***
					brueggemanni
					A. concinna
					tubicinaria ***variabilis***
					Montipora efflorescens
					M. informis ***M. laevis*** ***M. solanderi*** ***M. striata***
				Thamnasteriidae	***Asteropora ocellata***
				Pocilloporidae	***Psammocora contigua***
					Seriatopora hystrix
				Siderastreidae	***Pocillopora damicornis***
					P. verrucosa

				Portidae	***Pseudosiderastrea tayamai***
				Agarciidae	***Porites convexa*** ***P. lutea*** ***P. nigrescens*** ***Alveopora excelasa***
				Mussidae	***Pavona crassa*** ***P. frondifera*** ***Lophyllia hemprichii*** ***Symphyllia nobilis*** ***Polyphyllia talpina*** ***Oxypora lacera*** ***Goniopora columna*** ***G. fructicosa*** ***G. lobata***
				Caryophyllidae	***G. malaccensis*** ***G. stuchburyi*** ***Euphyllia glabrescens*** ***Plerogyra sinuosa*** ***Pectinia lacluca*** ***Paracyathus stokesi***
				Faviidae	***Herpolitha limax*** ***Podobacia crustacea*** ***Goniastrea retiformis*** ***G. benhami***

					G. pectinata ***Fungia fungites (solitary, mushroom coral) F. actiniformis*** ***F. repanda*** ***F. echinata*** ***Favia speciosa*** ***Patygyra lamellina*** ***Hydnophora exea*** ***H. rigida*** ***Favites abdita*** ***Leptoria phrygia*** ***Trachyphyllia geoffroyi***

2.2.3 Seagrass ecosystem

Status of Seagrass resources

There are not very much information on the status of seagrass resources in Myanmar. Based on the data prepared by Soe Htun et.al (2001), Myanmar has 9 species of seagrass belonging to 5 genera from 2 families. These are ***Cymodocea rotundata, C. serrulata, Halodule pinifolia, H.uninervis, Syringodium isotoefolium, Enhalus acoroides, Halophila beccarii, H. decipiens, H. ovalis.*** Of these, ***Cymodocea rotundata, C.serrulata*** and ***Enhalus acoroides*** are dominant in the seagrass beds. Though not many seagrass are occur along Myanmar coast, seagrass beds found in Gwa and Maung – Shwe – Lay-Gyaing in Rakhine and Pyinsabu Island in Myeik Archipalago are sizable and thick, supporting a large number of marine fish and shrimp larvae, especially the post larvae of ***Penaeus semisulcatus*.** No seagrass are present in Ayeyarwady Delta and Mon State coastal zone due to estuarine and brackish condition of the water influenced by large volume of freshwater runoff. The family Hydrocharitaceae represents the most dominant genera of seagrass in both the Rakhine and the Tanintharyi Coastal Region. However, the family Cymodoceaceae occours mainly in the Rakhine Coastal Region, except for ***Cymodocea rotundata,*** which is unique to the Taninthayi Coastal Region.

Table (3) The distribution of seagrass along Myanmar Coastal Regions

Seagrass ((Family/Genus/Species)	Rakhine Coastal Region											Ayeyawady Delta and Gulf of Mottama (Martaban) Coastal Region	Tanintharyi Coastal Region			
	Sittwe	Kyaukphyu	Mazin	Ngapali	Shwewar Gyaing	Kywethauk Gyaing	Maungshwela y Gyaing	Hmawchay Gyaing	Phothaung Gyaing	Wetthay Gyaing	Chaungthar		Kyaikkhami	Maungmagan	South Moscos Island	St.Luke Island
Cymodoceaceae																
Cymodocea rotundata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
C. serrulata	-	-	+	-	+	-	+	-	+	+	-	-	-	-	-	-
Halodule pinifolia	-	-	-	+	+	-	+	-	-	-	-	-	-		-	-
H. uninervis	-	-	+	-	-	-	-	+	-	+	+	-	-	-	-	-
Syringodium isotoefolium	-	-	-	+	+	-	-	-	-	-	+	-	-	-	-	-
Hydrochari-taceae																
Enhalus acoroides	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	+
Halophila beccarii	**x**	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
H. decipiens	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-
H. ovalis	-	**x**	-	-	-	+	+	-	+	-	-	-	-	-	+	+
TOTAL	**1**	**1**	**2**	**3**	**3**	**2**	**3**	**1**	**3**	**2**	**2**	**-**	**1**	**1**	**1**	**3**

Symbols: + Present; - Absence (no information available); x Presence according to C. den Hartog (1970)

The role of sea grass

Seagrass beds that are normally found in shallow areas intermingle with both mangrove and reef communities. They are productive and valuable resources which provide habitats and food supply for many species of fish and invertebrates as well as the dugong. Their primary commercial value lies in this role as essential forage and habitat for lucrative commercial fisheries, such as those for tiger prawn in the northeast of Australia (Coles and Long, 1985). Local people from Myanmar call seagrass as " Leik-Sar-Phat-Myet ", which means the food of marine turtles. Moreover, seagrass beds perform coastal stabilization, filters and exporting organic nutrients to the near by ecosystems of coral reefs and mangrove and also provide the sheltered habitats as crucial feeding, spawning and nursery grounds for economically simportant species of marine invertebrates, coral reef fishes, and the sea cow ***Dugong dugon.***

2.2.4 Seaweeds Resources

Myanmar being a tropical country has a rich and varied seaweed flora. Although Myanmar have for many years eaten several of the seaweeds as vegetable and used them as a source of agar extraction, they have hardly noticed or recognized them as an important part of the marine environment. Non Myanmar for various reasons have a great interest and curiosity relative to the seaweeds but there has not been any readily available source of information.

Seaweeds can grow from the upper tidal zone to the deep areas where light exists. The depth to which light can penetrate varies from place to place. Factors affecting the distribution of seaweeds are light, temperature, salinity, substrate, water movement and depth. Most seaweeds

need a firm substrate for growth and complection of their life cycle. A stable rock shore with extensive shallows and tide-pools is the best environment for most of the marine algae to grow abundantly.

The Rakhine and the Tanintharyi Coastal Regions formed by the subsided mountain ranges of the Rakhine Yoma and the metamorphic mountain ranges of Tanintharyi Yoma , provide many rocky shorelines and the rocky headlands and capes jutting out into the sea, for the greatest diversities of tropical marine algae. Also, a large number of islands along the Rakhine Coastal Region and the Myeik (Mergui) Archipalago along the Tanintharyi Coastal Region, totalling over 800 islands with many rocky shores are the most suitable habitats for the seaweed floras. Because of low salinity turbidity, the rocky and mangrove- bordered shores of the Ayeyarwady Delta and the Gulf of Mottama Costal Region as well as some areas of the Rakhine and the Tanintharyi support only euryhaline species which are able to tolerate the wide range of salinity fluctuations.

Studies on the seaweed flora of each coastal region are still incomplete. The small number of Myanmar phycologists find it difficult to cope with year round studies of the entire regional flora. Occasional visits are made possible only during the winter and summer months. Consequently, there are many areas along the three coastal regions which have not been investigated adequately.

Despite the problems, as many as 122 genera and 307 species of seaweeds from Myanmar have been reported by Kyi Win (1972) and Kyaw Soe and Kyi Win (1975,1977). Seaweeds can be considered as dependable natural resources of Myanmar if they are sistainably exploited (Kyaw Soe, 1970). However, detailed and systematic estimates on the quantities of seaweeds that can be sustainably taken from natural seaweed beds have not been made in Myanmar's coastal areas. From visual observations and transect data, the following seaweed genera may be of economic potential.

Chlorophyta: ***Ulva, Enteromopha, Monostroma, Caulerpa, Codium.***
Phaeophyta: ***Padina, Dictyota, Spathoglossum, Chnoospora, Rosenvingea, Hormophysa, Turbinaria,Sargassum.***
Rhodophyta: ***Porphyra, Gelidiella, Halymenia, Solieria, Catenella, Hypnea, Gracilaria, Laurencia, Acanthophora.***

Among these species, ***Sargassum*** and ***Hypnea*** are the most abundant species in Myanmar. The standing stock of ***Sargassum*** is estimated at 2,500 tons dry weight and 1,500 tons dry weight for ***Hypnea.*** Sargassum beds formed along the Rakhine and Tanintharyi Coastal Regions provide good habitats, refuges and spawning grounds for commercially important fishery resources.

2.3 Living Marine Resources Use and Development

2.3.1 Policy on Marine Resources Use and Development

The Government of Myanmar has implemented the Five Year National Plan in 1996, and the livestock and fishery sector was ranked as the second priority sector. The Ministry of Livestock and Fisheries emphasis on promoting the joint venture business with foreign enterprise in fisheries sector, the reinforcement of supplying commercially important fish and prawn and the encouragement of extending available new technology. In this connection, Myanmar Government has established the Livestock and Fisheries Development Bank responsible for a loan with low interest. Several committees consisting of several relevant ministries are set up to increase the fisheries' production by encouraging private sectors, to stabilize the products supply in domestic market, and to expand export of the production surplus.

2.3.1.1 Capture Fisheries Management

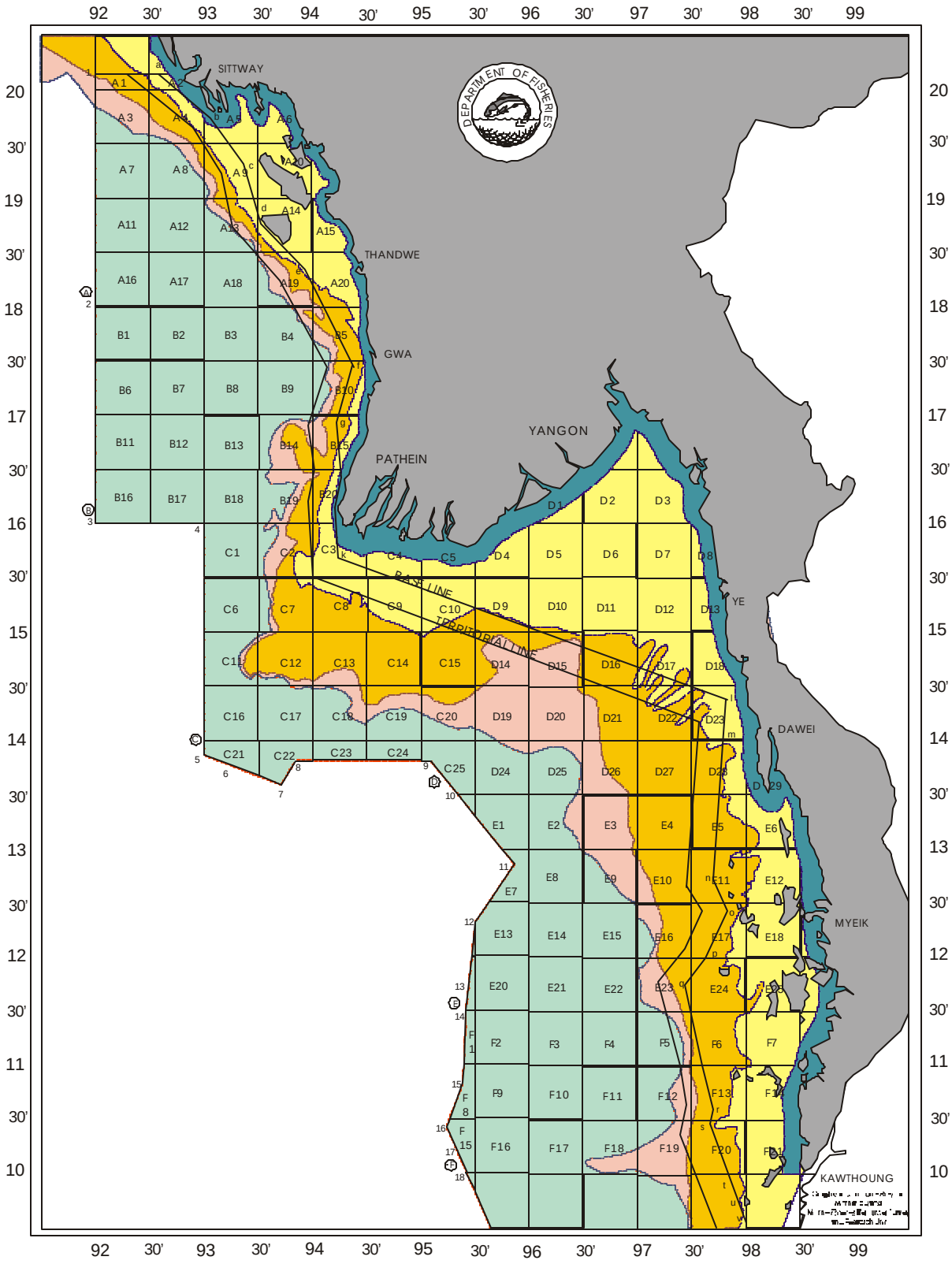
There exists fairly high potential on development of both marine and coastal fisheries for capture and aquaculture. The policies in view of sustainability are necessary for the fishery development in both coastal and marine, and the manner of these practices is to be environmentally friendly. The Ministry of Livestock and Fisheries is promoting the training courses sponsored by Southeast Asian Fisheries Development Centre (SEAFDEC) assisting the actual implementation of coastal and marine fisheries management in Myanmar.

Myanmar's marine fishery activities consist of three distinct fishing zones namely, onshore, inshore and offshore. From 1994-1995, the Department of Fisheries regulated the onshore area as inshore fisheries of marine fisheries according to the Myanmar Fishery Law. The inshore area starts from the lowest tide level to about 8 fathoms in depth (approximately 5 –10 miles from shore). As for the offshore fishing management, DoF had divided the Myanmar coastal line into 140 fishing grounds of 30x30 nautical miles block by using latitude and longitude lines and designated 4 fishing areas, such as Rakhine, Ayeyawady, Mon and Tanintharyi, which encompass 40,44,14 and 52 blocks respectively. The offshore areas are described the zone from 8 fathoms-line and beyond. (Fig:-1)

The Department of Fisheries has always enforced a licensing system to implement the principal of limited entry into fisheries. Any body, who wants to carry out fishing is required by law to have a fishery license. Fishery without a valid fishing license is an offence under the Fisheries Act. Several terms and conditions are attached to a fishing license. These stipulate how, when and where a fishing activity can be carried out.

(Fig:-1)

Department of Fisheries
Fishing Grounds of Myanmar
and Landing Sites



2.3.1.2 Aquaculture Management

Department of Fisheries introduced the aquaculture with tilapia, common carp species, and freshwater finfish from 1950s succeeding mass production of seeds by artificial propagation. In spite of promising market potential, the aquaculture contributed to a small amount in production, and there are only 3,000 ha of fish ponds established by 1989. Since one of main constraints was a lack of legislative support, Ministry of Livestock and Fisheries promulgated the Law Relating to Aquaculture in 1989.

Culture of tiger prawn (***Penaeus monodon***) was commenced in 1975 with traditional methods. A system of semi-intensive shrimp farming was encouraged very recently. In the year 2000, Ministry of Livestock and Fisheries gave technical assistance to potential investors to involve in shrimp culture. At the same time the Government formed the State/Division level committee to supervise the development of shrimp aquaculture industry. The committee launched a special operation maneuvering the three-year project plan to be commenced from May 2000 to May 2003. The shrimp ponds existed at the beginning plan is shown in Table (4). Based on the shrimp ponds in 2000 about 28,000 ha, and at the end of the three-year project plan the shrimp ponds will be increased up to about 49,000 ha. The expansion of aquaculture has no doubt increased fisheries production. But in many cases, it has also resulted in damaging sensitive ecosystems like mangroves and wetlands. There is a need, therefore, to assess carefully future aquaculture projects from the point of view of their environmental impacts. The policy of DoF on shrimp aquaculture in the mangrove area is 1) Primary mangrove forest should be reserved for sanctuary and not allowed to use for shrimp aquaculture. 2) Secondary mangrove forest or tidal forest can be used in some areas in which few shrubs are grown, and in few area be allowed for extensive or improved extensive type of shrimp farming with leaving buffer area.

Table (4) Expected increase in Area of Shrimp Ponds

(Unit – ha)

State / Division	Date Line Figure 31-3-2000	Project Period		
		2000-2001	2001-2002	2002-2003
Rakhine	24630	25850	27070	28700
Ayeyawady	2440	6630	10820	16400
Yangon	520	790	1070	1440
Bago	20	50	80	120
Kayin	0	30	50	80
Mon	30	140	260	410
Tanintharyi	20	630	1240	2050
TOTAL	**27650**	**34120**	**40580**	**49200**

Source: DoF report, 2001

DoF would select and allow shrimp aquaculture in tidal marshland. Majority of traditional shrimp farms are situated in the tidal marsh and secondary mangrove forest. Considering the low productivity in the area, DoF is encouraging farmers engaging the traditional shrimp farming to upgrade to improve extensive method or low semi-intensive in order to achieve more shrimp production per acre.

2.3.1.3 Fisheries' Laws and Regulations

` The DoF previously took the action under the Fisheries Act, 1905. After that from 1989 to 1991, the Government promulgated the following fisheries laws: the Fishing Rights Law foreign fishing vessels, the Marine Fisheries Law, the Aquaculture Law, and the Freshwater Fisheries Law.

Name of Fishery Acts	Year enacted
Law relating to the fishing right of foreign vessels	1989
Law relating to aquaculture	1989
Myanmar marine fisheries law	1990
Freshwater fisheries law	1991

Source: DoF

Under the Freshwater Fisheries Law, leaseholders are granted three-year leases on condition that they maintain or repair the waterways leading to their respective lease areas, the fish habitats as well as replenishing the exploited fish stocks. Under the Marine Fisheries Law, small-scaled fishermen (artisanal fishermen) are given priority to fish in all fishing zones. Foreign joint venture enterprise are allowed to fish within a defined belt starting the base line to the territorial line, while vessels operating under fishing rights agreement are allowed to operate from the territorial line to the Exclusive Economic Zone (EEZ). However, due to inadequate motoring facilities, control, and surveillance, illegal fishing activities are prevalent.

2.3.1.4 Current Situation of Fisheries Activities

Fisheries Production in Myanmar

(a) Capture Fisheries

The fishery sector in Myanmar is the fourth largest exchange earner after agriculture,timber, and minerals. Shrimp is the most important fisheries export. Although no data is available with the breakdown of products, shrimp may account for nearly 50% of the total value of fishery export. Recently some marine fish such as barramundi (***Lates calcarifer*** **),** red snapper, Chinese pomfret (***Pampus spp.***), and hair tail have been exported, Australia beign the principal market. Frozen shrimp are exported mainly to Hong Kong and thriie United States and dried shrimp to the Far East. According to DoF, the value of fisheries exports reached US $ 95 million during the April-May 1999-2000 against total exports of US $ 828 million. This is a result of increased harvesting of brackish water shrimp. Privatization of processing plants and the marketing system has also been a major stimulating factor in seafood exports. Most of the products are exported through the port of Yangon.

Table (5) Fisheries Production in Myanmar

(unit: 1,000 t)

	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
Freshwater	149	148	149	157	160	196	236
Leasable	65	65	63	63	68	83	91
Open	84	84	87	87	92	113	145
Marine	603	456	632	681	760	897	932
Coastal	222	169	234	252	281	332	345
Offshore	382	287	398	429	479	565	587
TOTAL	**752**	**602**	**781**	**831**	**920**	**1,093**	**1,168**

(b) Aquaculture

The production of finfish, freshwater prawn, and seawater prawn aquaculture in 1991 to 1996 are shown below. As it show there is a clear increasing trend in all aquaculture production. Shrimp culture with very primitive practice, such as, " Trap and Hold " has been commenced since 1980s in Rakhine state particularly at upper part of the coastal line. The production of this culture method was approximately 100 kg of shrimp / ha / year. It was said that the country of Myanmar was left behind comparing with the other Asian countries engaging shrimp aquaculture in terms of production rate and technology. This is partly because the country is blessed with the natural resources including fisheries, and the people are much relying on easy harvest from the wild and not so much interested in aquaculture. Another reason might be a lack of available biotechnology and financial support.

(Table 6) Area and Production of Aquaculture in Myanmar

Particular	Unit	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Fish	ha	15,390	20,871	23,511	15,180	19,723	20,108
Freshwater Prawn	ha	-	-	-	1,128	917	995
Seawater Prawn	ha	1,890	1,856	1,844	13,540	16,108	17,220
Production	t	25,900	51,600	67,800	71,700	79,800	85,200

Source: FAO,1998

2.4 Marine Fisheries Resources

Status of Marine Fisheries Resources

In Myanmar, fisheries are important for local consumption and export. Fish provides a relatively significant and healthy part of the diet. Currently, the average per capita consumption of fish in Myanmar is estimated about (21.04) kg. The fisheries resources of Myanmar can play

a crucial role in the production of food, improvement of income and generating of employment. It's industries create direct benefit to over 2.0 million people.

According to the survey conducted in the marine fisheries, it was noted about 1.0 million tons of pelagic fish and 0.75 million tons of demersal fish existed as biomass in Myanmar marine fishery waters. Out of the total biomass, 0.5 million tons of pelagic fish and 0.55 million tons of demersal fish (altogether 1.05 million tons) is marked as annual maximum sustainable yield (MSY) out of which 0.88 million tons were exploited during 1999-2000 (FAO, October 2001). Since the data has been collected only from the landing, it has excluded discarded fish at sea and the catch by innumerable poaching vessels, thus the capture fisheries production in the marine area may have reached MSY.

2.4.1 Demersal fish resource (Trawling surveys)

The four appraisal surveys of demarsal fish resources were conducted off the Myanmar continental shelf during 1981-83. The results of these trawl surveys are furnished below.

(Table 7) Biomass and MSY of Demersal Fish

Region	Depth range(m)	Surface area(km^2)	Standing stock		Averagee standing	M.S.Y m .t
			Pre-monsoon	Post-monsoon		
Rakhine Coast	0-50	20,130	103,200	240,100	171,650	121,195
"	51-100	14,000	14,000	97,100	55,550	39,222
"	101-200	38,700	38,700	36,600	37,650	26,583
Sub total		72,830	155,900	373,800	264,850	187,000
Ayeyawady	0-50	60,891	276,900	168,700	222,800	158,170
"	51-100	28,592	37,700	61,000	49,350	35,037
"	101-200	15,884	16,500	12,500	14,500	10,293
Sub total		105,367	331,100	242,200	286,650	203,500
Tanintharyi	0-50	31,723	155,600	113,700	134,650	92,036
"	51-100	35,732	97,900	76,200	7,050	59,501
"	101-200	17,246	14,100	9,200	11,650	7,963
Sub total		84,701	267,600	199,100	233,350	159,500
Grand total		262,898	754,600	815,100	784,850	550,000

Regarding demersal fish resource, namely, snapper (Nga Parr Ni), thread fin / Indian salmon (ka ku yan) and croaker (poke thin) their standing stock was about 800,000 m .t from these about 550,000 m .t was exploitable as maximum sustainable yield (M.S.Y). Thus, a total of about 1.05 million m .t could be harvested as yearly (m .s .y) for the whole shelf areas.

2.4.2 Pelagic fish resources (Acoustic survey)

Pelagic fish dwell and feed at the surface or in the water column in schools in water of temperature ranging from 26º to 30º C. The fishing ground of pelagics are generally of muddy-sandy bottom and associated with rich biomass of plankton. The coastal small pelagics frequently inhabit the nutrient-rich inshore neritic waters, while the large pelagics inhabit the

offshore neritic and oceanic waters. The shallow water fishing grounds are highly productive and account for much of the total pelagic catch. The small pelagics are exploited mostly with shallow water purse seines, surface and mid-water gillnets and other surrounding gill nets.

The commercially important pelagics classified by the Myanmar Department of fisheries, include (28) species of Carangidae, (15) species of Clupeidae, (12) species of Scombridae and (12) species of Engraulidae. (Resources Survey Group, 1994)

Fisheries Resources Surveys have been conducted during 1979 and 1980 by hydro-acoustic method and indicating fishing with FAO assigned vessel " R.V. Dr. Fridtjof Nansen". The estimate of pelagic fish calculated on the basis of the hydoracoustic surveys were as follows-

Table (8) Biomass of Small Pelagic Fish

Area	Biomass (M.T)		
	Premonsoon	Postmonsoon	Average
Rakhine	180,000	170,000	175,000
Ayeyarwady Delta	370,000	640,000	505,000
Tanintharyi	70,000	520,000	295,000
Total	**620,000**	**1330,000**	**975,000**

The Acoustic survey conducted by R.V. Fridtjof Nansen has indicated that total biomass of pelagic fish could be approximately one million metric ton and out of which, 500,000 metric tons could be harvested annually.

A considerable resources of pelagic fish, such as Sardine, Horse mackerel and Anchovy in the Rakhine coast, Hilsa in Ayeyarwady Delta area and Mackerel, Anchovy and Small Tuna in Tanintharyi area were observed by local fishermen and these were confirmed by acoustic surveys.

Some commercially important species of demersal and pelagic fishes of Myanmar are shown in Table (9).

Table (9) 15 -Economically Important Species Group of Fish.

Sr.No		Scientific Name	Common Name	Local Name
1.		**ARRIDAE**	**Sea Cat Fish**	
	1.	***Arius caelatus***	Engraved catfish	Nga-Yaung
	2.	***A.maculates***	Spotted catfish	-do-
	3.	***A.thalassinus***	Giant catfish	-do-
	4.	***A.venosus***	Veined catfish	-do-
	5.	***Osteogeneosus militaris***	Soldier catfish	-do-
2.		**CARANGIDAE**	**Trevally / Scad**	
	1.	***A. Alectic indicus***	Threadfin trevally	Byar-san-wike
	2.	***Alepes djeddaba***	Djeddaba crevally	Pann-zinn
	3.	***Alepes melanoptera***	Black fin crevally	-do-
	4.	***Atropus atropus***	Kuweh trevally	Nga-da-ma
	5.	***Carangoides chrysophrys***	Long nose cavalla	Zar-gyann
	6.	***C. ciliarius***	Long nose cavalla	-do-
	7.	***C. ferdau***	Ferdau's cavalla	-do-
	8.	***C. malabaricus***	Malabar's cavalla	Waing-phyu-gyi
	9.	***Caranx ignobilis***	Yellow fin jack	Zar-gyan
	10.	***C. sexfasciatus***	Dusky jack	-do-
	11.	***Decapterus macrosoma***	Layang scad	Pann-zinn
	12.	***D. maruadsi***	Round scad	-do-
	13.	***Gnathanodon speciosus***	Golden toothless trevally	Ka-la-ngu
	14.	***Megalaspis cordyla***	Hard tail scad	Pyi-daw-tha
	15.	***Scomberoides commersonianus***	Talang queen fish	Nga-let-war
	16.	***Selaroides leptolepsis***	Yellow stripe trevally	Myet-san-kje
	17.	***Seriolina nigrofasciata***	Black banded trevally	Nga-thaw-but
3.		**CLUPEIDAE**	**Herring/Shad/Sardine**	
	1.	***Anodontostoma chacunda***	Chacunda gizzard shad	Nga-wun-pu
	2.	***Dussmieria acuta***	Rainbow sardine	Nga-kyaw-nyo
	3.	***Tenualosa ilisha***	Hilsa shad	Nga-tha-lauk
	4.	***Hilsa ilisha***	Elongate ilisha	Zinn-byar
	5.	***Opisthopterus tardoore***	Tardoore	Nga-par-shar
	6.	***Sardinella gibbosa***	Gold stripe sardinella	Nga-kone-nyo

4.		**LUTJANIDAE**	**Snappers**	
	1.	***B. Aprion virescens***	Green job fish	Nga-ba-yin
	2.	***Lutjanus argentimaculatus***	Mangrove red snapper	Nag-par-ni
	3.	***L.johni***	John's snapper	-do-
	4.	***L.malabaricus***	Malabar red snapper	Nga-ba-yin
	5.	***L.russelli***	Russell's snapper	-do-
	6.	***L.sanguineus***	Blood red snapper	-do-
	7.	***L.sebae***	Emperor red snapper	-do-
	8.	***L.vitta***	Brownstripe red snapper	-do-
	9.	***Pristipomoides typus***	Sharp toothed snapper	-do-
5.		**MULLIDAE**	**Goat fish**	
	1.	***Parapeneus heptacanthus***	Spotted Golden goat fish	Kyo-war
	2.	***Upeneus moluccensis***	Golden band goat fish	-do-
	3.	***U.sulphuresu***	Yellow goat fish	-do-
	4.	***U.vittatus***	Yellow stripe goat fish	-do-
6.		**MURANESOCIDAE**	**Sea eel / Pike conger**	
	1.	***C. Congresox talabon***	Yellow pike conger	Nga-shwe
	2.	***Congresox talabonoides***	Indian pike conger	-do-
7.		**NEMIPTERIDAE**	**Threadfin bream**	
	1.	***Nemipterus dalagoae***	Dalagoa threadfin bream	Shwe-nga
	2.	***N.japonicus***	Japanese threadfin bream	-do-
	3.	***N.nematophorus***	Double whip threadfin bream	-do-
	4.	***N.tolu***	Notched threadfin bream	-do-
8.		**POLYNEMIDAE**	**Threadfin**	
	1.	***D. Eleutheronema tetradactylum***	Four finger threadfin	Zayaw-gyi
	2.	***Polynemus indicus***	Indian threadfin	Ka-ku-yan
	3.	***P.sextarius***	Black spot threadfin	Zayaw
9.		**POMADASYIDAE**	**Grunt / Javelin fish**	
	1.	***E. Pomadasys hasta***	Lined silver grunt	Gone-gyi
	2.	***Pomadasys maculatus***	Blotched grunt	Gone-pyauk

Sr.No		Scientific Name	Common Name	Local Name
10.		**SCIAENIDAE**	**Croaker / Drum**	
	1.	***Chrysochir aureus***	Reeve's croaker	Thin-war
	2.	***Otolithes rubber***	Tiger toothed croaker	Thin-phyu
	3.	***Otolithoides biauritus***	Bronze croaker	Nat-ka-daw-gyi
	4.	***Panna microdon***	Penna croaker	Nat-ka-daw
	5.	***Pennahia macrophthalmus***	Big eye croaker	Gaung-pwa
	6.	***P.macrocephalus***	Big head pennah croaker	-do-
	7.	***Prontonebia diacanthus***	Spotted croaker	Ka-tha-myin
	8.	***Pterotolithus maculates***	Blotched tiger toothed croaker	Nat-ka-daw
11.		**SCOMBRIDAE**	**Mackerels**	
	1.	***Rastrelliger branchysoma***	Short bodied mackerel	Pa-la-lum
	2.	***R.kanagurta***	Indian mackerel	Pa-la-tu
	3.	***Scomberomorus commerson***	Narrow barred Spanish mackerel	Bee-zin
	4.	***S.guttatus***	Indo-pacific Spanish mackerel	Nga-kun-shut
	5.	***S.lineolatus***	Streaked Spanish mackerel	Bee-zin
12.		**SERRANIDAE**	**Grouper / Seabass**	
	1.	***Epinephelus bleekeri***	Bleeker's grouper	Kyauk-nag
	2.	***Epinephelus tauvina***	Greasy grouper	-do-
13.		**STROMATEIDAE**	**Pomfret**	
	1.	***F. Pampus argenteus***	Silver pomfret	Nga-moke-phyu
14.		**SYNODONTIDAE**	**Lizard fish**	
	1.	***G. Saurida micropectoralis***	Short fin lizard fish	Nga-pa-lway
	2.	***Saurida tumbil***	Greater lizard fish	-do-
	3.	***Saurida undosquamis***	Brush toothed lizard fish	-do-
15.		**TRICHIURIDAE**	**Hair tail / Ribbon fish**	
	1.	Trichieurus lepturus	Small head hair tail	Nga-da-gon

Table (10) EXPORT EARNING FROM FISHERY PRODUCT

US $ - Million

Sr.No.	YEAR	US $
1	1988-89	10.2
2	1989-90	15.4
3	1990-91	13.0
4	1991-92	22.5
5	1992-93	51.0
6	1993-94	68.4
7	1994-95	120.6
8	1995-96	113.7
9	1996-97	163.0
10	1997-98	167.1
11	1998-99	201.3
12	1999-2000	183.7
13	2000-2001	218.3
14	2001-2002	251.5
15	2002-2003	317.4

Source: Department of Fisheries

Table (11) Export of Fish and Fishery Products

Ton-Original
US $ - Million

Year	Fish		Shrimp/prawn		Others		Total	
	Ton	US $	Ton	US $	Ton	US $	Ton	US $
1989-90	7116.9	4.0	2131.6	11.3	25.4	0.1	99273.9	15.4
1990-91	11621.1	5.9	1273.0	7.0	1033.5	0.1	13927.6	13.0
1991-92	11032.0	5.7	2672.9	15.8	554.1	1.0	14259.0	22.5
1992-93	21053.0	12.9	5827.1	34.0	1607.5	4.1	28487.6	51.0
1993-94	12884.1	12.7	6195.0	45.1	4136.7	10.6	23215.8	68.4
1994-95	78590.0	35.3	7940.0	63.2	10210.0	22.1	96740.0	120.6
1995-96	34740.9	28.5	8814.5	72.4	10805.4	12.8	54360.8	113.7
1996-97	41068.3	45.9	12827.8	95.6	13504.7	21.5	67400.8	163.0
1997-98	45853.7	54.2	13467.2	91.9	14859.0	21.0	74179.9	167.1
1998-99	70906.4	70.2	13764.5	97.0	42202.9	34.1	126873.8	201.3
1999-2000	72210.1	68.8	15536.0	90.7	28863.1	24.2	116609.2	183.7
2000-2001	92302.2	80.8	19477.3	104.2	32844.3	33.3	144623.8	218.3
2001-2002	138250.7	103.6	21453.9	94.4	41962.2	53.5	201666.8	251.5
2002-2003	136036.2	143.2	22868.1	105.2	54095.3	69.0	212999.6	317.4

Source: Department of Fisheries

The coastal waters of Myanmar have been heavily exploited since the introduction of trawling in the 1970s. Several signs of over-fishing are visible and there is considerable concern, particularly because of demand for fish for local consumption and because the vast majority of fisherfolk are artisanal fisherfolk dependent on coastal waters for their livelihood. The trawl fisheries are considered the most destructive. Environment degradation, especially in the estuarine regions, is also a concern. The need for managing the coastal fisheries has been recognized and several efforts have been undertaken. Licensing of vessels and banning trawl fishing within 5-mile in Rakhine and Tanintharyi Coastal Region and 10-mile in Ayeyarwady Delta Coastal Region have not been successful due to inadequate monitoring and enforcement and this need to be address.

2.4.2 Sea Turtle Resources

Status of Sea Turtle Resources

The water of Myanmar coastal areas harbors many of species of marine turtles. Of the sea turtles five species breed regularly on Myanmar's beaches. They are the Olive Ridely Turtle (***Lepoidochely olivacea***)(In Myanmar -Leik Lyaung), Loggerhead Turtle (***Caretta caretta***) (In Myanmar – Leik Khway), Green Turtle (***Chelonia mydas***) (In Myanmar – Pyin Tha Leik), Hawksbill Turtle (***Eretmochelys imbricata***) (In Myanmar – Leik Kyet Tu Yway), and Leather Back Turtle (***Dermochelys coriacea***) (In Myanmar – Leik Zaung Lyar). However, the latter two species are considered extremely rare. The Hawksbill Turtle and Leather Back Turtle, which were occasionally reported by fishermen from some part of Rakhine and Tanintharyi Coastal areas are totally disappeared from the Ayeyarwady Delta Coastal areas. All species have evidently abundant in the past. The beaches of " Tha-mi-hla Kyune" (Daimon island 15º 51' N 94º 17' E), an island at thee mouth of the Pathein River, host the nesting Gereen turtle and Loggerhead turtle. But " Kaing – Thaung – Kyune " (Kaing-Thaung Island) (15º 44' N 95º 04' E) and " Taung-Ka-Done-Kyune "(Taung-Ka-Done Island) (15º 43' N 95º 18' E), two small islands, which situated at the mouths of Ayeyarwady and Bogalay Rivers, respectively host the nesting Olive Ridely Turtle and Loggerhead Turtle.

Maxwell (1911) conducted extensive investigation of the " turtle banks " of coastal area in Myanmar, as part of a review for the Burmese Fisheries Act of 1902. At that time 1.5 million Olive Ridely Turtle eggs and 1.6 million Green Turtle eggs were harvested annually. Based on this egg harvest and several assumptions regarding female fecundity, Maxwell estimated a nesting population of 5,000 Green Turtles and 3750 Olive Ridely Turtles. According to the data from the Department of Fisheries the total number of nests in the region is currently about 300 annually, indicating a drastic reduction in regional turtle population during this century. Most nesting is by Olive Ridely Turtle (70%), followed by Loggerhead Turtles (20%) and Green Turtle (10%).

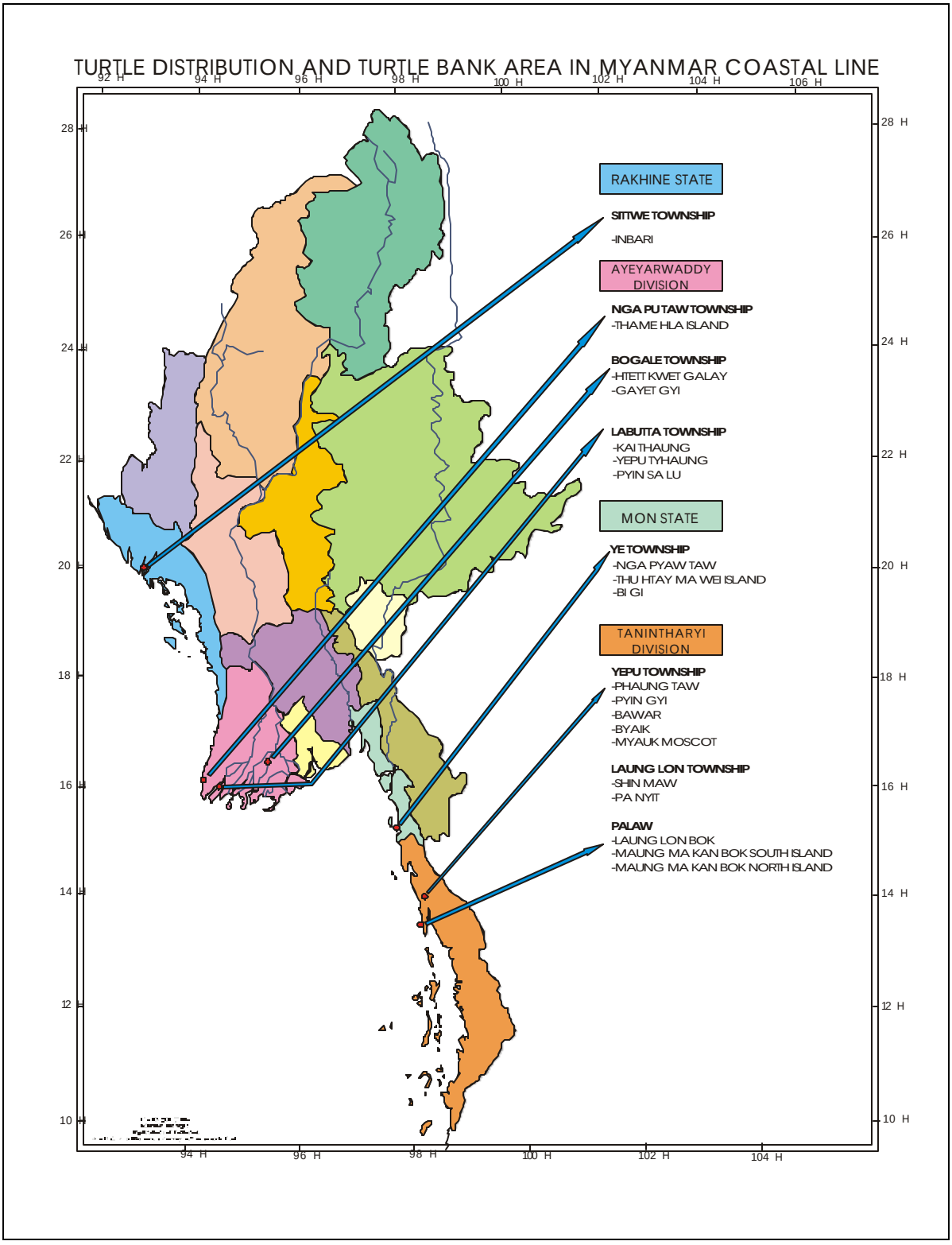
The Department of Fisheries started the conservation of turtle and biodiversity of marine ecosystems since 1905 by promulgated with " The Fisheries Act". It has protected all species of sea turtle as a conservation aspect. In the Fisheries Act (111-1905) protection for turtle hatching areas and turtle was included and those who trespassed on those areas without official consent were effectively penalized. In 1924, the Government of Burma, Agriculture (Forest Department) Notification No.1 made an official announcement, not to trespass with three miles radius from

the turtle hatching area. In 1991, the Myanmar redrew a new " Freshwater Fisheries Law " due to the great changing conditions. In 1993, the Department of Fisheries enacted " Notification No 2 /93 for Sea Turtle Conservation.

The objectives of Sea Turtle Conservation and Management is as follows:

- To restore developmental, feeding and nesting habitats;
- Make nesting beaches acceptable to turtle by eliminating the impact of artificial lighting through technology, ordinances (Law) and publication;

Fig: (3)


TURTLE DISTRIBUTION AND TURTLE BANK AREA IN MYANMAR COASTAL LINE
92 H
94 H
96 H
98 H
100 H
102 H
104 H
106 H
28 H
26 H
24 H
22 H
20 H
18 H
16 H
14 H
12 H
10 H
RAKHINE STATE
SITTWE TOWNSHIP
-INBARI
AYEYARWADDY DIVISION
NGA PU TAW TOWNSHIP
-THAME HLA ISLAND
BOGALE TOWNSHIP
-HTETT KWET GALAY
-GAYET GYI
LABUTTA TOWNSHIP
-KAI THAUNG
-YEPU TYHAUNG
-PYIN SA LU
MON STATE
YE TOWNSHIP
-NGA PYAW TAW
-THU HTAY MA WEI ISLAND
-BI GI
TANINTHARYI DIVISION
YEPU TOWNSHIP
-PHAUNG TAW
-PYIN GYI
-BAWAR
-BYAIK
-MYAUK MOSCOT
LAUNG LON TOWNSHIP
-SHIN MAW
-PA NYIT
PALAW
-LAUNG LON BOK
-MAUNG MA KAN BOK SOUTH ISLAND
-MAUNG MA KAN BOK NORTH ISLAND

3. Identified major threats to the coastal and marine environment of the country and its living marine resources.

3.1 Mangrove ecosystem

3.1.1 Causes of mangrove forest degradation

3.1.1.1 Overexploitation of firewood and charcoal production

Since 1924, the Ayeyarwady mangrove forests had supported firewood and charcoal to Yangon, the capital city of Myanmar and other towns in the Delta area. The annual firewood requirements for Yangon only is about 700,00 hoppus ton and this demand is increasing gradually due to dynamic population growth. However, the Ayeyarwady Delta firewood production, including some 432,200 hoppa tons is sufficient to meet only 62% of demand. Although it provided sufficient supply of firewood until 1970, it has been overexploited due to population pressure and scarcity of alternative energy source. In addition, the introduction of permanent beehive type charcoal kilns in that area in 1970 created severe degradation of mangrove forest as they consume a great number of mangrove trees. For this reason, mangrove forests from the Ayeyarwady Delta area have become under pressure due to over exploitation of the forest for charcoal production.

The excessive extraction of fuelwood and conversion to agricultural lands of the mangroves in the Ayeyarwady delta are typical mangrove tragedies. The deforestation rate of these fragile forests has been estimated to be around 2.30% in the 1980. Rehabilitation and community development is being carried out in these areas. A similar malady is afflicting the mangroves off Rakhine and Tanintharyi coast.

The satellite image of the February, 1995 of Ayeyarwady Delta area indicate 5.8% of forest area in Latputta in place of 32.2% and 19.5% in Bogalay in place of 51.89% and no forest exist in Mawlamyainegyun at present. The condition of mangrove vegetation during 1974 and 1995 show extent of degradation within two decades.

3.1.1.2 Aquaculture Development

In general, mangroves have been the first victim of coastal environment, where the aquaculture development is concerned. Since in the early centuries, mangroves areas have been clear for traditional aquaculture operation in Indonesia and in India. In Myanmar aquaculture in mangroves has been introduced since 1980 as a pilot scale. In northern part of Rakhine, shrimp culture has been wide spread in 1990s and most of these areas were previously degraded unclassed mangrove forest. A few area of south western part of Ayeyarwady Delta area, mangroves have been converted into brackish water shrimp pond. Theoretically, the conversion of mangroves forest to shrimp pond has been associated with the development of acid-sulphate soils. That kind of situation leads to a number of problems resulting in slow shrimp growth, low yields and mass shrimp mortality. At present no similar case is not traceable in Myanmar.

3.1.1.3 Agriculture Development

Conversion of mangroves for paddy cultivation is major threats for mangroves conservation, particularly in Ayeyarwady Delta area. To meet the requirement of regional food security, agriculture expansion in mangroves are also common in other two regions.

Generally, mangrove soil are not favoured for agriculture practices certainly.

3.2 Coral Reef Ecosystem

3.2.1 *Principle threats to Coral Reefs*

Coral reefs are self-sustaining and resistant to natural impacts such as cyclones and will normally recover in 10 to 20 years to something that closely resembles the original structure. However coral reefs are fragile to persistant stress by humans, and surveys made in last few year indicated that during the past 15 years, many reefs south of Latitude 11º N have suffered much destruction. Dynamite fishing, anchor damage, trampling and over-fishing have devastated the marine flora and fauna associated with the reefs. Sedimentation cause by erosion from the mainland and from the islands also smoother corals and associated animals by burying them. But this kind of threads was not identified yet in Myanmar waters. The law relating to fishing rights of foreign vessels (1984) and Myanmar Fisheries Law (1990) clearly prohibit the use of explosives, poison and toxic chemicals, harmful agents and damaging gears. However, the difficulty in having access to remote areas, lack of adequate infrastructure, insufficient manpower and lack of trained personnel are some of the major constraints in effective management of the resources. More information are still lacking to assess this ecosystem correctely.

3.3 Seagrass Ecosystem

3.3.1 *Principle threats to Seagrass resources*

There is a lack of information on the overall condition of seagrass. In general, major threats to seagrass are water pollution by industrial wastes, thermal discharge and petroleum product spills, unauthorized bottom trawling and dredge and fill operation. Due to lack of reliable data, these reason are not quite sure to say threats of seagrass in Myanmar. But illegal near shore bottom trawling may be the main threats to seagrass in Myanamr.

3.4 Seaweed Ecosystem

3.4.1 Principle threats to Seaweed resources

Information on the overall condition of seaweed is still lacking in Myanmar. Due to lack of technology for mass production of ager-ager or carrageenan from seaweed and lack of demand by local user, most of the seaweed beds are still remain unexploited. At present, collecting ***Sargassum*** from its natural beds for making natural fertilizer is the only threat to seaweed in some areas.

3.5 Marine Fishery Resources

3.5.1 Principle threats to marine fishery resources

3.5.1.1 Over-fishing of some commercially important species

The coastal waters of Myanmar have been heavily exploited since the introduction of trawling in the 1970s. The rapid increase in demand for quality marine products significantly accelerated momentum on shrimp and other demersal resources exploitation, resulting in resources use conflict and violence between trawlers and small scale fishermen. Several signs of over-fishing are visible and there is considerable concern, particularly because of demand for fish for local consumption and because the vast majority of fisherfolk are artisanal fisherfolk dependent on coastal waters for their livelihood. The trawl fisheries are considered the most destructive. Environment degradation, especially in the estuarine regions, is also a concern. The need for managing the coastal fisheries has been recognized and several efforts have been undertaken. Licensing of vessels and banning trawl fishing within 5-mile in Rakhine and Tanintharyi Coastal Region and 10-mile in Ayeyarwady Delta Coastal Region have not been fully success due to inadequate monitoring and enforcement and this need to be address.

(a) Sign of over-fishing of shrimp off the Rakhine Coast

Sann Aung (2000) reported that an over all average catch per hour of shrimp during 1989 to 1991 off the Rakhine (Northern) Coast was 32 kg/hour of a combined species, out of which 50% was good quality white and tiger shrimp. The catch rate was based on the fishing logs, recorded by the observers of Department of Fisheries on board the commercial shrimp fishing vessels. There are some shrimp vessel owners who have been recording some of their shrimping vessels performance regularly after noticing that there was declines in catch rates. According to these observations, after 6 years, during 1997, the shrimp catch rate was 13 kg/hr. Similarly, in 1998; the catch rate was 10 kg/hr, in 1999, 12 kg/hr, and in 2003, again the rate of 10 kg/hr. An over all average catch rates of the last seven years (1997 –2003) was found to be around 11 kg/hr. Thus, the present shrimp catch rate of (2003) comparing to 1991, it is only 34% of the past. It shows that there is heavy fishing. Tarbit (1983) estimated that the optimum annual yield of shrimp at 4,400 mt. off the Rakhine Coast by trawling.

It is assumed that an annual catch of a shrimp trawler could be obtained about 50 mt, for the shrimp resource of 4,400 mt. off the Rakhine Coast. In this regards, 88 shrimp vessels could be operated for the resource. However, at present there are 18 vessels at Sittwe at the northern most areas, 20 vessels at Kyauk Phyu, next southern areas and 102 vessels at Than Dwe at middle areas, totaling 140 shrimp fishing vessels in this area. Thus, there is about 37% of over capacity of fishing pressure (vessels) off the Rakhine Coast, so it is a real threat to shrimp resources. In addition to this, there are illegal some small shrimping vessels in the area; locally it is called "Baby trawl "trawling in shrimp nursery grounds for juvenile shrimp. These baby trawls are very difficult to control.

(b) Sign of over-fishing of fish off the Ayeyawady Delta area

Sann Aung (2000) has analyzed fishing logs (1980-81) of 22 commercial fishing vessels and found that an over all average catch per hour off the Myanmar Coast is 260 kg. On the other hand, during 1981-82, survey vessel has estimated that an average catch rate of 241 kg/hr at daytime and 146 kg/hr at nighttime, averaging 200 kg/hr for day and night catch rate(Rijavec and Tun Thein,1983). During these periods, a fishing vessel of 80-100 GT class, could fill a vessel in 14-15 days. However, at present, to catch the same tonnage of fish, it has to fish about 28 days, in order to maintain freshness of the fish, the vessels owners used one of the fishing vessel as carrier vessel. Catching time for a vessel with the fish from 14 to 28 days shows that the catch rate has decreased to 50%. It could interpret that catch rate of fishing vessel is decreasing from 260 to 130 kg/hr.

(c) Over-fishing of some commercially important species.

Other commercial marine species, such as pomfret **(*Pampus spp.*)**, Indian threadfin **(*Polynemus spp.***) are decreasing its population due to high demand and good price. Even there is no reliable data, some sign of over-fishing are visible. According to the data from Marine Fisheries Resources Survey and Research Unit of the Department of Fisheries, the dominant total length of ***Pampaus argenteus*** is 35 cm in 1990 and it is only left 30 cm in 1995. This data indicate that some commercial fish are heavily exploited and become smaller and smaller year by year. Similar situation can also observed in ***Polynemus indicus***. Nowadays, it is very difficult to get big size of ***Polynemus indicus*** in Myanamr waters. Species composition has also changed and catch per unit efforts are also declining in some commercial species. Fish trawlers, which can filled its fish hold within 15-day of fishing operation in last decade are not sure to fill its fish hold after spending more than a month fishing in the sea now.

During 1980-81, when an average catch per hour of trawler was 260 kg, some commercially important fish species of catch rates were (1) Croaker (Sciaenid) 40 kg /hr (2) Sea catfish (*Arius species*) 39 kg/hr (3) Sardine and Ilisha (Clupeids) 17 kg/hr (4)Grunt/Javelin (*Pomadasys species*) 15 kg/hr(5) Hairtail/Ribbon fish (*Leptunacanthus species* and *Trichiurus sp*ecies) 15 kg/hr (6) Sea eel (*Congresox species*) 14 kg/hr. Since it is considered that an over all catch rates has coming down to 50%, it is assumed that species-wise catch rate might be falling to 50%. However, all the species catch rates may not be coming down uniformly.

(d) Hilsa Fishery

Hilsa is has occupied a very important position in local consumption as well as in export market. In the last four years (1999/00-2002/03) in export, hilsa stood first position in weight with 40% (43,800 mt.) among the top ten other exported species of croaker, pomfret, hairtail, yellow croaker, tongue sole and threadfin. And it has also been contributed 40% of a total export revenue in US$. In price, it stands fifth place after fish fillet, pomfret, mackerel and threadfin (Sann Aung, 2003). Hilsa is contributed by a single species of Hilsa shad (*Tenualosa ilisha*).

There are two groups of hilsa in Myanmar. The Rakhine Yoma (Arakan Mountain Ridge), which immerses into the sea at Pagoda Point (Southern tip), is continued to South as submarine ridge along the Andaman and Nicobar Islands to join the mountain change of Sumatra Islands. Consequently, the submarine ridge and Andaman Islands divide the water mass into two, namely, Bay of Bengal and Andaman Seas. As a result, it separates two groups of hilsa as Bay of Bengal Group and Andaman Group. Since the Bay of Bengal Group of hilsa is migratory moving to Bangladesh and India, at present, off Northern coast of Myanmar (Rakhine), hilsa shoal is so small and appearing only occasionally, commercial fishing of hilsa is not in feasible. Thus, at present Myanmar is fishing only Andaman Group of hilsa.

Hilsa fishing season and fishing gears

The studies on hilsa landing at Yangon fish market had revealed that here are two fishing seasons of hilsa. These are winter months of December, January, February, which is a major peak season. And March, April and May, the month of April is second peak season. Most effective fishing gear is imported technology of purse seine equipped with satellite navigator, depth sounder and sonar/fish finder. The other fishing gear is local technology of encircling gill net. It is not like purse seine, it is encircled with many small non-mechanized boats and nets are joined together and the fishes are gilled.

Sign of over-fishing of hilsa off the Ayeyawady Delta (Andaman Seas)

Sann Aung (2001) analyzed and estimated hilsa catches from purse seine and encircling gill nets for a period of ten years (1999-2000), based on fishing capacities of each type of fishing vessel and the number of registered fishing vessels. It has found that during in the third year of the of ten year period, in 1992-93, there were a total of maximum number of 286 vessels were fishing, estimated that producing about 106,000 mt. Hilsa. After this period, hilsa catches were declining with 86,000 mt. (1993-94) to 28,000 mt.1996-97) and 42,000 mt. (1999-00), respectively. Since then, hilsa catch was falling; the corresponding numbers of fishing vessels were also reducing in the fishing grounds. At the same time the size hilsa at local markets very small which varied from 150-200 gm while normal size of hilsa was over one kilo.

Hilsa lives and grows in the seas and ascending rivers from sea for spawning. So it is called anadromous fish. Before they enter rivers for breeding, hilsa is moving and feeding near Ayeyawady Delta forming big schools of 20 – 50 mt; there. This is the time where the purse seine and encircling gill nets vessels are in operation.

Studies on hilsa gonads show that hilsa spawn throughout the year, but the peak season is at the end of the rainy season September and October and again winter months of December to January. At this time there are numerous fishermen looking for spawning hilsa at the lower

reaches of the rivers with small boats and three layers nets (trammel net) to catch the fish. Spawning hilsa fetches highest price in the markets, since the fish is larger in size, some of these with roes, it is very fresh fish for fishing grounds are very close to the markets. With the introduction of highly efficient monofilament nets and mechanization of the boats with outboard engine, which can intensified the fishing effort increasingly that can create very high fishing mortality.

Conservation of hilsa

Pressure of hilsa fishing in Myanmar is very great and it is very difficult to manage for a sustained fishery. Inadequate knowledge in some important issues concerning to conservation and management are major drawback in this subject. In this regards, to maximize economic return, it is important to consider a wide range of scientific, economic and social management issues.
Regarding hilsa conservation, the following points should be to be considered.

(1) Close areas and close seasons for hilsa

There is a saying in Myanmar that " A fish with many enemies would lay many eggs" it could be true in case of hilsa. A female hilsa carries the eggs from 200,000- 1,800,000.

After spawning, on an average, if a female hilsa could leave one young hilsa, there is no reason that hilsa resource to deplete. In order to sustain the hilsa resource and to protect spawning female, close seasons and close areas should be marked in rives and at seas. In addition to these, in the rivers hilsa sanctuary should be established prohibiting fishing in that area.

(2) Mesh size regulation of hilsa

Before the introduction of purse seine (1990), major hilsa fishing gear in Myanmar has been only encircling gill net with 10 cm mesh (4"), in this arrangement, the fish smaller than one-kilo sizes are escaped from the net and they would grow bigger size to spawn. Similarly, drift net at sea and rivers are also to be used only the nets with 10 cm mesh size. Thus, Myanmar has succeeded sustained hilsa fishery for many years with simple fishing gears. Introduction of purse seine and trammel (three layer net) in Myanmar is consequences of hilsa resource declining. Thus, introduction of suitable mesh size could contribute increased catch rate and conservation of hilsa.

(3) To promote public awareness not to kill spawning hilsa.

Since hilsa has occupied the position of first in both tonnage and revenue, the fish should be considered as " National Fish of Myanmar ". Conservation of hilsa should also be undertaken on public awareness through media such as TV, Radio talk, Poster and T-shirt, telling them not to kill and not to eat spawning hilsa. In addition to these, hilsa conservation and research should be carried out with the formation of a committee. Public awareness and education alone is not enough for the conservation of hilsa, to be more effective in this regards, it should be supported by legislation with departments concerned.

Other commercial marine species, such as pomfret **(*Pampus spp.*)**, Indian threadfin **(*Polynemus spp.*)** are decreasing its population due to high demand and good price. Even there is no reliable data, some sign of over-fishing are visible. According to the data from Marine Fisheries Resources Survey and Research Unit of the Department of Fisheries, the dominant total length of ***Pampaus argenteus*** is 35 cm in 1990 and it is only left 30 cm in 1995. This data indicate that some commercial fish are heavily exploited and become smaller and smaller year by year. Similar situation can also observed in ***Polynemus indicus***. Nowadays, it is very difficult to get big size of ***Polynemus indicus*** in Myanamr waters. Species composition has also changed and catch per unit efforts are also declining in some commercial species. Fish trawlers, which can filled its fish hold within 15-day of fishing operation in last decade are not sure to fill its fish hold after spending more than a month fishing in the sea now.

(d) Sea Turtle

Recently, the number of sea turtles in Myanmar has decreased markedly for the following reasons:

1. The use of sea turtle and their eggs as food in the past. The numbers of young sea turtles released were too low to replenish the wild populations.
2. The sale of sea turtle products
3. The invasion of nesting habitats
4. The incidental capture of sea turtle in off shore waters. Sea turtles are frequently caught by commercial fishing gears, such as trawls, drift nets and longline hooks.
5. Insufficient legislature and weak law enforcement.

After sometime Department of Fisheries has noticed that there is a declining trend of receiving the eggs from natural turtle nests, and from 1986, more priority has given for conservation measures, turtle nursery and research has established at Turtle Island/Diamond Island/ Tha-Mee-Hla (Beautiful Daughter Island) in the same year (1986). 1n 1989, the Government has promulgated fishery laws including conservation of turtle.

Maximum number of marine turtle eggs is laid in the Ayeyawady Delta areas, mainly in three places. In these areas, with a view to conservation of marine turtle, three turtle-hatching stations have been established, namely: (i) Turtle Island off the coast, in Nga pu taw Township; and in Bogalay Township there are two stations (ii) Gayet gyi Island; and (iii) Gadon galay Island. The last two turtle egg hatching stations are very close to main land, due to this, more disturbances by human activities.

There are significant declining situations in the collection of marine turtle eggs in Ayeyawady Delta areas. Availability of the turtle eggs for the three hatching stations in Ayeyawady Delta are as follow:

Table (12) Table showing situation of turtle egg collection at three hatching stations (1998-2002)

(1) Turtle Island				(2) Gayet gyi Island				(3)Gadongalay Island			
Species: Green turtle				Species: Olive Ridley turtle				Species: Olive Ridley turtle			
Year	No. of nest	No. of eggs	Hatch. Released	Year	No. of nest	No. of eggs	Hatch. Released	Year	No. of nest	No. of eggs	Hatch. Released
1991	-	34,334	26,939	1998	171	19,330	14,017	1998	161	17,337	12,733
2000	231	45,673	43,472	1999	82	8,882	7,474	1999	60	4,225	4,225
2001	102	46,680	43,590	2000	97	11,019	8,256	2000	201	18,978	18,978
2002	122	11,549	9,133	2001	71	7,727	6,418	2001	107	11,363	11,363
2003	55	5,170	3,308	2002	41	4,272	3,846	2002	68	7,420	7,420
	510	143,406	126,442		462	51,230	40,011		597	59,323	54,719

Source: Department of Fisheries

During 2000, a total of 231 turtle nests were recorded at the Turtle Island, however, in the year 2003, nesting was reduced to 55 nests, showing only 53% of the nest of last three years. Similarly, in the same period, the numbers of the turtle eggs collected were reduced from 45,673 to 11,550; it was 25% of the eggs of the last three years. In Gayet gyi Island, at turtle egg hatching center, in five years period from 1998 to 2003, the nesting of turtle was decreased to 41 from 171 nests, showing only 24% the nests of the last 5 years, for similar period the turtle eggs collection was reduced to 4,272 from 19,330, representing only 22% of the first year. Likewise, at Gayet galay hatching centre, nesting sites were decreased from 166 to 68 nests showing 42% of the last 5 years, similarly, in egg collection, it has fallen from 17,337 to 7,420 eggs recording only 43% of the last 5 years.

Thus, since there is a decreasing trend in the marine turtle nesting and egg collection, it should be very cautious for conservation of these species, particularly, for location like Gayet-Gyi Island because nesting and egg collection were reduced to around 20% of the last 5 years.

3.5.2 Others development activities

3.5.2.1 Impacts of Coastal Aquaculture

In Myanmar there are nearly 2,832 kilometers coastline and round about 0.5 million hectare of swamp areas serving as spawning , nursery and feeding ground for aquatic and near shore and brackish marine fauna. This reveals that there are great deals of potentials waiting for coastal aquaculture development. In terms of aquaculture, only shrimp culture has been practiced since the year 1970s with "trap and hold" culture system in Rakhine State. In the year 1990-2000

fiscal year, there are round about 67446.97 acres (27306.5 hectares) of shrimp ponds existing in the whole country. As shrimp farming potential is a very large generator of foreign exchange, the Government of Myanmar has implemented a special plan to develop shrimp aquaculture industry since 1995. One of the main objectives of the shrimp aquaculture development is to increase the existed shrimp ponds of 674,446 acres in the year 2000 as a base-line data of three-year development plan up to 120,000 acres in year of 2003

Shrimp farming has become a major aquaculture attraction for investors over the past two to three decades. Currently, shrimp farming accounts for 30% of total world shrimp production, and this share is growing. In the face of stagnating or declining catches from the wild, shrimp farming is expected to play an even more important role in the future.

Shrimp farming production systems are technically diverse. They are commonly classified as traditional, extensive, semi-intensive, intensive and super-intensive. Various other intermediate designation such as " improved intensive" are also used. In practice, these terms are ill-defined, reflecting a broad and continually changing spectrum of systems that vary according to how intensively they use different resources.(capital, labor, skill, water, seed, feed, fuel and equipment). Most shrimp farming in the world is still extensive or semi-intensive.

As with most development activities, including agriculture, shrimp farming is associated with a number of negative environmental impacts. These include habitat conversion, conversion of land from other valuable uses, nutrients and organic matter in effluent, chemical use in soil, water and disease treatment, salinization, and the introduction of non-native species or genetically distinct varieties.

The Department of Fisheries, the most responsible department for the fisheries sectors, is much aware of environmental degradation and conservation of aquatic ecosystem. Myanmar understand the reasons of the success and failure of shrimp farming in Asia and Pacific and has issued a notification in 1998, which mentions that the semi-intensive method of shrimp culture shall be allowed as the highest intensity to safeguard the environment and ecosystem.

In the field of marine fin fish culture, Myanmar is still in the experimental phase only. Though a few experiments on the culture of grouper were carried out in near shore net cage culture during 1999 in Myeik and Rakhine. The experimental culture of Sea-bass (***Lates calcarifer)*** net cage was initiated only in the year 2000. Results obtained from experiments on grow out production of the grouper in cage culture are quite encouraging.

With the rapid growth and increasing intensification in coastal aquaculture, effluents from shrimp farms especially shrimp ponds and marine fish cages, have been recognized as a serious source of pollution in the coastal environment. Such discharges are known to increase the nutrient, organic and sediment loads of the receiving waters, leading occasionally to anoxic conditions in the bottom sediments and harmful algal blooms. At present no research work on this issue is undertaken and not much report on that issues was received in Myanmar .

3.5.2.2 Pollution

The marine pollution in Myanmar caused by industry or agriculture has been minimal at present due to low level of industrialization and relatively small amount of chemical used in agriculture. In order to cooperate with the international community to prevent and protect marine pollution, Myanmar has signed the United Nations Convention on the Law of the Sea in 1982. In 1988, Myanmar acceded to the International Convention for the Prevention of Pollution from

Ship 1973 and the Protocol of 1978 (MARPOL 1973/78). Myanmar has also enacted local laws and regulations for preventing the marine pollution. The pesticide law enacted in 1990 monitors and controls the selections, storage, transportation and use of pesticide to protect people, crops, other biological entities and the environment.

Sources of Polltion

(a) Rivers

Most municipalities, industries and agriculture in Myanmar discharge waste into nearby creeks or rivers waterways and usually not directly into the sea.

In Myanmar it is almost a custom to discharge all kinds of waste into the rivers. Besides, the gradual growth of industries, increase use of fertilizers and pesticides, urbanization and discharge of municipal waste continuously polluting the river system. Moreover, the numerous rivers and their tributaries that criss-cross the country carry pollutants of the whole catch-ment area including up stream areas . So, the water pollution in Myanmar will be endemic and wide spread in the near future and our hilsa population will be affected seriously if appropriat protective measures are not undertaken.

Globally, the study of the water quality of rivers has been reported elsewhere by many workers. But very few study has been reported on the rivers of Myanmar (Aung Myint et al.,1994)

The Ayeyarwady river is one vital artery waterway of Myanmar and is navigable throughout the year. It is know definitely to be *Myanmar river of heritage* because not only the two head-waters, namely, "Maykha" and "Malikha" but also the whole length and breadth are wholly located in Myanmar. Today, many industrial zones are known to be situated along the banks of the Ayeyarwady rivers. Among these industries, some industrial plants in one way or other directly discharge their industrial effluents without any waste treatment into the Ayeyarwady river. It is obvious that the quality of this waterway will eventually become affected due to the extended discharge.

At present, we can say that the coastal water of Rakhine and Tanintharyi are still in good condition and many water localities are still in their pristine state. However some area of the coastal water of Ayeyarwady Division and Mon State may be polluted to a certain extent. Yangon, with a population of 5-millions discharges its sewage and industrial waste into the Yangon river, which is a tributary of the Ayeyarwady. A similar condition can be found in the river mouth of Thanlwin, which is about 50 miles south of Mawlamyaing, the third largest city with population of 700,000. The city of Pathein, which is the fourth largest city also discharge its waste into the Nga-wun river, a tributary of Ayeyarwady. There is a large paper mill near the mouth of the Sittaung River, which discharg waste into the river.

Even the Myanmar Investment Commission in June 1994 notified that all permitted enterprise shall compulsory install Sewage Treatment Plant, Industrial Waste Water Treatment Plant and other pollution control procedures and abide with the sanitary and hygienic rules and regulations set by the authorities concerned, pollution assessment has yet to be made in the coastal water region. Pollution assessment and measurement should be therefore started as soon as possible.

(b) Oil Pollution

There are (8) major ports in Myanmar coastal areas, namely Sittwe, Than Dwe, Kyauk Phyu, Yangon, Mawlamyaing, Dawei, Myeik and Kawthoung. Ports and shipping operations are inherently hazardous to the marine environment. Fortunately, there has been no significant pollution incident recorder at the major port.

Major marine sources of pollution include ship-borne pollution and land based pollution. Land-based pollutants originate from municipal, agricultural and industrial activities. Hence, major land-based sources of pollution are domestic sewage, solid wastes, agricultural wastes, and industrial effluents and wastes.

Under normal operations, most cargo and oil/gas ports are not major sources of pollution. Only in fishing ports, where regulations on pollution control are difficult to implement on small boats, is oil pollution from fuel/lubrication oil dumping and bilge water discharge seen. Fishing ports exist in every coastal areas and they usually near to major urban areas, thus making it difficult to separate the contribution from the two sources. There are probable over (23,000) fishing boats of various sizes registered and operating in Myanmar coastal waters. All of the discarded oil is believed to be discharged into the sea. In addition, leaks and spills of fuel (diesel) oil during filling and transfer occur but this cannot be estimated. Marine accidents, although still low in frequency, could release significant amounts of oil into sea. However, no data are currently being collected to accurately assess the impact of oil pollution on the marine and coastal environment and its living resources.

Table (13) Inshore Fishing vessels in Myanmar

No	**Years**	Number of Vessels			Remarks
		Mechanized	Non-mechanized	Total	
1.	1990-91	-	-	**6032**	
2.	1991-92	-	-	**5958**	
3.	1992-93	-	-	**8628**	
4.	1993-94	-	-	**9588**	
5.	1994-95	-	-	**17957**	
6.	1995-96	**3653**	**7962**	**11615**	
7.	1996-97	**17299**	**10161**	**27460**	
8.	1997-98	**12211**	**9660**	**21871**	
9.	1998-99	**14245**	**10720**	**24965**	
10.	1999-2000	**12043**	**11191**	**23234**	

Source: Department of Fisheries

3.5.2.3 Utilization of Agriculture Inputs

Overall fertilizer use in 1996-97 was quite high in the Ayeyarwady, Yangon and Mon area, where rice is commercially grown. But use of fertilizer in Rakhine and Tanintharyi remained relatively less. The most common fertilizer currently utilized are Urea, Triple Super Phosphate, Muriate of Potash and compound fertilizer for paddy in a small extent. However, the use of gypsum about 2,800 MT, is only common in Mon State. In total, about 53,000 tons of Urea, 15,000 tons of TSP, 6,700 tons of Potash, and 8,500 tons of compound fertilizers were used in the coastal states and division.

In comparison with the sown area of crops, the use of pesticides is rather low due to lack of availability and partly due to low level of incidences of pest and disease in the coastal region. Pesticides are mainly used in Ayeyarwady Division, Yangon Division and Mon States as there are larger and more intensive cropping area than Rakhine State and Tanintharyi Division. For the year 1996-97 Mon State used some 45,000 liters and 13,033 kg of pesticides, while the Ayeyarwady coastal zone utilized a total of 12,555 liters and 5,226 kg of pesticides. On the other hand, Yangon Division used 350,000 liters and 92,100 kg of pesticides for the same period. Tanintharyi utilized the least amount, with a nominal use of 2,200 liters and about 600 kg of pesticides

As the overall utilization of agrochemical in the coastal zones of Myanmar, particularly in the Rakhine State and Tanintharyi Division is minimal, there is no immediate threat to the fragile ecological conditions of these areas. But as agricultural production expands, the use of agrochemicals are bound to increase in the near future. The increased utilization of agrochemicals could adversely affect land and water resources, environment and biodiversity, and merit serious consideration in use and methods of application. As such, Integrated Pest Management practices should be applied to the most possible extent in order to reduce number of applications and scale of chemical usage.

(Table 14) Utilization of Fertilizer and Pesticide in Different Parts of the Coastal Zone for the Year 1996-97

Agricultural Inputs	Amount of inputs used in different parts of Coastal Zone				
	Rakhine	Ayeyarwady	Yangon	Mon	Tanintharyi
Fertilizer (ton)	5,142	24,266	36,479	18,308	2,010
Urea	4,342	15,738	21,080	10,197	1,454
Triple Super Phosphate	558	4,661	7,636	2,237	314
Potash	260	1,223	2,882	2,218	159
Compound	-	2,644	4,881	878	83
Pesticide					
E. e.formulation F. (liter)	9,291	12,555	348,216	44,671	2.226
Powder (kg)	1,584	5,226	92,087	13,033	586

3.5.2.4. Tourism Industry

In Myanmar, tourism sector becomes one of the vital sector for economic development and number of visitors are increasing yearly. Nature tourism or eco-tourism has been recognized as a potentially significant source of revenue and it generates income and economic activity for the forest dwellers and rural people. Money earned from lodging, transportation, food, guides and souvenirs will accrue the local communities to minimize any negative impacts on the protected areas by reducing dependence on earning from forest products. On the other hand, it will compensate for the loss of access to biological resources which had been used traditionally by the local people. Nature tourism also contributes significantly towards economic development. Nature tourism or Eco-tourism sites were also implemented by Hotel and Tourist Department cooperation with Forest Department. So far, 28 wildlife sanctuaries, 2 nature reserves and 2 parks and 6 national parks, constituting about 4.27% (31,972.06 km2) of the total land area of the country have been established under the existing Protected Area System (PAS). Out of these (17) sanctuaries were increased in last (10) years.

Table (15) Sanctuaries and Parks

1	Pitaung sanctuary	Kachin State
2	Khakaborazi national park	Kachin State
3	Indawgyi Wildlife Sanctuary	Kachin State
4	Hukaung vally sanctuary	Kachin State
5	Kahilu sanctuary	Kayin State
6	Natma Hill national park	Chin State
7	Kyauk Pan Taung national park	Chin State
8	Kaylatha sanctuary	Mon State
9	Kyaikhtiyoe sanctuary	Mon State
10	Rakhine Yoma elephant training area	Rakhine State
11	Taunggyi sanctuary	Shan State
12	Inlay Lake sanctuary	Shan State
13	Wasa natural area	Shan State
14	Loimwe natural area	Shan State
15	Shwe-U-daung sanctuary	Mandalay Division & Shan State
16	National Kandawgyi Garden	Mandalay Division
17	Popa Mountain Resort	Mandalay Division
18	Lawkananda sanctuary	Mandalay Division
19	Mularit sanctuary	Magway Division
20	Wethigan sanctuary	Magway Division
21	Shwesettaw Wildlife sanctuary	Magway Division
22	Chuttin Wildlife sanctuary	Sagaing Division
23	Alaungdaw Kathapha national park	Sagaing Division
24	Minwun Hill sanctuary	Sagaing Division
25	Htamathi sanctuary	Sagaing Division

26	Hlawga Park	Yangon Division
27	Yangon Zoological Garden	Yangon Division
28	Moeyungyi Lake sanctuary	Bago Division
29	Seinyay Forest Camp	Bago Division
30	Myainghaywun Elephant Camp	Bago Division
31	Thameehla-kyun sanctuary	Ayeyawady Division
32	Meinmahla Island wildlife sanctuary	Ayeyawady Division
33	Moscos archipelago sanctuary	Taninthayi Division
34	Lampi marine national park	Taninthayi Division

Total number of tourist arrived in Myanmar during last decade and increase in number of rooms and beds are shown in table (16) and (17) respectively.

Table (16-)
Overseas Visitors

Sr.No	Year	Total	Tourist 1				Other Visitors 2
			Total	By Air	by Sea	by Land	
1.	1980-81	27,587	27,587	27,587	-	-	-
2.	1985-86	35,948	35,948	35,948	-	-	-
3.	1990-91	25,261	8,806	8,446	360	-	16,455
4.	1994-95	132,257	95,616	47,230	2,826	45,560	36,641
5.	1995-96	170,143	120,205	81,428	1,978	36,799	49,938
6.	1996-97	310,298	251,501	110,038	1,603	139,860	58,797
7.	1997-98	329,379	265,122	117,490	3,288	144,344	64,257
8.	1998-99	345,829	287,394	119,159	1,116	167,119	58,435
9.	1999-2000	309,418	246,007	113,940	387	131,680	63,411
10	2000-2001	272,880	208,676	120,317	61	88,298	64,204

Source Immigration and National Registration Department

1 Visitors with tourist visa only
2 Includes visitors with entry visa, business visa and multiple-journey visa.

Table (17 -)
Hotels, Motels and Inns / Gust Houses by Type of Ownership

S. N	Particulars	1992-93			1993-94			1994-95			1995-96			1996-97		
		No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds
1.	State-owned	46	1,467	3,141	46	1,477	3,161	46	1,477	3,161	46	1,477	3,161	28	1,096	2,129
2.	Private-owned	19	370	698	115	1,611	2,968	92	2,033	4,066	96	1,603	3,206	402	6,955	13,910

Table (13) Continued
Hotels, Motels and Inn/Guest House by Type of Ownership

S.N	Particulars	1997-98			1998-99			1999-2000			2000-2001		
		No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds	No.	No. of rooms	No. of beds
1.	State-owned	33	1,544	3,108	32	1,585	3,170	32	1,585	3,170	27	1,235	2,470
2.	Private-owned	447	8,472	16,944	439	8,717	17,434	463	9,277	18,554	463	9,846	19,692

Source: Directorate of Hotels and Tourism

Tourism impacts

Beaches and islands are the focal points for coastal recreation and tourism and a major source of income for many countries and Myanmar is not an exception. Tourism is one of the fastest growing industries in Myanmar, especially since 1996, when the Myanmar Government launched Visit Myanmar Year in 1996.

One of the most serious impacts from tourism development, worldwide, is that of a decline in local water quality (Saenger, 1989). Sewage discharges, particularly if poorly sited or inadequately treated, are the most common source of adverse effects on the biota. Biodiversity reduction, resource depletion and human health problems may result from the accumulated environmental effects of tourism.

Some major potential impacts on the natural environment by tourism industry are as follows:

- physical damage through removing samples, careless use of fires, logging by fires, clearing for camping, dumping of waste, or vehicle use;
- loss of fragile species;
- sustainability of only the most resilient species, thereby disturbing the ecological balance;
- disturbing regeneration and growth rates;
- disturbing soil creation processes; and
- reducing vegetation cover and species diversity.

At present, tourism industry in Myanmar is still in infant stage compare to her neighbouring countries. Environmental impact arise from tourism in the coastal are only in under serious situation. However, due to rapid development of tourism in recent years, appropriate countermeasures are needed to consider to avoid tourism impact on marine ecosystems and living resources.

To be environmentally responsible-travel and visitation to relatively undisturbed natural marine areas, in order to enjoy and appreciate nature that promote conservation, has low visitor impact, and provides for beneficially active socio-economic involvement of local people, not only the government agencies but also private entrepreneurs in related fields have fully responsibility. Only when there are mutual benefits, sustainability can last longer. Obtaining lessons from already spoilt tourism sites in some countries, great precaution should be taken in construction of infrastructure against the nature. Awareness and participation of people to the protection and conservation of our coral reefs, one of the most important heritages essentially and urgently needed before too late through proper marine eco-tourism.

(4) On going and planned activities relevant to address the identified issues.

4.1 Marine Coastal Habitat Ecosystem Destruction

4.1.1 Mangrove ecosystem

Forestry plays a pivotal role in economic development in the country. Since 1994, the Forest Department has implemented the following projects with the assistance of UNDP; (1) Community Multipurpose Fuel wood Woodlots Project in the Central Myanmar; (2) Watershed Management for Three Critical Areas Project at the Kindar dam, In-Lay lake and Hpu-Gyi lake; and (3) Community Development of Ayeyarwady Mangroves. These projects were continuously implemented for the period of 1997-1998.
Identify those actions, which could best be undertaken on a regional collaborative basis,

The Study on Integrated Mangrove Management through Community Participation in the Ayeyarwady Delta is started from February 2002 in accordance with the Scope of Work and Minutes of Meeting agreed between the Forest Department (FD) of the Ministry of Forestry (MOF) and the Japan International Cooperation Agency (JICA) on September 2001.

The objectives of the study are as follows:

1) To formulate and Integrated Mangrove Management Plan (IMMP) which aims at rehabilitation and sustainable use of mangrove resources by local communities;
2) To implement a Pilot Project (P/P) in order to confirm the practicability of IMMP, and for capacity building of stakeholders; and
3) To transfer relevant technology to the Myanmar counterpart personnel through on-the-job training in the course of the Study.

The study are covers the following five reserved forests in Bogalay and Laputta township in Ayeyarwady division with a total area of approximately 223,400 ha.

Township	Reserved Forest	Area (ha)
Bogalay township:	1. Kadonkani Reserved Forest	60,505
	2. Pyindaye Reserved Forest	76,972
	3. Meinmahla Reserved Forest	13,747
Laputta township:	1. Kyakankwinpauk Reserved Forest	28,702
	2. Pyinalan Reserved Forest	43,517
TOTAL		**223,443**

The Study consists of two phases namely, the Phase I for formulation of IMMP from February 2002 to January 2003, and the Phase II for implementing of P/P from February 2003 to December 2004.

The Study is conducted by the JICA study team and the counterpart personnel of Forestry Department. Major works in Progress Report is summarized hereunder:

(1) Preparatory Work in Japan (February 2002)

1) Preparation of the Inception Report and Draft Technology Transfer Plan

(2) First Work in Myanmar (February 2002 to April 2002)

1) Presentation and Finalization of the Inception Report
2) Presentation and Finalization of the Technology Transfer Plan
3) Collection and Selection of Subcontractor for the Village Profile Survey
4) Collection and Analysis of Relevant Data and Information, and Field Survey
5) Review of Integrated Resources Management of Kadonkani reserverd forest
6) Review of Community Forest based on Community Forest Instruction
7) Implementation of Village Profile Survey through Subcontracting
8) Collection of Information on UNDP/FAO Projects and Consideration of Collaborative Measures with the Study
9) Literature Survey on Fauna and Flora
10) Consideration of Concepts, Discussion and Selection on Revision of GIS System
11) Discussion on Data Input Method for Forest Type Classification and Selection of Work Concept
12) Field Reconnaisance
13) Understanding Changes in Lang Cover and Land Use based on 1995,2001 Land Use Map
14) Aerial Photograph Interpretation

(3) Second Work in Myanmar (September 2002 to December 2002)

1) Implementation of Rapid Rural Appraisal (RRA)
2) Local Workshop
3) Digitization of Forest Type Classification to GIS
4) Field Reconnaissance
5) Field Survey and Interviews on Fauna and Flora
6) Consideration of Fauna and Flora Conservation Guideline
7) Socio-economic Evaluation of Mangrove Forests
8) Additional Data Input to GIS, Revision of Database, and Customize Software
9) Implementation of Cost-Benefit Survey and Marketing Survey for Candidate Priority Project
10) Consideration of Basic Concepts for IMMP
11) Presentation and Discussion on Basic Concepts for IMMP
12) Initial Environmental Examination (IEE) and Feedback to the Draft IMMP
13) Zoning for Mangrove Forestry Operation
14) Formation of Draft IMMP
15) Preparation of Management-planning Map
16) Preparation and Discussion on the Progress Report

4.1.2 Marine fishery recources

(a) Sea Turtle

Myanmar law has protected all sea turtles since 1905. In the Fisheries Act (Burma Act 111-1905) protection for turtle hatching areas and turtle was included and those who trespassed on those areas without official consent were effectively penalized. In 1924, the Government of Burma, Agriculture (Fishery Department) Notification No.1 made an official announcement not to trespass within three-mile radius from the turtle hatching area.

Myanmar has also been a member of CITES (Convention on International Trade in Endangered Species), which prohibits the import or export of sea turtles and their products. Therefore, the Ministry of Livestock and Fisheries, with the aim to protect more effectively against the extinction of sea turtles, have declared coastal regions along the Myanmar coastline, Myanmar waters and islands as sea turtle sanctuaries. Although the Department of Fisheries is putting their best efforts in the conservation of the sea turtles, there are a lot of problems to implement the conservation project because of lack of experts in this subject and equipment, necessary for the implementation of the project.

Although Myanmar have many islands and sand bars for sea turtle nesting in her coastal areas, the Department of Fisheries can only conducting sea turtles conservation program in Ayeyarwady delta areas at present. As sea turtles are recognized as one of the most seriously endangered species in the world, the Department of Fisheries is also planning to set up a new unit for sea turtle conservation and management in its organization. For this reason, nearly all of the turtle nesting areas along the Myanmar coastal will be controlled by the Department of Fisheries in future for conservation and management.

In order to conserve the population of sea turtle and to rehabilitate their habitats, the Department of Fisheries has already laid down appropriate guidelines in its Thirty-Year Fishery Development Program. In the Thirty-Year Fishery Development Program, it is mentioned as follow-

- The potential of sea turtle nesting beach will be identified systematically.
- According to the existing fisheries law, appropriate action will be taken to whom involve in collection of turtle eggs and killing the turtle for any kind of purpose.
- Turtle nesting beaches and island will be conserved and protected from illegal turtle hunters
- Protected area will be established in certain area for to eliminate loss of sea turtle habitats
- Sea turtle hatchery will be constructed in appropriate area and juvenile turtle will be released into the sea for resource enhancement
- Cooperate with International organization, including ASEAN in sea turtle conservation and management activities

4.2 Environmental Conservation

In Myanmar, environmental degradation is still minimal. However, like other developing countries, the major source of environmental issues in Myanmar lies in the problem of underdevelopment. So, in the national endeavour to protect and conserve the environment, Myanmar's approach to the environmental protection is through alleviating poverty and uplifting the living standard of the people.

In the long term-term interests of the State, the National Commission for Environment Affairs (NCEA) has been formed under the Government Notification No. 7/90 since 14th February 1990. It has been constituted with the Minister for Foreign Affairs as chairman and members are Head of department from various government agencies. Under the commission, four specialized committees are formed. They are:-

Committee on Conservation of Natural Resources
Committee on Control on Pollution
Committee on Research, Education and Information and
Committee on International Co-operation

The National Environment Policy of Myanmar was adopted under the Government Notification No. 26/97 on 5th December 1994. The Policy calls for harmony and balance between environment and development through the integration of environmental considerations into the development process. National Environment Policy forms the basis for developing environmental strategies, environmental programme and plans.

Myanmar is a party to the Convention on Biological Diversity, Convention on Climate Change, Vienna Convention for the Protection of the Ozone Layer and London Amendment, Convention to Combat Desertification and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Myanmar Agenda 21 in line with the global Agenda 21 adopted at the United Nations Conference on Environment and Development was published in 1997.

In the area of achieving sustainable management of coastal, marine and island ecosystems, Myanmar Agenda 21 aims to address the following activities.

(1) To promote research and monitoring programmes
(2) To develop and implement strategies for the sustainable use of marine resources
(3) To strengthen legal and regulation framework
(4) To enhance education and awareness campaign
(5) To conserve marine biological diversity
(6) To establish a coordinating mechanism
(7) To promote coastal zone management and development

Environment management pattern in Myanmar largely sectorial, with existing policies and regulations relating to environmental management being formulated and administrated by the sectoral ministries and departments concern.

Myanmar has a number of sectorial laws that are related to protecting and conservation of natural resources and control of pollution. They are:

(1) The Factories Act 1951 controls factories involve with chemicals, particularly hazardous or toxic chemicals

(2) The Forest Law 1992 declared all mangrove forests as protected areas. Fishing within three hundred yards around mangrove area is strictly prohibited

(3) The pesticide law 1990 monitors and controls the selection, storage, transportation and use of pesticides

(4) The Myanmar Marine Law 1994 controls safe disposal of waste, tailing and fumes

(5) The Myanmar Pearl Law 1993 protects and conserves water areas of pearl oyster fishing ground from destruction and oysters from over-fishing

(6) The Water Power Act 1927 prohibits pollution of public waters for obtaining energy and mining purpose

(7) The Law Relating to Aquaculture 1989, The Law Relating to the Fishing Rights of Foreign Fishing Vessels 1989, The Myanmar Marine Fisheries Law 1990 and the Freshwater Fisheries Law 1991 are provided for further development of fisheries, preventing over fishing, safeguarding and protection of fishing grounds and management of fisheries. These laws prohibit fishing without license, causing water pollution, use of destructive fishing practices and promotion of sustainable use of fishery resources.

(8) The Territorial Sea and Maritime Zone Law 1997 defines and determines the maritime zone, contiguous zone, exclusive economic zone and continental shelf in respect of preservation and protection of marine environment, its resources and prevention of marine pollution.

(9) The Ministry of Industry (1) issued a standing order in 1995 on water and air pollution for prevention of pollution and damage to the environment by waste discharged by factories.

(10) The Myanmar Investment Commission notified in 1994 that all permitted enterprises shall compulsorily install sewage treatment plant, industrial waste water treatment plant and other pollution control procedures and abide with existing sanitary and health regulations set by the State.

(11) Myanmar is a party to international conventions relating to marine environments as shown in Table (18)

Table (18) Status regarding International Conventions, Agreements and Conduct related to Marine Environment

No.	Convention	Date of Signature	Date of Ratification	Date of Membership	Remarks
1.	International Convention for Prevention of Pollution from Ships. London, 1973.		Accession		Undertaken to give effect this convention under para 1&2 of Article 1 of the protocol of 1978
2.	Protocol of 1978 relating to the international convention for the prevention of pollution from ships, London, 1973		Accession 4-8-1998		Except for Annexes III,IV and V of the convention.
3.	United Nations Convention on the Law of the Sea, Montogo Bay, 1982.	10-12-1982	Ratification 21-5-1996		
4.	United Nations Framework Convention on Climate Change, New York, 1992.	11-6-1992	Ratification 25-11-1994	22-2-1994	
5.	Convention on Biological Diversity, Rio de Janeiro, 1992.	11-6-1992	Ratification 25-11-1994		
6.	Vienna Convention on the Protection of the Ozone layer, Montreal, 1987.		Accession 24-11-1993	22-2-1994	
7.	London amendment to the Montreal Protocol on substances that deplete the Ozone layer, London, 1990.		Accession 24-11-1993	22-2-1994	
8.	Convention on International Trade in Endangered Species of wild fauna and flora, Washington, 1973 and this convention as amended in Bonn, Germany, 1979.		Accession 13-5-1997	11-9-1997	

Table (19) Summary of Laws and Regulations related to the environment and natural resources

Laws/Regulations	Year implemented	Brief description
The Factories Act	1951	Controls factories involved with chemicals, particularly hazardous or toxic chemicals.
The Forest Law 1992	1992	Declared all mangroves forests as protected areas. Fishing within three hundred yards around mangrove areas is strictly prohibited.
The Pesticide Law 1990	1990	Monitors and controls the selection, storage, transportation and use of pesticides.
The Myanmar Mines Law 1994	1994	Control safe disposal of waste, tailing and fumes.
The Myanmar Pearl Law 1993	1993	In general, this law is aimed to protects and conserves water areas of pearl oyster fishing grounds from destruction and oyster from over fishing.
The Waterpower Act 1927	1927	Prohibits pollution of public waters for obtaining energy and mining purpose.
The Law Relating to Aquaculture 1989, The Law Relating to the Fishing Rights of Foreign Fishing Vessels 1989, The Myanmar Marine Fisheries Law 1990, and the Freshwater Fisheries Law 1991	1989 1989 1990 1991	These Fisheries Laws are provided for further development of fisheries, preventing over fishing, safeguarding and protection of fishing grounds and management of fisheries. These laws also prohibit fishing without a license, causing water pollution, use of destructive fishing gears and practices and promotion of sustainable use of fishery resources.
The Territorial Sea and Maritime Zone Law 1977		This law defines and determines the maritime zone, contiguous zones, exclusive economic zone and continental shelf in respect of preservation and protection of marine environment, its resources and prevention of marine pollution.

(5) Proposed priority actions to address environmental impact on coastal and marine environment and its living marine resources

In order to address environmental impact on coastal and marine environment and its living marine resources, the following proposed projects are needed to implement as a priority actions.

5.1 Monitoring and Assessment of Impact of Fisheries on Pollution in Coastal Waters

Coastal waters and the environment of the Bay of Bengal are subjected to pollution from variety of sources, such as industrial effluents, agricultural residues, domestic sewage, and oil. It is general knowledge that such pollution damage aquatic resources and the environment that nurtures them, occasionally kill fish, and sometime result in toxic substances entering the human food chain. However, the impact of the pollution on the aquatic resources has not been assessed and monitored systematically. Further more, there is a lack of appropriate methodologies to monitor and assess the impact of pollution on aquatic resources and habitats. Development of methodologies for such assessments are required for conservation of aquatic resources in the region, for the protection of public health as well as for the prevention of fish diseases.

National fisheries agencies working in close cooperation with environmental agencies and research institution, including universities, could undertake the effort. Facilitation and coordination by regional and international bodies concerned with such efforts, such as IMO, UNEP, ESCAP and UNICEF, would be beneficial. External inputs may be necessary to supplement national efforts and expertise.

5.2 Methodologies for Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) in Coastal Aquculturel

The rapid growth of marine shrimp culture throughout the region, with its large scale clearing of mangroves, conversion of agricultural land to shrimp ponds, pumping of seawater into the freshwater zone leading to salinization of soils and groundwater, excessive extraction of ground water, and discharge of pollution pond effluents has led to serious environmental degradation and social conflicts between the shrimp farmers and other land and water users. At present, there are either no legal requirements for EIA or SIA for shrimp farming in most countries or, in cases where they exist, the EIA or SIA is not always effective as there are no clear guidelines for assessments or standards. There are also cases where EIA and SIA are urgently needed to ensure that aquaculture development is environmentally and socially sustainable and to predict the types of adverse impacts that aquaculture can have. Thus enabling the development of mitigating measures. Appropriate and timely EIA and SIA would greatly assist decision-maker to decide whether the ecological and social consequences of aquaculture projects would be acceptable or not, thereby enabling speedy and better policy decisions to guide the development.

5.3 Assessment of Offshore and High Seas Fisheries Resources

Fisheries resources beyond the immediate coastal areas, in the EEZs and in the high seas are the only ones in the region that are not heavily exploited. No recent and reliable assessment exists of these resources and the understanding of the potential that exists is inadequate. Not only are large areas of EEZs of some of the countries not fully exploited, but a large area of high seas exists in the region. There is every prospect that as a result of the UN Conference on Straddling and Highly Migratory Stocks, some from the international involvement in the management of high seas resources will become a reality in the near future and there is an urgent need for the countries in the region to have a better understanding of the resources and potential to facilitate and enable their participation in such management regimes. With increasing demands from the private sector for offshore and high seas fishing, governments need timely, and reliable, information to take rational decisions on the use of these fisheries resources. This requires national as well as coordinated efforts in the region. Some countries in the region have the capacity to conduct surveys of marine resources and have collected data on some areas of their national waters. However, the region does not have current data and information to assess the resource potential of the Bay nor adequate capability to analyze and interpret data to facilitate policy decisions. The vary nature of the resources requires the countries of the region to evolve a regional mechanism to share in the generation of data and information, and to coordinate and facilitate monitoring, control, surveillance and management of shared resources. While the region as a whole has the capacity to undertake resources surveys and assessment of such nature, the effort required is beyond the means of any one country.

5.4 Monitoring and Assessment of Impact of Mangrove Foreset.

Mangrove is one of the most productive ecosystem for the maintenance of foodweb in aquatic environment apart from its role as protector of soil, moderator of salinity and provider of timber, fuel wood, charcoal and range of non wood forest products. For this reasons, protection and conservation of mangrove is essential for Sustainable Food Security of the people from the whole world. Mangroves and its ecosystem is the one, very unique and significant for international attraction due to its very recent popularity as most productive and dynamic ecosystem of tropical coastal areas of Indo-Pacific region, West coast of Africa and tropical America. It is said that 75% of the world's coastline between 25 degree North and 25 degree South was dominated by mangroves. Myanmar is situated at the center of World mangrove area and its role of international significance is high to get to get the interest as coastal biosphere for all round development of the Bay of Bengal. Some important existing situation and information of Myanmar Coastal Mangrove with its ecosystem is necessary to aware to manage for future development function like fisheries, eco-tourism and others…

Mangrove deforestration also has an impact on shrimp culture itself as the latter's success if the traditional method of culture is used, depends on the amount of post larvae in the wild for stocking in ponds. For the intensive culture system, the number of spawners caught in coastal waters, which are used for breeding in hatcheries may decrease because the wild shrimp populations also use mangrove swamp as their feeding ground.

Other negative effects of mangrove destruction to make way for shrimp ponds in coastal areas include water pollution, due to release of pond effluents; sedimentation due to release of solid material from ponds; the interruption of the shrimp and fish stocks due to increased

pollutants and product contamination due to indiscriminate use of chemicals. In recent years, an epidemic was prevalent among intensive cultured fish and shrimp in a number of Southeast Asian countries; this might have been due to mismanagement in fish culture, e.g. high stocking density, over-feeding etc. Chemical and antibiotics have also been used in fish and shrimp culture recently to prevent and control bacterial and virus diseases; the implications for human health are not clear.

The present situation shows very clearly that various activities together with weakness in present management policies have resulted in massive mangrove losses in the ASEAN region . In this connection, systematic research program should be conducted on the loss of fisheries due to resource degradation such as managrove. Developed rehabilitation programme for degraded areas, community participation and involvement is also needed. The guidelines on community forest should be applied for rehabilitating degraded mangrove resources, as community forests natural regeneration should be encourage to rehabilitate the degraded mangrove of the Ayeyarwady Delta areas and other mangrove forest areas.

TABLES

FIGURES

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19. U Naung Ho
    Fish Trawler's Owner

20. U Tin Tun
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21. U Myint Kyi
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