PN-AAX-137
75 copy
Tunstall

BACKGROUND PAPER ON INDONESIA'S COASTAL RESOURCES SECTOR

Nora Berwick
Office of Forestry, Environment,
and Natural Resources
Bureau for Science and Technology
U.S. Agency for International Development
Washington, D.C. 20523-1812

April, 1989

TABLE OF CONTENTS

		PAGE
I.	INTRODUCTION	1
II.	THE ROLE OF INDONESIA'S COASTAL SECTOR IN THE ECONOMIC DIVERSIFICATION	4
III.	SUMMARY OF INDONESIA'S COASTAL SECTOR ECONOMIC ACTIVITIES, ISSUES, AND RECOMMENDATIONS	6
	A. Shipping and Ports	6
	B. Oil and Gas Development	7
	C. Fisheries	9
	D. Aquaculture	13
	E. Coastal Agriculture	16
	F. Coastal Forestry	19
	G. Mining	23
	H. Industry	25
	I. Tourism	26
	J. Transportation and Communications	29
	K. Coastal Communities	30
IV.	INTERNATIONAL NGO ACTIVITIES IN THE COASTAL SECTOR	32
V.	MAJOR DONOR ACTIVITIES IN THE COASTAL SECTOR	34
	A. Multilateral Assistance	34
	B. Bilateral Assistance	41
VI.	INDONESIA AND COASTAL RESOURCES MANAGEMENT	44
VII.	ANALYSIS AND RECOMMENDATIONS	47

I. INTRODUCTION

Indonesia is the world's largest archipelago with more than 13,700 islands. Indonesia's land and territorial waters total 9.0 million square kilometers, of which 7.1 million square kilometers, or 79%, is composed of marine and coastal waters. The coastline of this archipelagic nation extends over 81,000 kilometers and comprises 14% of the earth's shoreline. The length of Indonesia's coastline ranks second to that of the Soviet Union, the longest in the world (Salim, 1988).

The Law of the Sea Convention (LOSC) of 1982 extended Indonesia's coastal and marine resource base to include the waters between the islands such that the islands are viewed as one unit with the waters between the islands functioning as a "linkage element." Prior to the recognition of the "archipelagic principle" by the LOSC, Indonesia's land-based natural resources covered an area of about 1.9 million square kilometers; now, with the new LOSC of 1982, Indonesia's natural resource base covers an area of about 9.0 million square kilometers, and, with the marine and coastal sector representing most of the national territory.

Stretching across some 5,110 kilometers from west to east, Indonesia spans two of the world's major biogeographic regions: the Oriental region which includes the islands of the Asian Sunda Shelf, Sumatra, Borneo, Java and Bali; and the Australasian region with Irian Jaya resting on the Sahul Shelf along with the remainder of Papuasia and Australia. In between lies the zoogeographic sub-division known as Wallacea and characterized by a mixture of elements from these two biogeographic regions. The marine environment is thus characteristic of the Indo-Pacific region . Indonesia's seas have continued to provide an estimated 60% of the protein in the diet of the population (Berwick, 1985), now estimated at more than 170 million people, nearly 80% of which are settled near the coast (Petocz, 1988). Indonesia's coastlands and the nearshore support a variety of additional economic sectoral activities as well (see below).

By virtue of its vast dimensions and unique biogeographic position, Indonesia has an extraordinary rich fauna, both on land and under water. Indications are that Indonesia's marine and coastal ecosystems are more diverse, complex, extensive, and productive than those in any other nation of comparable size (Burbridge and Maragos, 1985). Extensive mangroves and swamps, and tens of thousands of coral reefs are some of the most productive habitats in the region, nurturing the huge fisheries industry and protecting the adjacent coastal lowlands.

Veron (1989) reports, for example, that an estimated 510 species belonging to 70 genera of hermatypic or reef-building corals are found in the western Pacific extending from the Philippines in the north through Australia's Great Bareer Reef in the south. Approximately 450 (or 90%) of the 510 species are located in Indonesian waters. According to a preliminary survey of fish species in the Bay of Maumere at Flores Island, 850 species in 82 families were listed (Kuiter, 1988). This list was compiled from a two week survey of only a small percentage of the reefs within one bay of only one of Indonesia's 13,700 islands. Kuiter's preliminary list of fish species is indicative of the significance of Indonesia's underwater diversity when compared to such well known areas as the Maldives in the Indian Ocean, with about 400 species, and the entire Red Sea with about 500 species (including deep-water species). Kuiter (1988) estimates that within certain families, such as the Gobiidae alone, the number of species could triple when a full scale investigation takes place.

Indonesian's are concentrated in Java, Madura, and Bali where 65% of Indonesia's 170,000,000 people occupy 7% of the land area. Java, with over 90 million residents estimated at 700 persons per square kilometer, is one of the most densely populated islands of the world. The population density of Indonesia as a whole is approximately 80 persons per square kilometer (CIDA, 1987a). Eighty percent of Indonesia's population lives in the coastal zone, which also contains some 75% of the nation's cities with populations over 100,000 (Burbridge et al., 1988). The settlement of coastal area on Indonesia may be attributed to essentially two factors:

(1) better soils with favorable slopes are concentrated in the coastal lowlands of major watersheds where agriculture is developed at elevations of between 7-25 meters above sea level; and,

(2) the natural productivity of estuaries and the shallow nearshore yields the major part of the capture fishery harvest (68% within the 12 mile territorial waters) and supports the development of both aquaculture and mariculture.

Most of Indonesia's population live in the lower reaches of river basins with overpopulation and small holdings of land resulting in over-exploitation of land resources, which, in turn, creates erosion and sedimentation of rivers that drain into the seas. In addition, increased use of pesticides in agriculture is resulting in pollution of nearshore fish habitat (Salim, 1988). For example, pollution of the estate tambak development at Krawang, approximately 40 km east of Jakarta, is threatened by agricultural pollution of the watershed above it (Wiley, 1987). Hehanussa (1981) reports that 90% of pollution in Indonesia coastal waters is derived from land-based sources. These trends reflect an emphasis on a sectoral approach to the development of land resources that disregards the potential role of the coastal zone in aquatic resource development.

It is estimated that Indonesia's population is expected to increase to between 216 and 222 million by the year 2000 (Burbridge et al., 1988) resulting in an imbalanced population to land ratio and requiring a restructuring of the nation's economy. There will be increasing pressure to derive an increasing portion of the GDP from under-utilized and under-exploited products from coastal sources. Due to the richness of the coastal natural resource base as compared to upland areas, coastal regions will not only have to absorb the bulk of the increased population, but will also have to produce a large proportion of the food and materials required to sustain the growing population.

Development patterns are confirming this shift towards renewable resources exploitation of Indonesia's coastal lands and waters. Large areas of the coastal zone are being transformed into rice fields to absorb transmigrants from Java. Luken (1983) reports that between 1969 and 1979, an estimated 700,000 hectares of mangroves were converted for rice fields, aquaculture, and other agricultural uses. Indonesia's mangrove resources are the largest in the world at 4.25 million hectares (Bina, 1982). Mangrove forests continue to be over-exploited for firewood and transformation to tambak. Since 1975, at least 200,000 hectares of mangroves have been clearfelled for wood chip production (Saenger et al., 1983). Since there are no baseline data readily available on mangrove areal extent prior to 1969, working backward from Bina's 1982 figures on Indonesia's total mangrove hectarage, a calculated loss of a rounded 1,000,000 hectares between 1969 and 1979 represents a 19% reduction in the mangrove resource base prior to 1980.

II. THE ROLE OF INDONESIA'S MARINE AND COASTAL SECTOR IN ECONOMIC DIVERSIFICATION

With Indonesia's marine and coastal sector representing most of the national territory, the sector contains a broad diversity of natural resources which represent a potential basis for economic development opportunities. Due to increasing demands for food, energy, raw materials for industrial use, employment generation and foreign exchange revenues, utilization of marine and coastal resources in Indonesia will continue to intensify as the population pressure increases at more than 2% per year. Although over-exploited in some regions, Indonesia'a marine and coastal resources are presently under-utilized on a national basis and represent a significant opportunity for enhanced economic diversification. By broadening the base of the Indonesian economy, exploitation of the sector could provide the basis for improving the socio-economic conditions for the residents of the 7122 coastal communities who are among the poorest citizens of Indonesia (CIDA, 1987a).

The coastal waters and bordering land support a variety of economic sectorial activities: shipping and ports; oil and gas development, coastal fisheries, aquaculture, agriculture, forestry, mining (tin, iron sands, coral and sand), industry, tourism, transportation and communications, and coastal community activities (Table 1).

TABLE 1. Estimate of Economic Activity in Marine and Coastal Regions, 1987 (BAPPENAS, 1988, Samsi, 1989).

	Coastal Subsectors	Rupiah (Billions)
1.	Shipping and Ports	4,905
2.	Oil and Gas	11,777
3.	Capture Fisheries	1,589
4.	Aquaculture	319
5.	Agriculture	3,674
6.	Forestry	295
7.	Mining	116
8.	Industry	7,588
9.	Tourism	694
10.	Transportation and Communications	5,528
11.	Coastal Community Activities	128
Total		Rp. 36,643

These marine and coastal activities play a significant role in Indonesia's economy, representing Rp. 36.6 trillion (US$ 22.3 billion) in 1987, or, an estimated 22% of the GDP. These revenues directly or indirectly support about 60% of an estimated 136 million people currently residing in the coastal areas (BAPPENAS, 1988), or about 48% of the population of the country. While the economic contribution of the fisheries subsector alone to the GDP is only 2% according to "1986" statistics, this subsector represents only one of an entire spectrum of coastal activities. According to Samsi (1989), the fisheries sub-sector over the last decade represented 5% per annum or about one fifth of the "coastal" contribution to the GDP. Preliminary estimates indicate that marine and coastal activities directly employ a labor force of 13.6 million people from which about 3 million are directly engaged as fishermen and aquaculture workers. The growth rate of the marine and coastal sector "is at least twice that of traditional land-based activities, suggesting that their role in the sustainable economic development of Indonesia can only become more prominent" (BAPPENAS, 1988).

Despite the reported "low" economic contribution of the fisheries sub-sector to the GDP, it is difficult to ignore the 22% contribution provided by the entire realm of marine and coastal activities. The fisheries sub-sector is more important than these 1986 statistics indicate since: (1) the industry is rapidly increasing (Soewardi, 1989), (2) the by-catch of many fishermen never enters trade channels, (3) commercial fishing is currently confined to a narrow band of inshore waters, especially off northern Java, and, (4) subsistence fishing is an unmeasured but significant occupation of millions. With many of the existing coastal activities in Indonesia interactive and linked to terrestrial based land use practices, and with coastal activities providing a significantly increasing fraction of the nation's economy (BAPPENAS, 1988), all coastal activities must be considered as part of an interactive biophysical, social, and economic system.

The significance of coastal and marine activities is reflected in the following examples: coastal marine fisheries supply an estimated 60% of the animal protein consumed in Indonesia, about 40% of the nation's oil and tin is produced offshore, coastal areas at the base of large watersheds contain some of the more fertile agricultural lands where the production of estate crops is concentrated (oil palm, coconut, and sego palm, etc.), and coastal tourism is an important growing source of revenue (BAPPENAS, 1988). In 1984, there were 683,000 tourists (mainly on the islands of Java and Bali) with revenues totalling US$ 519 million.

By 1989, 1.2 million tourists are anticipated (The Europa Yearbook, 1988). These data represent a projected 76% increase in the number of tourists with revenues almost tripling (US$ 1460 million according to international exchange rates of September, 1988) in this sector alone over a five year period.

III. SUMMARY OF INDONESIA'S MARINE AND COASTAL SECTOR ECONOMIC ACTIVITIES, ISSUES, AND RECOMMENDATIONS (ADAPTED FROM CIDA, 1987a)

A. Shipping and Ports

As an archipelagic nation, Indonesia relies on shipping as an important mode of transportation for goods, services, and people. It's waterways, including inland seas, straits and large rivers, such as those found in Sumatra, Kalimanatan and Irian Jaya, cover a navigable length of more than 12,300 kilometers. An efficient shipping and port system is essential to reduce the cost of trade and to facilitate economic development of non-oil revenues. Most of Indonesia's commercial ports are not equipped for the introduction of modern cargo handling technologies.

Since petroleum production is a major economic activity in Indonesia, numerous oil-carrying tankers operate in Indonesian waters. Approximately 100-150 domestic tankers per month ship crude oil from offshore terminals and refined petroleum products from the Balikpapan refinery. Furthermore, non-Indonesian oil tankers transit Indonesian waterways to travel from the Middle East and Africa to East Asia and Western North America. With new regulations restricting the size of tankers which may operate in the Strait of Malacca, approximately 25-30 large crude carriers and 100-150 tankers use the Celebes Sea and the Makassar-Lombok Straits annually as the main transportation route between the Indian Ocean and the Pacific, thus adding to the already congested shipping lanes in Indonesia's coastal waters.

Issues. The size and number of vessels using the Makassar and Lombok straits, coupled with the oil exploration and production activities in the Makassar straits, makes the area a high risk potential for shipping accidents and oil spills, as well as potential conflict with local fisheries activities.

The Malacca Strait is even more congested despite the new regulations restricting the size of tankers which may operate in the strait. An average of 150 ships pass through the strait every day (Wisaksono and Bilal, 1988), and much of Indonesia's fisheries activities are concentrated in those waters (Chia, 1988). The Strait of Malacca is rich in fisheries which is to be expected given the abundance of mangroves along its shores. Areal estimates of mangroves by Wiroatmodjo and Judi (1978) along with Sumatran coast are 50,000 hectares for Aceh, 60,000 hectares for North Sumatra, and 95,000 for Riau (Koesoebiono et al., 1982). In a recent survey of fish resources by the Indonesian Directorate General of Fisheries, the fish stock density in the 55,000 square kilometers of the Indonesian portion of the Strait of Malacca was estimated at 4.6 tons per square kilometer for demersal fish and at 4.0 tons per square kilometer for shrimp. For pelagic fish and shrimp, the stocks are higher than in any other area in Indonesia, while for demersal fish stock it is nearly as high as that of the Java Sea (4.00 - 4.24 tons per square kilometer), the highest in Indonesia (Soesanto, 1985). Furthermore, with no shore reception facilities available for the discharge of ballast water, raw sewage and solid waste, many vulnerable coastal areas along the Makassar, Lombok and Malacca Straits are at high risk for impact from these activities.

Recommendations to address the issues associated with shipping activities in Indonesia's waters include:

- development and implementation of regulations to eliminate and control accidental discharges from ships as well as to insure port reception facilities to receive waste discharges;
- development of vessel traffic management and separation schemes;
- development of a coastguard enforcement capability; and
- upgrading Indonesia's port system for more efficient cargo handling.

B. Oil and Gas Development

Oil and gas development activities in Indonesia include extensive offshore exploration and production, heavily used tanker lanes serving Pacific rim nations, refineries and large-scale terminal operations.

According to 1985 statistics, recoverable oil reserves were estimated at 8.65 billion barrels (2% of the world's total) and recoverable reserves of natural gas were estimated at an equivalent 14.5 billion barrels of crude oil. Indonesia, a member of OPEC, is the largest exporter of oil in Asia and is one of the leading producers and exporters of liquified natural gas (LNG). All the natural gas produced in North Sumatra is exported entirely to Japan (Chia, 1988). Oil and gas development is anticipated to continue to be Indonesia's leading source of export revenues despite the present slump in global petroleum prices.

An estimated one-third of Indonesia's oil production is currently located in offshore areas of the Java Sea and Makassar Strait. Key exploration areas include the South Java Sea, the Strait of Malacca, the South China Sea surrounding Natuna Island, West Kalimantan, Malacca Strait, and South Sulawesi. Offshore oil and gas development are linked to numerous related support activities, such as shipping operations that supply drill rigs and offshore installations, as well as onshore infrastructure and support services that are a source of employment and local business opportunities.

Issues. The primary conflict or constraint of Indonesia's oil industry activities is the potential for major oil spills. The country's oil-spill response capability and contingency capabilities is limited. Although there exists legislation (1982) that requires oil-related development projects to produce contingency plans, a national oil spill contingency plan has not been developed, much less implemented.

Onshore petroleum facility operations can have potential impacts to local coastal areas and nearshore waters through, for example, chronic discharges of pollutants, air emissions, conversion of coastal land to industrial use, development of new coastal communities and associated population-based impacts (e.g., sewage disposal). Such chronic pollution has the potential of affecting fishing incomes and food sources for locals.

Recommendations to alleviate the pressures of oil and gas development on coastal and marine resources include:

- development and implementation of a national oil spill contingency plan; and

- development and implementation of regulatory guidelines for petroleum industry operations (e.g. exploration, development, production, refining, transportation, support, etc.).

C. Fisheries

Fisheries are the fifth largest non-oil export commodity in Indonesia. The majority of the country's fish production is consumed by the domestic market, with fisheries products comprising two-thirds of the animal protein consumption of Indonesia. Indonesia's fisheries sector involves two main types of capture fisheries: a coastal inshore fishery operating within the 12-mile territorial seas, and an offshore fishery operating from the 12-mile limit of Indonesia's territorial seas and extending to the 200-mile exclusive economic zone (EEZ).

Coastal inshore fisheries, concentrated in the Malacca Straits, the North Coast of Java, the Bali Straits and Sulawesi, consist of traditional small-scale artisanal fishermen. These artisanal fishermen generate approximately 95% of Indonesia's total fish production using long lines, traps, gill nets and various types of seines (Samsi, 1989). It is estimated that more than half of these landings are consumed for subsistence or sold "fresh" in local markets. As the country's population continues to grow, the domestic demand for fish is anticipated to expand. Indonesia's annual per capita fish consumption increased from 8.0 kg in 1960 to 15.0 kg in 1987 (Samsi, 1989). The government's objective is to increase per capita fish consumption to a minimum 18.0 kg by the year 2000. An annual increase of 0.8 million metric tons over present production levels is necessary to maintain the current per capita fish consumption alone.

The offshore fishery, which accounts for about 5% (Samsi, 1989) of the total fish production in Indonesia, is capital intensive, using large seagoing vessels to capture such pelagic species as tuna and shrimp. Shrimp exports provide the major source of foreign exchange revenues from the fishery sector, accounting for about 32% of the total offshore capture fishery export volume and 73% of the value. Capture fishery-related export revenues are projected to increase by an estimated 400% by the year 2000 (from US$ 280 million to more than US$ 1 billion).

There exist large unexploited pelagic fish stocks, especially in the eastern half of the Indonesian archipelago. Many pelagic stocks utilize nearshore coastal waters as nursery grounds. The total sustainable potential catch is 6.6 million tons per year, with the potential of 4.5 million from Indonesian internal territorial waters within the 12 mile limit, and 2.1 million tons from the Indonesian EEZ beyond the 12 mile territorial waters. The total production in 1987 was 1.9 million tons, or only 29% of the potential maximum sustainable yield (Samsi, 1989). Current production from the EEZ is only 35,000 tons or 1.7% of the potential yield from Indonesia's EEZ. (Berwick and Soewardi, 1989). Therefore, there exists the potential to quadruple the nearshore catch and increase the offshore catch over fifty-fold to reach the theoretical sustainable yield. This enormous potential for growth is recognized by the government as a means to increase current protein production levels in light of rapidly diminishing arable agricultural lands.

Although only 5% of the total national work force is absorbed by the fisheries sub-sector which provides employment for 3 million fishermen and fish farmers, the true total, which would include artisanal and subsistence fishermen, is not known. The low employment rate of this commercial sector is attributed to the extremely low standard of living of the fishermen, whose average annual income is US$ 300. Given these circumstances, coupled with the low contribution of the fisheries sector to the GDP (2%), it is anticipated that future population growth will be accompanied by (1) pressures to find employment and revenues in the coastal zone outside the fisheries sector or by (2) expanding utilization of under-exploited fisheries resources.

Issues. The major sources of stress on fisheries resources are: overfishing in nearshore waters off densely populated coastal communities (e.g. Malacca Strait and the North Coast of Java), habitat destruction, and coastal pollution. Additional constraints to the economic development of the fisheries sector include inadequate infrastructure, marketing and distribution facilities, insufficient skilled manpower, shortage of capital and credit, and inefficient production unit technology. Basic information on fish stocks, sustainable yields, fishing grounds, and up-to-date information on fish handling, preservation, processing and distribution methods is not readily available.

Although regulation of fish catches is beginning to limit overfishing, coastal habitat degradation poses the most serious threat to coastal fisheries if existing trends continue. Pollution discharges from land (e.g. pesticides from agriculture practices, siltation from forestry practices, raw sewage discharge, etc.) are the regular by-products of daily activities that impact coastal fisheries habitat. However, information is lacking as to their precise impacts.

The greatest source of stress on coastal and nearshore fisheries is the physical modification of coastal habitat resulting from extensification of inappropriate land use management systems such as tambak, as well as subsistence and cash farming systems in tidal swamps, wetlands, and other marginal coastlands. The destruction of mangroves, seagrass beds, and coastal wetlands has eliminated spawning, nursery, and foraging grounds for 60 to 80 percent of commercially valuable coastal fishery species (Samsi, 1989).

The major exploited food resources of coral reefs are fishes. In 1979, the export of reef-associated fish from Indonesia earned more than US$ 97 million, or 16% of the total revenues from fish export (Salm, 1984). The predominant destructive causes of the coral reef resource base upon which these fisheries depend are: (1) extractive activities such as coral mining for use in lime, calcium carbide, and cement production, and removal of corals for the lucrative curio trade; (2) destructive fishing methods such as dynamite, muro ami net, and fish traps; and (3) sedimentation and sewage pollution from land-based sources (Hutomo, 1987).

Critical fishery habitat management is necessary to production. Unless effective habitat management exists, fish stocks will decline, and marketing and technology/infrastructure modernization will be of little use. Major constraints to effective coastal habitat management include: (1) lack of clear delineation of the responsibilities of individual ministries regarding cross-sectoral impacts; and (2) the fact that coastal habitats are not subject to local government management, since provincial authority extends only to the waterline.

Rapid commercialization of this sector likely to pose some problems as reflected in the unanticipated adverse environmental and economic impacts that caused a

market-driven change in technology in the Mandar flying fish fishery of South Sulawesi. Mandar Province in Indonesia is a land-poor, ocean-rich region of fishermen and traders. Mandarese fishermen in South Sulawesi have exploited flying fish for subsistence and "local" markets over the centuries utilizing barrel-shaped basket traps (buaro traps). In the 1970s a Japanese market for flying fish roe developed. Prior to the development of this export market, fishermen would realize about US$ 75 per voyage (2 weeks up to a month in duration). Now the roe yields US$ 3000 for a one week trip. The increase in number of gill net users (from 247 in 1969 to 1700 in 1976), who typically deploy as many as 30 sets of nets at one time and capture about two tons of fish/week, has resulted in a decreased catch of flying fish after 1980 (i.e., from 1200 tons/yr. to 566 tons/yr.) (Zerner, 1987).

Recommendations to realize the socio-economic potential of the fisheries sub-sector include:

- development of "awareness enhancement" programs on, for example, the relationship of fish production to coastal ecosystems;
- development of an accessible information base on stock assessment and fishing grounds/fish habitat, resource mapping, and fisheries research with particular emphasis on the economic and environmental effects of habitat conversion (e.g., tambak and agriculture) on natural fish stocks;
- development of programs to evaluate and monitor the impacts of other resource use activities on fisheries and critical fish habitats;
- development and implementation of fisheries management guidelines that address water quality issues and destruction or alteration of critical fishery habitat as part of the overall management strategy;
- delineation of responsibilities of the ministries involved in cross-sectoral activities;
- development and implementation of provincial regulations on coastal habitat utilization;

- development and implementation of regulations on fisheries exploitation that include multiple use zoning of waters and rotational fishing practices as a means of addressing the uneven distribution of fisheries exploitation;

- development of programs to encourage harvesting and utilization of under-exploited stocks;

- coastal habitat restoration (e.g. mangroves seagrass beds, and coral areas); and

- technology and infrastructure modernization and associated training.

D. Aquaculture

The dominant form of aquaculture in Indonesia is fish and shrimp culture in brackish water ponds called tambak. According to 1987 statistics, there are about 240,000 hectares (ha) of tambak located primarily along the coasts of Java, Sulawesi, Kalimantan, and Northern Sumatra (Samsi, 1989). Between 1974 and 1985, total tambak area increased by approximately 30% while production increased by 136% and the value of production (unadjusted for inflation) increased by 1205%. Total 1985 production was 156,367 metric tons (mt) consisting of 118,079 mt of fish and 38,288 mt of shrimp. Production is largely milkfish (70%), other fish species, tiger shrimp and other shrimp species. Fish output as a percentage of quantity has decreased from 83% to 76% over the last decade, while shrimp output over the same period rose from 17% to 24%. Total value of production in 1985 was Rp. 235 billion, of which fish represented 57% and shrimp 43% of the total. The 1989 value of production is anticipated to exceed Rp. 350 billion (Samsi, 1989).

Aquaculture production in the form of brackishwater, paddy field, and cage culture increased 7.7% between 1976 and 1984 and 9.2% between 1984 and 1987 (Samsi, 1989). Expansion of aquaculture operations holds promise toward meeting the domestic demands for protein production. Approximately 80,000 households are directly involved in aquaculture production. Additionally, related activities such as fry production, provision of inputs, marketing, processing and construction profvide a source of employment and income to coastal communities.

Government programs call for aquaculture output to be increased through "intensifikasi" (i.e., higher yields from existing tambaks) and "extensifikasi" (building of new tambaks). Under the "intensifikasi" programs, it is expected that existing aquaculture operations can increase productivity levels through better management of water quality, and quantity, improved habitat, higher stocking rates, development of enriched feeds, disease diagnosis and treatment, and development of polyculture and alternate rearing technologies (e.g., cage culture). Under the "extensifikasi" programs, significant new hectarage is expected to be brought under cultivation with most of this expansion anticipated to occur in new areas (e.g., Kalimantan, Nusa Tenggara, etc.). Since only 240,000 of the 840,000 ha identified as having potential for brackishwater shrimp and milkfish culture have been developed, the government has targeted an average annual increase in tambak production of 11.5% per year during REPELITA V (Samsi, 1989). The average tambak presently produces an estimated 287 kg shrimp/ha /yr, which is greater than the offshore shrimp yield (Whitten et al., 1987).

Issues. The principal issue in the expansion of aquaculture is the extent to which new tambak development be allowed at the expense of coastal ecosystems (e.g. mangroves and tidal swamplands) that support other coastal resource uses (e.g. fisheries and forestry). Development of brackish water fisheries using tambak should proceed to ensure the sustainable utilization of the mangrove resource base since the loss of one hectare of mangroves to tambak (and the production 287 kg. of shrimp) results in an approximate net loss of 480 kg of offshore fish and shrimp catch. This reflects a net loss in permanent production of about 200 kg. However, in terms of monetary value, shrimp are about ten times as much as finfish (i.e., Rp 15,000/kg of shrimp vs. Rp 1500/kg finfish) (Samsi, 1989).

In Sumatra, the profits from the export of prawns subsidizes the sale of fish which are caught in trawlers' nets (Whitten et al., 1987). With the influence of mangroves extending beyond the prawn fisheries themselves (e.g. nearshore finfish nurseries), widespread loss of mangroves and intertidal habitat to tambak combined with overexploitation of immature shrimp stocks has the potential to severely impact not only the offshore capture fisheries, but also the post-larvel

fishery necessary to stock the ponds for the production of tambak-raised shrimp (Berwick, 1988). In turn, these impacts are likely to result in loss of employment and income. Indonesia's fisheries industry which depends on mangroves was valued at US$ 192 million according to 1978 statistics (Turner, 1985).

An assessment of the impact of a mangrove reclamation project on the largely deforested south Java coast conservatively estimated that the development would eventually lead to loss of employment for 2400 fishermen in the area and loss of US$ 5.6 million on annual income (Whitten et al., 1987). Therefore, the Government of Indonesia has declared a 200 meter green belt of mangroves measured from the lowest low tide. A potential negative impact of aquaculture operations on coastal capture fisheries can come from uncontrolled fishing for shrimp larvae to stock the tambak. The potential wildstock of shrimp post-larvae is estimated at one billion. The "current" capture of shrimp post larvae according to 1979 statistics averaged about 800 million (Juyanto, 1979). The by-catch of non-shrimp larvae of finfish are often killed accidentally in the fine mesh nets necessary for the capturing of the shrimp post-larvae. This practice has the potential of impacting artisanal fisheries by eliminating schools of baitfish necessary for line fishing as well as the immature stocks of economically important species of fish and invertebrates (Berwick, 1988).

Aquaculture operations are particularly susceptible to the downstream influences of land use activities. These result in siltation from poor forestry practices, fertilizer and pesticide loading from poor agricultural practices, toxic and heavy metal loading from uncontrolled industrial discharges, and nutrient loading from domestic sewage output. Additional impediments to expansion of Indonesia's aquaculture potential include the lack of investment in, for example, cage culture as an alternative to tambak and lack of training in appropriate hatchery technology.

Recommendations necessary for sustainable development of Indonesia's aquaculture activities include:

- development and implementation of programs to monitor and manage the impacts of other resource use activities on aquaculture;

- conducting applied research and pilot feasibility studies to improve the database on, for example, the impact of tambak on coastal ecosystems (i.e. mangroves), etc.

- identification of appropriate areas for tambak intensification and extensification of other culture techniques seaward;

- implementation of NES (nucleus estate and small land holder) schemes in developing shrimp culture where the private sector will act as a nucleus and support fish farmers as the plasma;

- initiation of integrated marketing programs to assist the industry and community organizations to better exploit market potential;

- development and establishment of aquaculture oriented training and education programs; and

- upgrading extension staff to enforce existing Indonesian legislation (e.g., present law calls for a 200 meter "buffer zone" of undisturbed mangrove to be left between the coastline and tambaks. However, this rule is seldom known or enforced.

E. Coastal Agriculture

There is no clear delineation between coastal agriculture and upland agriculture in neither the national guidelines (GBHN) or the Five-Year Development Plan (REPELITA V). For the most part, specific statements are given only when referring to a particular development closely related to the coastal zone such as fishery development or coastal village development.

Rice, the most important agricultural commodity of Indonesia, dominates the coastal plains of North Java where conditions of high irrigation potential are coupled with suitable soil types. Along coastlands of Sumatra, Sulawesi, and the north coast of Java, polyculture systems combining brackish water fishponds and rice paddies prevail. These operations contribute significantly to export earnings from shrimp culture as well as to food supply.

Coastal resource use of agricultural land is traditionally one of multiple use, either simultaneously or sequentially on the

same site, or on different ecosystems within the same coastal region. Examples of such uses include: salt production (the "dry season" use of tambaks), estuarine and inshore fisheries, harvest of forest products (e.g. nipah palm, sego palm, charcoal production from mangroves), and cash crop agriculture (e.g. coconut plantations). The variations in coastal agricultural operations take advantage of their synergistic interactions to counteract subsistence and production constraints. Such traditional farming practices will most likely continue since fragmentation of land continues due to the increasing growth of population. Understanding of local traditional patterns of agricultural coastal zone use complemented by development of agricultural technologies specific to the coastland environment is imperative to sustainable development of the coastal agriculture sector.

Issues. Indonesia is experiencing losses in arable land. In Java, for example, the annual loss of arable land due to new settlements as well as industrial estates and associated infrastructure is estimated at 100,000 hectares (Soewardi, 1989). This problem is exacerbated by the need to increase food and protein production to accommodate Indonesia's growing population. Consequently, in order to meet GBHN National Policy objectives on agriculture....(1) "agricultural development through diversification, intensification, extensification, and rehabilitation"; and, (2) "improve nutritional standards through diversified foodstuffs and increase protein consumption of both plant and animal protein"...., there is increasing pressure for the development of new lands for agriculture. As a result, cultivation has been pushed to marginal uplands as well as to marginal coastlands (e.g., tidal and mangrove swamps).

However, most of the land currently available for agricultural expansion in the coastal zone has varying fertility, acidity, and drainage not necessarily conducive to agricultural use, with a potential for lower yields than those coastlands currently under cultivation. In Java, for example, tidal swamplands converted to rice paddies yield only one-fifth of the rice produced in the best fields. Although off Java there is interest in expanding rice development by opening freshwater coastal swamplands found along the east coast of Sumatra and South Kalimantan, these areas are peatlands that are not suitable for agriculture.

Conversion of mangrove swamps to agriculture production not only results in non-productive sulfate soils but also results in loss of habitat essential to fisheries. Furthermore, coastal wetland agricultural sites are the potential recipients of downstream industrial effluents, and, downstream aquaculture and nearshore fisheries activities are the potential recipients of pesticides and nutrient loading from agricultural runoff.

Development of a marginal coastlands for agriculture are also characterized by limiting socio-economic factors. Many of these lands are remote from population centers, and, existing nearby coastal communities have the lowest per capita income in the country. Another constraint to the extensification of agriculture to marginal coastlands is the lack of agricultural technologies specific to such marginal lands.

Added to these problems with coastal agriculture are increasing sectoral and subsectoral land use conflicts (e.g., aquaculture, forestry, tourism, etc.) as well as conflicts between special interest groups within the coastal agriculture subsector (e.g., small holders, private companies, and estate-owned companies). To address these conflicts the Government of Indonesia has launched several programs such as NES/PIR (Nucleus Estate and Small Holders) and cooperative development.

Recommendations: Given (1) the increasing person to land ratio as a result of Indonesia's rapidly expanding population (2% per year), (2) the increasing losses of arable land to development, (3) the need for increasing animal protein production/consumption to meet the target minimum annual per capita nutritional standard of 18.0 kg protein by the year 2000, and, (4) the fact that an estimated 60% of the animal protein consumed in Indonesia is supplied by an under-exploited coastal marine fishery, three choices seem apparent:

- develop agricultural techniques specific to marginal coastlands and expand agricultural production to these lands;
- intensify existing agricultural production by using, for example, mixed-crop and polyculture techniques;
- "increase fishery production to meet the requirements of food nutrition and export through fishery culture in the coastal zone, brackish

water as well as freshwater, and fish catch in the coastalwaters as well as offshore and EEZ" (GBHN National Policy on Agriculture).

During REPELITA V the Ministry of Agriculture intends to focus its efforts towards increasing fishery production as the primary mechnaism for addressing the protein nutritional requirements of the nation since these requirements cannot be met by land-based agriculture alone (Soewardi, 1989).

Additional recommendations for sustainable development of the coastal agriculture sub-sector include:

- development of institutional mechanisms for subsector policy development and program implementation in integrated resources planning and management of upstream development to avoid conflict with downstream coastal uses;

- establishment and implementation of control systems and policies for management of water distribution, pesticides, herbicides, fertilizers, and industrial effluents to minimize downstream impacts to existing agricultural lands in coastal areas; and

- development of training and public education programs concerning proper pesticide, herbicide, and fertilizer use; etc.

F. Coastal Forestry

The coastal forestry subsector in Indonesia is primarily associated with coastal forests which occupy the dry, sandy, and rocky coastal area above the highest high tide line, tidal freshwater swamp forests, and mangrove forests.

The most important tree species in the first category are Baringtonia species, *Terminalia catappa*, *Calophyllum inophyllum*, *Hibiscus tiliaceus*, *Casuarina equisetifolia* and *Intsia biyuga*. These species produce timber for construction and ship building. As such, these forests are under increasing over-exploitation pressures. Only on the more remote islands of the archipelago does this type of coastal forest system continue to function without deterioration (Samingan, 1989).

Tidal freshwater swamp forests mainly occupy the eastern coastal plains area of Sumatra. Among the important tree species of these forests are meranti (Shorea spp.), merawan (Hopea spp.), punak (Tetramerista spp.), nyatoh (Palaquium spp.) and soulatri (Calophyllum spp.).

Freshwater swamp forests have agriculture potential when drained and are thus one of the targets for conversion to agricultural use in transmigration settlement programs. There are only a few thousand hectares of these forests remaining as a result of deforestation practices and those, for the most part, consist of the fire-resistant, low quality timber producing tree species known as gelam (Melaleuca leucadendron (Samingan, 1989).

Indonesia's mangrove resources are the largest in the world at 4.25 million hectares according to 1982 Bina Program (Director of Forest Planning) statistics. The greatest extent of Indonesia's mangroves is found in Sumatra, Kalimantan and Irian Jaya. Mangrove forests are one of the most productive and biologically diverse ecosystems in the world, providing habitat for more than 2,000 species of fish, invertebrates, and epiphytic plants (Hamilton and Snedaker, 1984). In addition to providing an important source of fuel, pulpwood and chips, timber, charcoal, and tannin for batik dyes for coastal communities, mangroves play an important role in (1) the stabilization of shorelines, (2) the maintenance of estuarine and coastal water quality, and (3) providing key nursery and foraging habitat for commercially important species of prawn, crab, shrimp, and fish.

There are several zones of specific species associations which comprise the mangrove forests:

- the zone of Sonneratia spp. occupying the area heavily influenced by the sea and characterized by a deep soft mud substrate rich in organic matter covered by the dense aerial-root system (pneumatophores) constructed by the Sonneratia trees;

- the zone of Rhizophora spp. adjacent to the Sonneratia zone forming the primary outer zone of the entire mangrove environment and characterized by a deep soft mud substrate rich in organic matter, a strong tidal influence, and pneumatophores;

- the zone of Bruguiera spp. inland to Rhizophora spp., which comprises the best spawning grounds for various fish species, and which are characterized by a soft, organic-rich substrate well-covered by intertwined root systems and deep tidal sea water influence;

- the Ceriops zone dominating the landscape inland from Bruguiera and characterized by minimal tidal influence; and

- the Nipa zone, a transition between mangrove and freshwater environments.

Martosubroto and Naaiman (1977), in a study relating the surface areas of tidal mangrove forest and the commercial shrimp production in these areas and offshore waters in Indonesia, determined that shrimp production increases with the size of the tidal forest. With shrimp abundance in offshore waters dependent, among other factors, on recruitment of juveniles from inshore mangrove estuaries, offshore landings will decrease in proportion to destruction of mangrove areas. Zalinge and Naaiman (1977) report the annual yields of fish at 667 kilograms per hectare and shrimp at 100 kilograms per hectare in the coastal waters off South Java that are largely supported by mangrove systems. Shrimp exports provide a major source of foreign exchange revenues, accounting for 90% of Indonesia's fishery exports if the offshore shrimp fishery and tambak shrimp exports are combined. (Goodland, 1981).

Burbridge (1983) compares the 1978 values of mangroves for fisheries (US$ 194 million) and for forestry (US$ 37 million) in Indonesia to demonstrate a fishery value of mangroves approximately 5.2 times greater than the forestry value and the significance of mangroves as the basis for sustained fishery development. Goodland (1981) reports a value for Indonesia's fishery exports (90% shrimp) at US$ 165 million for 1977/78. Using this latter more conservative figure demonstrates a fishery value for mangroves approximately 4 times that of the forestry value.

Coastal forest ecosystems perform important functions in the maintenance if coastal water quality (Wiebe, 1988). At the local level, coastal

forests provide an opportunity for a limited, but renewable source of fuel, timber, food resources, and other products such as tannin, agricultural fertilizer, textiles, etc. Coastal forest ecosystems are intimately linked to upland and coastal influences - a linkage that offers a number of resource use opportunities, provided that management strategies for coastal forests are used in conjunction with the management of upland and coastal uses.

Issues. The primary threats to the coastal forest system in Indonesia are clear-cutting, conversion to agricultural and aquacultural uses, and diversion of freshwater from upland watersheds for agricultural purposes altering hydrology and circulation patterns. Conversion of coastal forests to agriculture or aquaculture can result in soil acidification, loss of timber reserves, disturbance of estuary-dependent stocks, and an increase in malaria and waterbone diseases. Increasing harvests of the *Sonneratia* proproots for use in making "shuttle-cock" is resulting in localized erosion of coastal areas (Samingan, 1989). Degraded or over-exploited coastal forests are leading to salt intrusion, coastal erosion, as well as changes in vegetative cover, which, in turn, are resulting in loss of key habitat for commercially important species of fin and shellfish.

In Java, Madura and Bali where the human population is very dense, the mangrove forests have mostly been converted to tambak or agricultural land (Sukardjo, 1980; Sukardjo and Ahmad, 1982). Along the coastline of East Java, the west coast of Bali and in Madura, only poor quality remnants of once extensive mangrove forests are to be found (FAO, 1985). Between 1969 and 1979, 700,000 hectares of mangroves were converted for rice fields, aquaculture, and other agricultural uses (Luken, 1983). Since 1975, more than 200,000 hectares of mangroves have been clearfelled for woodchip production (Saenger, 1983). These figures represent an estimated 19% loss in Indonesia's mangrove resources in about ten years.

Recommendations to address these issues include:

- utilization of satellite imagery for mapping coastal areas and inventorying coastal forest resources;

- development of research programs to: identify the function and process of coastal forest ecosystems, determine the role of these forests in the productivity of commercial and subsistence fisheries, examine the economics of forestry policy in relation to other coastal sub-sectors, and monitor harvesting and conflicting uses;

- development and implementation of integrated coastal forest land-use programs, including the establishment of conservation programs; and

- establishment of public education and awareness programs on the conservation and use of coastal forests, etc.

G. Mining

The primary coastal-related types of mining activities in Indonesia include tin, coral, and sand mining. Tin reserves have been estimated by Sujitno (1974) to be 1.64 million tons of which 43% are located offshore. Coral is directly extracted for a variety of construction and industrial purposes (e.g. see lime, calcium carbide, and cement production), as well as for agricultural lime. Sand mining and coral extraction collecting activities are small scale operations by coastal fishermen of farmers seeking alternative sources of income. Although there is thought to be extensive pollution of the waters off the Belitang Islands (Kent and Valencia, 1984), the effects of tin mining on fish breeding and feeding grounds and upon tourism activities need to be assessed (MacDonald, 1981). Since Burbridge et al. (1988) among others, report no documentation on the impact of pollution due to tin mining in Indonesia's tin belt and a literature review by the author on tin and sand mining in Indonesia revealed no documentation as to the impacts associated with these mining activities, this paper will focus on coral mining and associated issues.

Coral reefs rank among the most productive ecosystems in the world, along with mangroves and seagrass beds. In terms of biological diversity, coral reefs represent the marine version of tropical rainforests, rivaling their terrestrial counterparts in productivity and richness of species. Coral reefs and their surrounding support systems (e.g., seagrass beds) provide key habitat for an estimated one-third of commercial fisheries resources (Ehrlich, 1977). Coral reef-dependent artisanal

fisheries account for up 90% of Indonesia's fish production (Soegiarto, 1977). Coral reefs supply food for harvestable pelagic fisheries in non-reef areas as well (Grannperrin, 1978). Indonesia's coral reefs also play an important role in protecting the majority of the island archipelago from storms and erosion in addition to their aesthetic value for the country's burgeoning tourism industry.

Issues. Over-exploitation of beaches and the nearshore, primarily through largely uncontrolled extraction of sand and corals for construction is leading to coastal erosion in a number of areas. For example, Cilincing Beach in Jakarta retreated about 50 meters at an average annual rate of 0.76 meters during the 65 year period between 1873 and 1938. From 1951 to 1975 shoreline retreat totaled 600 meters at an average rate of 24 meters per year. In the 3 year period between 1972 and 1975, the total retreat was 260 meters, or an annual recession rate of 87 meters. The main cause of the shoreline recession was the mining of about 200-300 truckloads of sand per day by the local people. Sedimentation from rivers was not sufficient to balance this loss (Pardjaman, 1977).

The coral islands Ubi Besar and Nirwana have decreased to about half their original size by coral mining. Although there are now regulations forbiding any type of mining in the Jakarta area, such activities continue to occur in Pulau Seribu (National Marine Park of Thousand Islands) and in the Komodo Islands (Taufik, 1987). Coral mining also occurs in proposed nature reserves at Pombo and Papagaran Islands in eastern Indonesia, where about 30% and 80% of these islands respectively have been destroyed by dynamite fishing (Kvalvagnaes and Halim, 1979a and b). At current levels of Indonesia's coral mining activities, reef communities are unable to generate new reefs to balance the rate of exploitation. Such a loss reduces the resistance of the reef to wave action, increases the likelihood of storm damage and beach erosion, and reduces the aesthetic qualities of the reef. The long-term effects on reef structure are not yet known. However, there is a positive correlation between fish standing biomass and the proportion of live coral cover (Carpenter et al. 1981). Although not strictly an extractive activity, widespread use of dynamite fishing is totally destructive of coral reef structure. Because most coral species grow at an averagerate of 10 centimeters per year, such destructive practices essentially render them a non-renewable

resource. The importance of reef-associated fish to Indonesia's export revenues was discussed in the fisheries section above.

Recommendations to address these issues include:

- conducting applied research on the ecology of coral reefs as a basis for formulating management and conservation guidelines;
- development and implementation of regulations to ensure conservation of coral reefs including the establishment of marine parks and multiple use conservation areas;
- development of alternative sources of income to offset the socio-economic effects of restricting sand and coral mining (e.g., exploitation of terrestrial sources of construction materials); and
- development of public awareness programs in addition to provision of formal education and training opportunities to increase resource management understanding among members of coastal communities, etc.

H. Industry

Indonesia's coastal zone is the target for the establishment of industrial centers and the development of regional industrial initiatives. Existing industrial uses include petrochemicals, steel, fertilizers, pulp and paper, coal, palm oil, electronics, and textiles, the leading manufacturing activity. Potential for expansion exists in the petrochemical, fertilizer, and pharmaceutical industries with an anticipated benefit of lessening the population flow to urban areas while at the same time strengthening the rural and coastal economy.

Issues. The major issue in industrial development in the coastal zone is the generation of toxic and hazardous waste effluents. For example, the preliminary investigations on mercury contamination in Jakarta Bay indicate concentrations two-to-three orders of magnitude above natural concentrations. This contamination is particularly acute in April and October, the transition period between monsoon seasons. Sixty percent of the fish and shellfish samples from Jakarta Bay exceeded the UN World Health Organization (WHO) standards for

acceptable levels mercury (Ongkosongo et al., 1987). Of the 157 samples of fish and shellfish taken from Jakarta Bay, WHO standards for heavy metals were exceeded in 76% of the samples for cadmium, 51% of the samples for copper, 44% for lead, 38% for mercury, and 2% for chromium (Martopo, 1987). Other industrialized seaport areas such as Cilicarp and Surabaya may also have water quality problems, however, data are limited or non-existent. Air discharges from industry also are a recurrent source of pollution.

Recommendations to address these issues include:

- conducting research and development of pilot demonstration projects in water quality management;
- development and implementation of water and air quality regulations to meet WHO standards; and
- development of training programs as well as provision of necessary infrastructure for government personnel to monitor effluents and receiving waters in coastal areas.

I. Tourism

Indonesia's geographic location and physical characteristics are particularly favorable for tourism development. High quality beaches, particularly in the province of Bali, along with crystal-clean waters, coral reefs, underwater grass meadows, tropical fish, a network of more than 20 marine parks, and the cultural variety of coastal communities provide the "appeal" to Bali's tourism industry. Outside Bali, Lombok is the fastest growing tourist area, and there are numerous new untapped opportunities for tourism development (e.g. Flores Island). Coastal tourism currently dominates tourist activities as a potential significant contributor to non-oil foreign exchange revenues and as a labor intensive service industry that supports transportation, communications, accommodations, food supplies entertainment, and local handicrafts. Such service-oriented activities supporting tourism have enormous potential to substantially stimulate national and local employment and income. Tourism currently occupies the number five position in foreign exchange revenues behind oil and gas, timber, textiles, and rubber. In REPELITA V tourism is targeted to become a major source of foreign exchange, second only to timber in non-oil export revenues (Ave, 1989).

In 1987 there were 1,060,347 tourist arrivals in Indonesia, an increase of 28.6% over 1986. From 1985 to 1986 the increase was 10.1% This figure surpassed the 1 million yearly arrival target of REPELITA IV. The total arrivals for 1988 were 1,286,300, an increase of 21.3% over that of 1987. It is estimated that the total earnings for 1988 is US$ 1,060,800 million, or 98.2% of the goal set by the REPELITA IV five-year economic development plan. The economic activity generated by this influx of tourists has led the Government of Indonesia to regard coastal tourism development as a key aspect of the nation's overall program for economic development. During the next five-year plan, the government expects a 15% increase in tourists per year with projected average length of stay between 12-12.7 days (Ave, 1989).

The government is encouraging foreign investment in the tourism sector by creating a favorable climate through wide ranging de-regulation and de-bureaucratization. Hotels, restaurants, travel agencies, and marine tourism are now open to foreign investment. The permit application process has been simplified so that an investor now only needs two, rather than 26 separate licenses, to build a hotel (Jusuf, 1989). A key component of REPELITA V is foreign investment in the tourism industry generally as joint ventures with domestic investors. To further enhance the burgeoning tourism industry, the Director General of Tourism, Joop Avenue, has requested that private companies take 75% of the shares for development of the tourism sector in an effort to increase the role of private companies in encouraging tourism development in Indonesia. The Director General of Tourism has also requested that investors look beyond Bali to other areas of the archipelago (including the potential of the outer islands), and study the advance of the Ancol Recreation Centre that has progressed well in managing tourism sectors (Jakarta Post, October 1988).

In order for tourism to reach the targeted number two position in non-oil foreign exchange earnings behind timber during the next five-year plan (1989 - 1993), the government will pay special attention to the coastal tourism sub-sector with the following targets:

- a 15% annual increase in arrivals,
- a total of 2.5 million tourists per year by 1993,

- a 12-day average length of stay,
- average spending per visitor of US$75 per day, and
- total earnings of US$ 2.25 billion during the next five years.

Seven new tourist destinations outside of Bali have been targeted for development: Aceh, Riau, South Sumatra, West Nusa Tenggara, East Nusa Tenggara, East Kalimantan, and Maluku. The development of these new regions are part of a continuing program to diversity the range of tourist destinations, there have been foreign-assisted development studies of the environment for nature-based tourism to identify the potential for tourist attractions in such areas as Bandanaira in Maluku, Gili Air in West Nusa Tenggara, Maumere in East Nusa Tenggara, and Bintan Island in Riau (Ave, 1989).

Issues. The primary constraints in expanding tourism opportunities are the lack of physical infrastructure in addition to support services such as reliable air transportation, communications, guides, interpreters, etc. The demand for 5,000 tourism support staff per year is met with an estimated 1,400 trained personnel per year. Additional concerns involved in the expansion of tourism in Indonesia include the potential for high densities of tourists and concomitant pressures on local cultures as well as the viability of the coastal resource base to support tourism development. The population explosion resulting from uncontrolled tourism development in the Kuta and Legion of Bali, for example, coupled with the well-planned Nusa Dua development has resulted in a serious solid waste disposal problem. The "dump" is a mangrove area between Dempasar and Nusa Dua. In addition, coral mining of the local reef system for use in construction of the Dempasar Airport and the Nusa Dua jetty has resulted in altering the nearshore current patterns such that nearby tourist beaches are eroding away. Seriously affecting the tourism potential of undeveloped areas is the unmanaged exploitation of coastal ecosystems (e.g., coral mining, destructive fishing practices, coastal agriculture, and forestry practices, aquaculture, etc.) and upland watersheds.

Recommendations to address the above issues and constraints to tourism development include:

- planning coordination of tourism development with existing coastal sector activities;

- development of domestic and international tourism marketing strategies and innovative tourism packaging that is integrated with coastal communities to insure local benefits, and development of training programs in hotel management, guide, and tour operations;

- coastal community development to supply the necessary infrastructure requirements and to insure local involvement in tourism activities; and

- development of public information systems demonstrating environmental and cultural characteristics of the area and awareness campaigns demonstrating the benefits of tourism, etc.

J. Transportation and Communications

"Multimodal" transportation services and communication systems are crucial to the expanded development and utilization of Indonesia's marine and coastal sector, particularly in fisheries regulation, oil and gas activities, and tourism development.

Issues. Indonesia's thousands of scattered islands and widely dispersed population centers continue to be the primary constraint to the economic development of not only the coastal resources sector, but also major terrestrial-based sectors as well.

Recommendations to address Indonesia's transportation and communications needs include:

- development of improved multimodal transportation systems and associated infrastructure for better intra- and inter-island transportation, etc.;

- development of an efficient integrated telecommunications system and associated infrastructure to assist in resources assessment, mapping, monitoring, and fisheries regulation;

- development of improved information processing capabilities; and

- development of improved radio and television networks for education and training purposes.

K. Coastal Communities

Approximately 7,122 (or 11%) of Indonesia's 66,400 villages are coastal communities. These villages have the lowest per capita income in the country. For the most part, coastal communities are involved in traditional fishing and agricultural practices. Less than one-third of this population has an elementary education, and community infrastructure is inadequate. With only an estimated 20 million village residents currently involved in coastal sector economic activities, there exists tremendous potential for these coastal communities to provide a significant portion of the labor force required for the economic development of Indonesia's coastal and marine resource base.

The wide distribution of marine and coastal resources throughout Indonesia offers opportunities, through targeted development, to bring improvements in social welfare and food security to the less advantaged regions and coastal communities. Increased marine and coastal development also has the potential to contribute to a more equitable sharing of development benefits by creating and diversifying employment opportunities in small coastal communities. Such economic diversification will help reduce migration to large urban areas where the capacity of the existing infrastructure is already strained.

A primary thrust of REPELITA V to motivate coastal community development is to provide incentives to the private sector to initiate fish/shrimp brackish water pond culture and marine culture. However, excessive dependence on the private sector through, for example, deregulation packages, might lead to deprivation of land titles for people in coastal communities. Currently, the rush for aquaculture landholdings is driving the economically strong groups to speculate on large-scale land titles. Equitable distribution of land in terms of small holdings must be enforced (Darus, 1989). Measures of success in coastal community development will not be reflected entirely by economic indicators but also by the degree of the participatory management of the villagers in their effort to pursue sustainable development of their resource base.

Sizeable populations residing in coastal communities are directly or indirectly affected by shifts in coastal resources management schemes resulting from natural, economic, or legal pressures. Since most coastal zone dwellers are characterized by low income, lack of social mobility,

and have limited access to alternative economic opportunities, it is important that their resource base be managed on a sustainable basis to ensure continued productivity. Design and enforcement of suitable coastal resources management schemes would economically benefit those people employed in the actual harvest and use of coastal resources, e.g. fishermen, or those employed in related industries such as tourism.

The major issues constraining coastal community development include:

- an adequate legal and administrative framework coupled with an inadequate data base and lack of coordination among local villagers and government agencies in the planning, management, and evaluation of development projects in coastal communities;

- isolation of coastal villages from development centers resulting in inadequate water supplies, roads, energy supply, and necessary facilities for sewage treatment and solid waste management;

- non-recognition that drainage and water management in coastal villages are linked with the larger hydrological system;

- the potential for these villages to exert deleterious pressures on the existing coastal resource base as a result of an increasing population;

- the potential for disruption of traditional multiple use practices and concomitant reduction in income diversification as a result of coastal resource development focusing on single-purpose use (e.g., plantations, hotels, etc.); and

- lack of knowledge, skills equipment, and capital on the part of coastal villagers to develop new economic activities, etc.

Recommendations to effectively address coastal community needs in the development process include:

- coordination of the national and local institutional organizations with the capabilities of village government and social development agencies;

- analysis and planning for coastal community development by developing an appropriate data base on the environmental, social, and economic factors affecting coastal villages;

- coordination of coastal community planning and development in conjunction with (1) natural resources planning and management to minimize the effect of local development on the coastal resource base, and with (2) regional planning and development for "upstream" users to minimize the effect of upstream activities on coastal communities (e.g., agricultural and forestry practices, water supply, flood control, etc.);

- improvement of community infrastructure;

- development of training programs for local villagers in the variety of employment resources offered by the broad-based spectrum of coastal resource opportunities;

- development of labor intensive community development projects to address unemployment needs, etc.

IV. INTERNATIONAL NGO ACTIVITIES IN THE COASTAL SECTOR

The international NGOs that have programs in Indonesia which either have a coastal community development or a coastal resources focus are listed in Table 2.

TABLE 2. International NGOs (CIDA, 1987b).

Organization	Sector of Interest
UNICEF	Women in Development in Rural Communities
Ford Foundation	Community Development, Support to Indonesian NGO's
Asia Foundation	Community Development Scholarships
Canadian University Services Overseas (CUSO)	Provide Volunteers for Community Development and Environmental Programs
Unitary Service of Canada (USC)	Community Development
Frederick Newman Stitung (FNS)	Community Development and Training
Konrad Adeunawer Stifting	Community Development and Training, Core Support to NGOs
NOVIB	Community Development including Training
Save the Children Fund	Community Development
Foster Parents	Community Development
World Neighbor	Environmental Projects
World Vision	Community Development
Mennonite Central Committee	Transmigration
Manitoba Institute of Management (MIM)	Skills, Training, Management Training
Cooperative Union of Canada (CUC)	Cooperative Training
The International Federation Institutes for Advanced Study	Research, Natural Resources, Environment, Agriculture

V. MAJOR DONOR ACTIVITIES IN THE COASTAL SECTOR

A summary of identified donor assistance related to marine and coastal resources is presented below (Adapted from CIDA, 1987b).

A. Multilateral Assistance

1. World Bank

The World Bank has supported projects at the Universities of Indonesia, Gadjah Mada, and Andalas focusing on technical assistance to the engineering, science, agriculture, fisheries, marine sciences and economics faculties.

The World Bank has loaned the Government of Indonesia $23 million for the development of brackishwater aquaculture (primarily shrimp), construction of freshwater and marine research labs, and fellowship training. The project areas are in South and Southeast Sulawesi, and Aceh Province in Sumatra. Forty-five percent of the funds are used for credit to processing facilities which, in turn, provide technical assistance to fish or shrimp farmers.

The World Bank had two previous loans with government fishery companies, to finance a feasibility study on government organization of its shrimp companies. It was determined that the government should not privatize its shrimp companies for economic reasons.

2. Asian Development Bank

The fisheries sector in Indonesia has received significant external development assistance. During 1967 to present, total external assistance amounted to approximately $400 million. About 75 percent came from miltilateral and 25 percent from bilateral sources. The Asian Development Bank (ADB) is the leading donor to the fisheries sector and has provided nine loans for eight projects and nine technical assistance grants totalling about $211 million (See Table 3). The ADB projects focused mainly on: (i) promoting the fisheries sector in less developed geographic areas primarily through public sector enterprises; (ii) alleviation of rural poverty among fishermen and fishfarmers; (iii) institutional development strengthening of fisheries services; (iv) provision of fisheries infrastructure; and (v) provision of credit facilities. Presently under consideration are projects in aquaculture extensification, fisheries credit for support industries and upgrading of the coastal environment (Greenwald, 1989).

TABLE 3

ASEAN DEVELOPMENT BANK
ASSISTANCE TO INDONESIA FOR THE FISHERIES SECTOR

SUMMARY

No.	TA/Loan No.	Title	Amount (in $ million)
	A.	Loans	
1.	94	Riau Fisheries Development (SF)	2.500
2.	154	Irian Jaya Fisheries Development (SF)	5.150
3.	155	Irian Jaya Fisheries Development	2.750
4.	216	Java Fisheries Development	13.200
5.	474	Sumatra Fisheries Development	14.000
6.	566	2nd Irian Javy Fisheries Development	34.000
7.	598	Brackishwater Aquaculture Development	23.000
8.	693	Fisheries Infrastructure Sector	50.000
9.	742	Fisheries Industries Credit	65.000
		Subtotal A	209.600
	B.	Technical Assistance	
1.	236	Sumatra Fisheries Development	0.098
2.	368	Sumatra Fisheries Development (A&O)	0.200
3.	395	Second Irian Jaya Fisheries Development	0.150
4.	415	Brachishwater Aquaculture Development	0.100
5.	422	Java Fisheries Development	0.180
6.	464	Fisheries Sector Study (A&O)	0.050
7.	529	Fisheries Infrastructure Development	0.237
8.	661	Second Brackishwater Aquaculture	0.260
9.	-	Fisheries Economy Study	0.250
		Subtotal B	1.525
		TOTAL:	211.125

3. FAO/UNDP

FAO/UNDP has provided the major grants to Indonesia for the development of the coastal sector. A list of the projects supported by FAO in coastal resources since 1973 is found in Table 4.

4. UNICEF

UNICEF's five year program in rural development training education terminates in 1989. The objective of the project is to train village administrators in rural development methodologies, with the intention that these local administrators will then become trainers. The project is being implemented in the five provinces of West Java, South Sulawesi, West Sumatra, West Kalimantan, and East Kalimantan because they have the highest infant immortality rates in the country.

UNICEF supports projects to compile statistics on women with the Bureau of Statistics as well as on income-generating opportunities for issues in rural and coastal areas using non-formal education techniques.

UNICEF also supports a literacy training program and supports a credit system named KARAWAWG whereby credit is provided by government banks to poor women without collateral, with UNICEF acting as the guarantor.

TABLE 4. Marine and Coastal Resources Programs Conducted by FAO/UNDP (CIDA, 1987b).

Name of Project	Location	Period	Project Cost	Description of Assistance
1. Marine fisheries Training(INS/72/063) UNDP	Tegal,Belawan Singaraja, Manado, Ambon	1973-1979	US$ 3,491,685	Providing facilities for marine fisheries training, processing and fisheries management
2. Brackishwater shrimp & milkfish culture, applied research & training (INS/72/003) UNDP	Jepara	1973-1981	US$ 1,413,499	Development and Research of brackishwater fisheries (shrimp and milkfish culture)
3. Fisheries development and management (INS72/064) UNDP	Jakarta and throughout Indonesia	1974-1979	US$ 2,146,456	Assistance in program planning development of statistical system. Survey for harbour construction throughout Indonesia. Pelagic resource survey for Lemu (Java Sea and Bali Strait). Ad-hoc skip-jack resource survey in the Moluccas and Nusa Tengara
4. Joint regional survey of fishery resources, their development & utilization (FAO-IOP-GTZ/West Germany - Australia	South Indonesia & North West Australia (Indian Ocean)	1979-1982	US$ 1,325,000	Joint surveys carried out by the FAO/Indian Ocean by the FAO/Indian Ocean Programme, German GTZ and Australia in the waters South of Java and North West Australia. Identification of common fish-stock resulting in the production of a book for publication.
5. Fisheries extension services, support for small scale fisheries (INS/78/014) UNDP	Semarang, Ujung Pandang, West Java	1979-1983	US$ 2,938,989	Development of model fishing villages through fisheries extension

TABLE 4. Marine and Coastal Resources Programs Conducted by FAO/UNDP (CIDA, 1987b) Cont'd.

Name of Project	Location	Period	Project Cost	Description of Assistance
6. Indonesian Fisheries Development Project (GCP/INS/056/CAN)/ INFIDEP - Phase 1	Sermarang, Sangihe/ Natuna Islands	1980-1983	US$ 1,009,710	Development of marine fisheries resources through surveys in seas around Sangihe and Natuna Islands.
INFIDEP - Phase II	Semarang and Riau archipelago	1984-1986	US$ 200,000	Phase II activities were concentrated in the high potential fisheries areas of the South China Sea in the Riau archipelago district.
7. Seafarming development (INS/81/008) UNDP	Lampung, Bali, North Sumatera, Sulawesi, Ambon (Moluccas)	1982-1983	US$ 288,220	Assistance in the establishment of a seafarming centre in Lampung.
8. Study on a fish disease quarantine system (TCP/INS/0107) FAO	Jakarta, Bali North Sumatra, North & South Sulawesi, Riau East Java	1981	US$ 65,000 (3 months)	Identification of the needs for an effective fish disease quarantine system in Indonesia, including regulatory and organizational framework covering both inter-island and inter-country fish transport. Identification of inputs and follow up assistance for implementation of the system.
9. Identification survey (TCP/INS/ 0002)FAO	Java, Sumatra Bali, NTB, Sulawesi Kalimantan	1980-1981	US$ 81,000	Survey and identification on site selection for for site selection to shrimp culture establish hatcheries/ shrimp culture development.

TABLE 4. Marine and Coastal Resources Programs Conducted by FAO/UNDP (CIDA, 1987b) cont'd.

Name of Project	Location	Period	Project Cost	Description of Assistance
10. GCP/INT/421/NOR - FAO/Norway EEZ-assistance and training in handling acoustic equipment	Semarang and the Asia Pacific Region	1984-1986	US$ 320,000	Training assistance in handling advanced fisheries acoustic survey equipment with emphasis on small pelagic fish.
Ongoing Projects				
11. Integrated extension services support to small scale fisheries particularly in the outer island (INS/83/014)DGF	Manado (N. Sulawesi) Central Sulawesi, SE Sulawesi, East Nusa Tenggara,	1984-1987	US$ 1,349,000	Development of a nationwide fishery extension service operating effectively at all government levels and at the coastal community level improving the well-being, income, production and productivity of small-scale fishing communities and fish farming families. This is a follow-up project of INS/78/014 operated mainly by national experts (See #5 above).
12. Shrimp culture development INS/85/009 DGF	Jepara, Aceh Ujung Pandang, Situbondo	1986-1987	US$ 297,500	Preparation for full scale implementation of a large-scale shrimp culture development project which has the aim to strengthen the capability of the DG Fisheries to adapt and disseminate advance shrimp production technology among fish farmers in three selected priority regions.

TABLE 4. Marine and Coastal Resources Programs Conducted by FAO/UNDP (CIDA, 1987b) cont'd.

Name of Project	Location	Period	Project Cost	Description of Assistance
13. Seafarming development INS/81/008 DGF	Lampung, Bali North Sumatral Sulawesi, Ambon (Mollucco)	1983-1987	US$ 1,500,000	Development of seafarming, transfer of technology, training of national staff. Establishment of marketing channels for seafarm products.
14. TCP/INS/2309 Rural women in transmigration areas	Jambi Province Pamenang	1983-	US$ 33,000	Development of a model for assistance to women in transmigration areas in Pamenang for use in program design, monitoring and evaluation of income generation projects for women. Training of extension agents, and transmigrant women in group activities involving food production and income generation
15. TCP/INS/4408- Training women in income generating activities in fishing communities through NGO participation	Central Java (Gempol Sowu village) and East Java (Lamongan)	1985	US$ 10,000	Involvement of an NGO in select villages in efforts & activities to improve & increase the income of poor fisheries community women & poor women of farming communities.

B. Bilateral Assistance

1. Japan

Japan is Indonesia's largest single donor. In the marine and coastal sciences sector, assistance has been focused on mariculture, technical training in fisheries, including extension service training projects, tuna fisheries development, fishing port development, fishery market identification and strengthening of fisheries institutions.

2. Australia

Australia's first priority in Indonesia has been to support higher education projects. About 120 fellowships are offered annually. Australia also supports an English Language Training Center.

Australia's assistance to Indonesia in the marine and coastal resources sector has included:

- awards for postgraduate study in Australia under general training programs, which have included some in food technology for members of the Directorate General of Fisheries.

- assistance to selected faculties of the Institute Pertanian Borgor (IPB) focussing on the basic sciences and English language training relevant to the entire University. The project does not focus on the fisheries faculty.

- research into fisheries resources, resulting in the production of the book "Trawled Fishes of Southern Indonesia and Northwestern Australia"--a guide to species in this region published by ADAB, the Directorate General of Fisheries, and the German Agency for Technical Cooperation.

- research into control of spoilage of fresh, cured and dried tropical fish in Indonesia that is supported by the Australian Centre for International Agriculture Research (which supports research into food and agriculture problems of developing countries). ACIAR is working with the Central Research Institute for Fisheries Technology.

3. USAID

The USAID program in recent years has been targeted and research and development projects. The major USAID

program areas related to the coastal sector include:

- Aquaculture: There is an Aquaculture Research and Development project to be implemented by AARD. The project budget is $5.6 million. The key project elements are fellowship training in the USA, identifying and testing solutions to production problems associated with freshwater aquaculture in Sumatra and Java, brackish water aquaculture production in Sulawesi, and pelagic fish processing in Maluku. This project has no formal linkages with the Directorate General of Fisheries. Funds from this project are to be used to establish a natural fisheries advisory group that will include other donors, researchers, farmers, and extension officers who will prepare annual fisheries plans.

  USAID is planning to support the institutional strengthening of the Coastal Aquaculture Centre in Maros at the University Hasanuddun.

- Fisheries: Through its Private Sector Development Office, USAID currently supports joint venture projects through private entrepreneurs. Projects have included development of tuna, shrimp and crab fisheries.

  Through its Fisheries Research and Development Project (FRDP), USAID/Jakarta is improving the technological and management resources available to public and private entities involved in the Indonesian fisheries sector. The purpose of the project is to install viable fisheries research programs at the Ministry of Agriculture (MOA) and key universities to address significant regional fisheries production and marketing constraints.

  Major planned outputs of the FRDP are the establishment of a national coordinated fisheries research agenda, upgraded research programs at the MOA and at key universities to address priority production constraints, and improved academic training at selected universities with mandated responsibilities for fisheries training. The project consisted of four components: a) upgrading the staff, facilities, academic training, and research programs of seven universities and research

institutes to resolve priority production, marketing, and policy/management problems; b) assisting the MOA and the Ministry of Education (MOE) to establish a national coordinated fisheries research agenda; c) assisting the MOA in evaluating the need and mechanisms to improve fisheries policy and planning to ensure the optimal utilization and management of Indonesia's aquatic resources; and d) improving technologies for the production and marketing of commercially important fish products.

In the December 1988 amendment to the Project Paper, the support to fisheries strategy development, policy research, and planning was significantly increased while support for the construction of research facilities and the procurement of research equipment will be discontinued. Graduate degree staff training will go forward under the USAID/GOI grant administered umbrella participant training project, i.e., the General Participant Training Program (GPTP). Thus, under the amended project, funding resources have been realigned to focus on the development of national fisheries development and research strategies including greater attention to the needs of the private sector.

- Training: USAID supported establishment of the Overseas Training Unit to be used to assist in managing CIDA's General Training Program.

  Additional Masters fellowship training projects in marine sciences are supported at IPB and the University of Pattimura. USAID also supported a marine sciences curriculum design project at the University of Pattimura. USAID is supporting the development of an aquaculture curriculum at the University of Riau by an advisor from Auburn University, Alabama.

- Coastal Resource Management: USAID is supporting an ASEAN-US Cooperative Program on Marine Sciences (Coastal Resources Management Project). This is a four-year program being executed by ICLARM (1986-1990). The goal of the project is to increase existing capabilities within the ASEAN region to develop and implement comprehensive, multi-disciplinary and environmentally-sustainable coastal resources management strategies. In Indonesia, a site-specific coastal resources management plan is currently being prepared for Cilacap in Southern Java. In addition, the preparation of relevant

publications, short-term and fellowship training and workshops and seminars will be supported. The National Institute of Oceanology is coordinating the Indonesia component of this project.

- Credit: USAID has supported an agriculture credit program which included provision of credit to fishermen for purchase of nets, fisheries equipment and development of markets for fish products.

4. Other Donors

- The Netherlands has supported institutional development of universities which have marine sciences faculties. The Democratic Republic of Germany has supported projects in small-scale fisheries and regional surveys of fish resources with FAO during the 1979-1982 period (see Table 4). Britain has provided assistance to the Institute of Fisheries Technology in Jakarta and to post-harvest fish research. Italy has provided support to fresh fish marketing studies in East Java; and New Zealand has provided support for marketing studies, training on fish trawlers, construction of fisheries cold storage facilities and feasibility studies on port development.

VI. INDONESIA AND COASTAL RESOURCES MANAGEMENT:

The main problem with existing coastal resources management in Indonesia is that a central integrated and coordinated program, as described as one of the central foci of REPELITA V, has not yet been implemented. The activities of oil companies, foresters, farmers, and tourists have not been related by planners. Little cross-sectoral or integrated planning policy exists, although the basic legislation has been passed, the lead Ministry identified (Population and the Environment), and a coordinating committee among ministries has been established. At present, the single purpose sectoral projects advocated by one line Ministry (or counterparts at the provincial or kabupaten level) do not usually consider the adverse environmental effects on other coastal resources. Furthermore, the potential exists for programmatic conflicts with counterpart agencies. Consequently, uninformed decisions are made, marine and coastal use options unnecessarily compromised, and resources lost.

Indonesia is in the process of implementing its next five year plan (REPELITA V). The National Development Planning Agency, BAPPENAS, intends to make the implementation of a marine and coastal resource use and management strategy an integral part of

REPELITA V (BAPPENAS, 1988). The priority sectors covering REPELITA V regarding Marine and Coastal Affairs involve the following: mining and energy, fisheries, tourism, and communications. However, according to Uktolseys (1989), these sectors are facing problems such as 1) destruction of coral reefs, seagrass beds, mangroves; 2) pollution of these resources; and 3) over-exploitation of the coastal resource base. Coastal zone management in Indonesia is not yet focused in a comprehensive national program in keeping with the sustainable development principle and effective use of coastal resources.

The primary coastal problems that must be focussed upon are habitat degradation associated with coral reefs, seagrass beds, and mangrove forest conservation. The major issues that still exist are the use of dynamite fishing (including poisoning as a fish capturing technique); coral mining; over-exploitation of mangroves (including clear cutting for settlements and destruction for tambak); and land-based sources of pollution (Uktolseys, 1989).

In response to the growing strategice importance of marine and coastal resources in national development and the potential high economic return generated by intensified sustainable resource development, the Medium Term Planning Support Project was commissioned by BAPPENAS to provide planning support to the Government in developing a coordinated marine and coastal resource use and manatement strategy for implementation in REPELITA V. The project was funded by CIDA and executed by BAPPENAS with the assistance of the Canadian Federal Environmental Assessment Review Office (FEARO). Administrative support was provided by the Ministry of State for Population and Environment (KLH).

The planning support project resulted in the National Workshop on Planning for Development of Marine and Coastal Resources held on December 1, 1987 in Jakarta, where 22 government agencies participated in reviewing a draft Action Plan. The Action Plan (BAPPENAS, 1988) delineates the following seven strategic action programs:

(1) Government Management

(2) Resource Protection and Management

(3) Regional Development Planning

(4) Coastal Community Development

(5) Business Involvement

(6) Training, Education and Extension

(7) Information and Research

VII. ANALYSIS AND RECOMMENDATIONS:

The BAPPENAS 1988 Action Plan delineates an overall strategy for marine and costal development in Indonesia. Additional potential areas for donor intervention surfaced as a result of the current review of Indonesia's coastal sector. These include:

- A program addressing conservation of coastal and marine biological diversity. Such a program is warranted at levels similar to that paid terrestrial systems since Indonesian nearshore waters have the highest concentration of diversity in the world and since coastal systems are the recipients of land-based pollution.

- A national coastal resources management (CRM) program relating coastal planning and management to provincial government structure. Currently there is a transfer of responsibility but no transfer of resources toward understanding CRM and environmental protection at the provincial level. There is a need to select and implement at the provincial level CRM strategies.

- An examination of coastal watersheds with regard to implementation CRM strategies components at the provincial level.

- Small-scale pilot natural resources management activities that include coastal components, as well as cross-sectoral impacts, interfacing, for example, coastal development and forest conservation, fisheries tourism, etc.

The task of addressing the coastal issues enumerated in this report in a comprehensive program, or of providing assistance toward implementation of the BAPPENAS Action Plan requires that priority areas for initial intervention be identified. Toward this end the following coarse analysis was employed in order to impose some order on the data presented in this report since refined statistical analyses were not compatible with the type of information found. Overall, existing data on coastal resource issues and trends in Indonesia can be charaterized as being of indeterminate quality, varying scale, and spotty coverage as reflected in the variety of sources and interest responsible for gathering the data (Appendix I and Literature Cited).

The positive and negative economic impacts of each coastal subsector as scored in Table 5 represent the interpretations of the author and those of several experts with knowledge of the subsectors evaluated (See Appendix I). The analysis can therefore be considered a first cut at demonstrating the uses of the information collected and the analytic procedure developed. Because of data uncertainties and the desirability of engaging additional experienced analysts, it is suggested that further issue identification and scoring be conducted using a workshop format prior to any programmatic response to this background paper is initiated. However, this review of Indonesia's coastal sector and the objectively designed analysis represent an initial attempt at "informed planning".

A. Overall Direction and Intensity of Impacts

Table 5 list the ten major development subsectors within Indonesia's coastal area in descending order of economic importance. Since the focus of the Government of Indonesia during REPELITA V is to expand and intensify the development of Indonesia's marine and coastal resource base as a mechanism to accelerate socio-economic development of non-oil export revenues, oil and gas development is not included in this analysis.

As illustrated in Table 5 the impacts of each subsector upon each other were determined. These can be positive and beneficial, or negative and destructive. Each impact was given a plus (+) or negative (-)sign and scored high (3), medium (2), or low (1). The numbers were added to derive the summed intensity of all impacts on each other.

B. Inter-Sectoral Integration of Effects

The pervasiveness of impacts generated by one particular sector on other important economic activities is a measure of the sector's potential to spin off positive or negative impacts. The number and strength of these links also indicated how much leverage a development activity in one sector may have - e.g. very localized, or a ramification through many activities in the country's economic fabric. Finally, the degree of linkage also related to the institutional, cultural, and regulatory complexity a successful development must anticipate. A highly "connected" sector is likely to be addressed by more agencies and policies and is therefore a larger management challenge. These more highly linked sectors are less tractable and they tend to present more of a policy challenge than more isolated sectors which respond to more purely technical interventions.

TABLE 5

Coastal Subsector

CROSS SECTORAL IMPACTS

Normalized Economic Importance*	Industry	Transportation & Communications	Shipping and Ports	Coastal Agriculture	Fisheries	Tourism	Aquaculture
Industry (1.00)	-	+3	+3	-3	+2(-2)	+2(-3)	+2(-3)
Transportation & Communications (0.73)	+3	-	+3	+2	+2(-1)	+3(-1)	+3
Shipping & Ports (0.65)	+3	+3	-	+2(-2)	+2(-2)	+2(-2)	+2
Coastal Agriculture (0.48)	-1	+2	+2	-	-1	+1(-1)	-3
Fisheries (0.21)	0	+1	+2	0	-	+1(-1)	0
Tourism (0.09)	+2	+3	+2	+2(-1)	-3(-1)	-	+3
Aquaculture (0.04)	0	0	0	-2	-3	0	-
Coastal Forestry (0.04)	+1	+2	+2	+2(-2)	-2	+1(1-3)	-2
Coastal Communities (0.02)	+2	+2	+2	+3	+3	+3(-1)	-3
Mining (0.02)	+2	+3	+3	-1	-2	+2(-3)	-2

* Source: BAPPENAS 1988

** Interconnections = the breadth of links (e.g. # of sectors) + the degree of or intensity of links (ie: sum of all scored relationships)

*** Sum of the positive impacts multiplied by economic importance + the sum of the negative impacts multiplied by economic importance

TABLE 5 (Cont'd)

Coastal Subsector

CROSS SECTORAL IMPACTS

Normalized Economic Importance	Coastal Forestry	Coastal Communities	Mining	Interconnectedness**	Sum of Positive Impacts	Sum of Negative Impacts	Current Net Impact***
Industry (1.00)	+1(-2)	+2(-1)	+1	39	16	-14	2
Transportation & Communications (0.73)	+2	+2(-2)	+2	35	22	-4	13.2
Shipping & Ports (0.65)	+2	+2(-1)	+2	36	20	-7	8.4
Coastal Agriculture (0.48)	-2	+3(-1)	0	25	8	-9	-0.5
Fisheries (0.21)	0	+3(-1)	0	15	7	-2	1.0
Tourism (0.09)	+1	+2(-2)	+3	34	21	-4	1.5
Aquaculture (0.04)	-2	+2(-1)	0	14	2	-8	-0.2
Coastal Forestry (0.04)	-	+2(-1)	0	28	10	-10	0.0
Coastal Communities (0.02)	+3	-	+2	33	23	-1	0.4
Mining (0.02)	-1	-2	-	30	12	-9	0.06

** Interconnectedness = the breadth of links (e.g., # of sectors) + the degree of or intensity of links (i.e., sum of all scored relationships)

*** Sum of the positive impacts multiplied by economic importance + the sum of the negative impacts multiplied by economic importance

The degree of linkage or "interconnectedness" of the coastal subsectors was approximated by counting the total number of cross-sectoral interactions (Table 5) and adding this total to the sum of the scored strength of each cross-sectoral interaction, regardless of whether the impacts were positive of negative. The strength of the relationship between the two sectors is logically assumed to independent of its sign. Both positive and negative impacts were added as though no sign existed. If one cell of the matrix showed both strong positive and negative relationships, the linkage was determined to be stronger and more complex (e.g. the effect of industry on tourism = 5) than if it were either strongly positive or strongly negative, or simply very weak (e.g. the effect of agriculture on industry = 1). Normalized and ranked "interconnectedness" for each coastal subsector is listed in Table 6.

C. Scoring Cost and Benefits

Since impacts can be either positive or negative, it is important to support sectoral involvement which can project the most benefits (i.e. "positive" impacts) across all sectors. Dealing with negative impacts is not as straight forward since involvement can either be avoided or take the form of aggressive mitigation. Since many sectoral activities are practically unavoidable, reducing their impacts becomes an important family of interventions. Developing cultural resiliance and methods of coping with tourism for example, or developing better methods of sugar factory filter waste disposal (rather than halting tourism or refining) are examples of such interventions.

It is useful to project the demands of negative and harmful impacts for developing mitigation technology. It is also important to identify positive or low impact development for supporting environmentally sound activities of low impact sectors. The positive and negative impact potential for each subsector is shown in Table 5 while normalized and ranked figures for positive and negative impacts are listed in Tables 7 and 8, respectively.

D. Current Impacts of Sectoral Activities

The potential of each coastal subsector for linked effects and positive or negative impacts is important in decision-making for allocation of finite resources or development activities within each subsector. However, it is also useful to have an indication of the subsector(s) in which serious impacts are currently being generated and the pervasiveness of these impacts. By subtraction (potential minus current impacts), the coastal subsectors with the biggest "bang for the buck" can be

Table 6 Normalized and Ranked Interconnectedness of Each Coastal Subsector

Coastal Subsector	Interconnectedness	
Industry	1	HIGH
Shipping and Ports	.92	
Transportation & Communications	.90	
Tourism	.87	
Coastal Communities	.85	
Mining	.77	MODERATE
Coastal Forestry	.72	
Coastal Agriculture	.64	
Fisheries	.38	LOW
Aquaculture	.36	

Table 7. Normalized and Ranked Positive Cross Sectoral Impacts.

Coastal Subsector	Potential Benefits	
Coastal Communities	1	HIGHEST POTENTIAL BENEFITS
Transportation & Communications	.96	
Tourism	.91	
Shipping and Ports	.87	
Industry	.69	MODERATE
Mining	.52	
Coastal Forestry	.43	
Coastal Agriculture	.35	
Fisheries	.30	
Aquaculture	.09	LOW

Table 8. Normalized and Ranked Negative Cross Sectoral Impacts

Coastal Subsector	Negative Impacts
Industry	1
Coastal Forestry	.71
Coastal Agriculture	.64
Mining	.64
Aquaculture	.57
Shipping and Ports	.50
Transportation & Communications	.28
Tourism	.28
Fisheries	.14
Coastal Communities	.07

HIGH DELETERIOUS IMPACTS

↓

LOW DELETERIOUS IMPACTS

identified. Table 5 summarizes the net current impacts. These scores represent the difference between the sum of the net positive impacts and the sum of the negative impacts for each subsector multiplied by the pervasiveness of that subsector. As no data were available for measuring the true extent of activities for each subsector, the relative economic importance of each subsector was used as a surrogate for pervasiveness - a crude but expedient assumption.

For example, although the impact of aquaculture on nearshore fisheries is serious, it is fairly local at the present time. However, the negative effects of industry on several subsectors such as tourism and aquaculture are both serious and widespread because industry is more economically pervasive than the localized activities of the tourism and aquaculture subsectors. The ranked economic importance of each coastal subsector enumerated in Table 5 was normalized using the figures presented in Table 1 of this report. Table 9 lists the normalized and ranked current net impacts for each subsector.

E. Discussion of Results

The analysis described above focuses on the several facets of program screening which should be structured into USAID planning:

- linkages between coastal subsectors,
- potential positive and negative impacts, and
- current impact status

The raw data in Table 5 for each of these catagories was normalized and ranked in Tables 6, 7, 8, 9, respectively. The figures in each table were grouped into "high", "moderate", and "low" classifications by the apparent clustering of numbers. For example, in Table 9, the coastal subsectors with the highest net positive impacts are transportation/communications and shipping/ports. Those which currently are of moderately positive net impacts are industry, tourism, fisheries, and coastal communities, while those subsectors with the most negative impacts upon the other coastal subsectors are forestry, aquaculture, and agriculture.

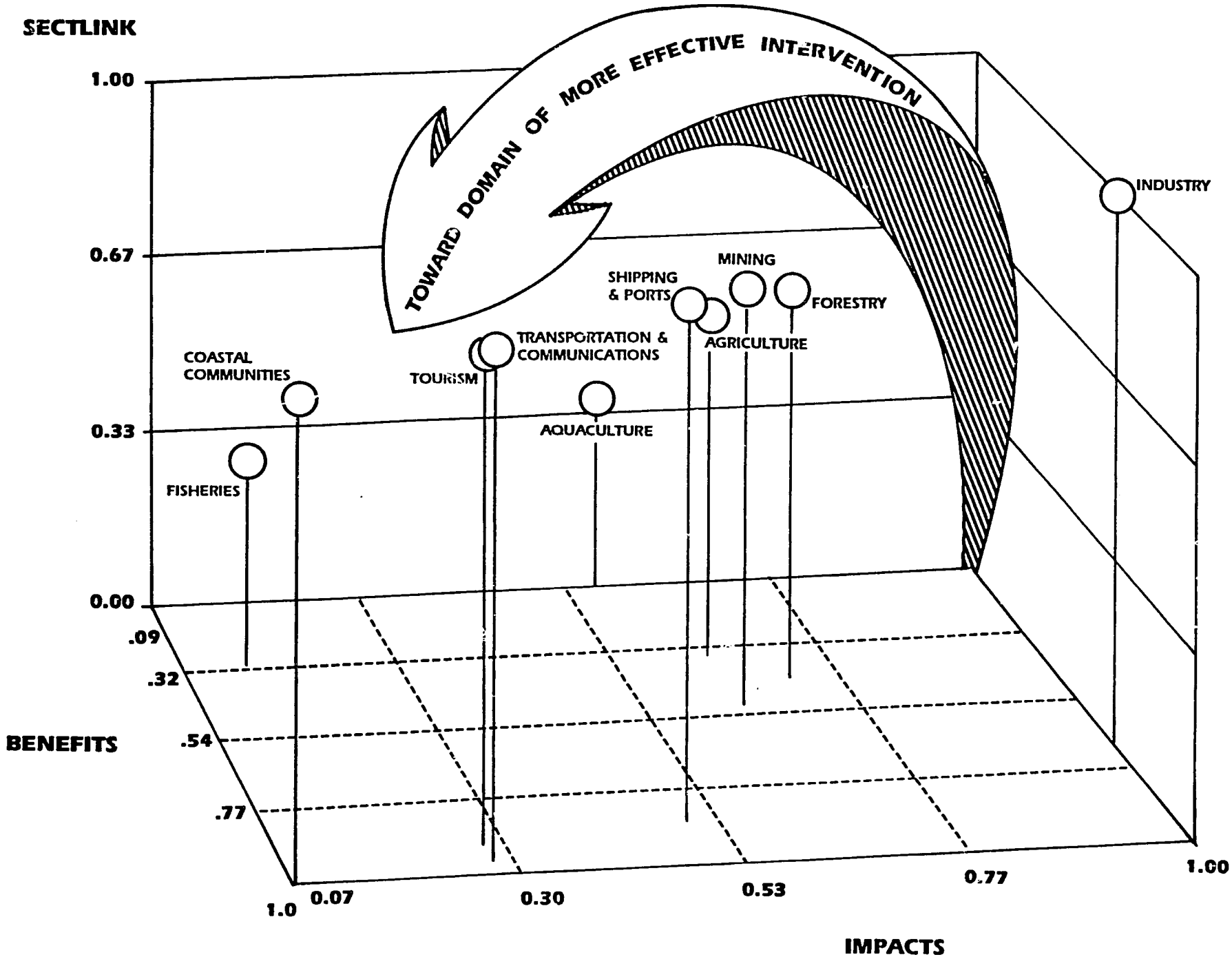
Table 9. Normalized and Ranked Current Impacts

Coastal Subsector	Current Net Impacts	
Transportation & Communications	13.2	HIGH
Shipping and Ports	8.4	
Industry	2.0	MODERATE
Tourism	1.5	
Fisheries	1.0	
Coastal Communities	0.4	
Mining	.06	LOW
Coastal Forestry	0.0	
Aquaculture	-0.2	
Coastal Agriculture	-0.5	

However, the future is mortgaged to the past if programmatic planning focuses only on existing impacts (Table 9). It is thus necessary to look at development possibilities in areas which provide the most potential benefits (the most positive and the least negative impacts) and compare these subsectors to the present situation. In Table 7, the subsectors with the highest potential cross sectoral benefits according to this analysis are coastal communities, transportation/communications, tourism, and shipping/ports. The subsectors with the least negative cross sectoral impacts as indicated in Table 8 are transportation/communications, tourism, fisheries, and coastal communities. Three subsectors emerge from this analysis as have the most potential benefits and the least negative impacts: coastal communities, transportation/communications, and tourism.

Although according to Table 7, the shipping and ports subsector ranks high in potential benefits, development of this sector also has the potential for higher deleterious impacts than transportation/communications, tourism, fisheries, and coastal communities. By the same token, although in Table 8 the fisheries subsector ranks low in deleterious impacts, the net positive impacts of this subsector on the other subsectors in the matrix is relatively low. This is not to say, however, that future development of fisheries will not have a positive impact on the protein intake of Indonesia's growing population, or that increases in fisheries production will not have a positive socio-economic influence on coastal community development. Determination of the positive and negative impacts of each coastal subsector relative to each other was the object of the analysis in Table 5. No secondary or indirect impacts were included in the analysis. Although such higher order impacts are undoubtedly important, such an analysis must await more sophisticated models.

According to the current analysis, coastal communities, transportation/communications, and tourism appear to be the most logical areas for future development intervention since these are the subsectors that offer the most potential benefits with the least potential for negative impacts. However, since the transportation and communications subsector is currently providing widespread net positive benefits (see Table 9), coastal community development and tourism fall out as the top two candidates for future development assistance. It is of interest to note that these same sectors are also found to be highly interconnected with other coastal subsectors (see Table 6). These subsectors therefore exert the most influence and leverage of efforts. Figure 1 illustrates the relationship between sectoral linkages, benefits, and negative impacts in a three dimensional graphic.


SECTLINK
1.00
0.67
0.33
0.00
TOWARD DOMAIN OF MORE EFFECTIVE INTERVENTION
INDUSTRY
MINING
SHIPPING & PORTS
FORESTRY
AGRICULTURE
TRANSPORTATION & COMMUNICATIONS
COASTAL COMMUNITIES
TOURISM
AQUACULTURE
FISHERIES
.09
.32
.54
.77
BENEFITS
1.0
0.07
0.30
0.53
0.77
1.00
IMPACTS

Interconnectedness cuts across jurisdictions of many government ministries and agencies as well as local institutions. This is particularly true of coastal resources whose uses are controlled by Ministries of Agriculture, Forestry, Tourism, Mining and Energy, etc. The more highly interconnected the coastal subsector, the more increasingly complex its interactions and demands of increased disciplinary skills. In addition, increased interconnectedness means that:

- policy development and coordination become increasingly important;
- an integrated systems approach is increasingly appropriate; and
- a well-founded intervention in one sector will have beneficial effects - higher order "ripple" or "spinoff" effects - on the many related or linked sectors.

F. Conclusions

The above is a mechanical analysis which does not reflect political and institutional constraints, activities of other agencies, the Mission's long term strategy, availability of expertise and interest, and other considerations which would determine a programmatic response to coastal resources management. Such a mechanical analysis is an important first element in programmatic planning. However, comprehensive programs should incorporate the above mentioned considerations in a setting where all required experience and expertise in available. The following near-term activities are suggested:

1. conduct a workshop to re-score, tabular rassa, the linkage/impact matrix (Table 5) with knowledgeable Indonesian representatives of each coastal sector (10) and A.I.D. coastal and programming experts (3) and competent facilitators;

2. back-to-back with the matrix analysis, each coastal subsector should be analyzed with respect to its potential for economic growth, indicators for measuring the issues, and the types of policies currently being used to address the issues. A comparative set of approaches on different options for dealing with the problems should be weighted according to:

- government priorities and current approaches toward coastal resource issues,
- the degree of difficulty in removing key constraints, and
- the comparative advantage of USAID.

This should be developed prior to recommending options for targeting USAID intervention. Both activities would require a total of one week. The documentation/report will require an additional one to two weeks.

Benefits emerging from utilizing the workshop format include:

- an updated information base,
- a clearer understanding of sectoral linkages and new approaches to addressing coastal issues as a result of collective thinking and information exchange, and
- participant support of future initiatives and programmatic responses emerging from the workshop because of involvement in the planning process (patricipant "ownership" of the results).

Although to date, CIDA has played a major catalytic role in stimulating activity to address Indonesia's coastal issues, the approach has been more generic than that represented by this analysis. This background paper differs from the CIDA reports in that it incorporates a more detailed data base and incorporates an analytic process in an attempt to prioritize potential areas for technical assistance by USAID. What the workshop process would accomplish would be an extension of the analytic approach used in this report toward increasing objectivity and participation, in addition to appreciation and ownership of the results.

Whether or not USAID wants to involve itself in any future programmatic response to coastal resource issues, an unfettered analysis is still necessary. Such an analysis can then serve as the basis for the nature and extent of USAID's involvement.

REFERENCES

Ave, J. 1989. Director General of Tourism. Department of Tourism, Posts and Telecommunications. Press Release, January 16, 1989.

BAPPENAS. 1988. Action plan for sustainable development of Indonesia's marine and coastal resources. National Development Planning Agency (BAPPENAS) in collaboration with the Canadian Federal Environmental Assessment Review Office: Indonesia Medium Term Planning Support Project. 34pp.

Berwick, N.L. 1985. Global assessment of tropical nearshore living resources: patterns, processes, policy and impacts (World Resources Institute/International Institute for Environment and Development, Washington, D.C., unpublished monograph, submitted, 1985.

_____ .1988. Design of an artisanal fisheries component of ZEM activities in Ecuador. Unpublished technical report. 7pp.

Berwick, S. and B. Soewardi. 1989. Guidelines for applying the environmental impact assessment process to resource development in Indonesia. USAID through the Agricultural Planning Project with Winrock International Institute for Agricultural Development. 249pp. (In press).

Bina Program. 1982. Report of the forest of Indonesia, 1982. Directorate of Forest Planning. 45pp.

Burbridge, P.R. 1983. Coastal resource management. Government of Indonesia-United Nations Development Program Environmental Sector Review. UNDP. Jakarta, Indonesia. 91pp. (p. 57).

Burbridge, P.R. and J.E. Maragos, 1985. Coastal resources management and environmental assessments needs for aquatic resources development in Indonesia. International Institute for Environment and Development, Washington, D.C. 113 pp.

Burbridge, P.R., Koesoebiono, and R. Dahuri. 1988. Problems and issues in coastal resources management and planning in Eastern Sumatra and the Strait of Malacca. In: P. Burbridge, Koesobiono, H. Dirschl, and B. Patton (eds.), Coastal Zone Management in the Strait of Malacca. Proceedings of a Symposium on Environmental Research and Coastal Zone Management in the Strait of Malacca. November 11-13, 1985. Medan, Indonesia. 317pp.

Carpenter, K.E., Miclat, R.I. Albaladejo, V.D. and V.T. Corpuz 1981. The influence of substrate structure on the local abundance and diversity of Philippine reef fishes. Proc. Fourth Int'l Coral Reef Symposium 2:497-502.

Chia, Lin Sien. 1988. Transportation of oil in the Strait of Malacca and potential marine pollution. In: P.R. Burbridge, Koesoebiono, H. Dirschl and B. Patton (eds.), Coastal Zone Management in the Strait of Malacca. Proceedings of a Symposium on Environmental Research and Coastal Zone Management in the Strait of Malacca. November 11-13, 1985. Medan, Indonesia. 317pp.

CIDA, 1987a. Marine and coastal sector development in Indonesia: a strategy for assistance. Volume I. 198pp.

_____ .1987b. Marine and coastal sector development in Indonesia. Volume II: Appendices.

Darus, B. 1989. Coastal Communities Development Consultant. Personal Communication.

Ehrlich, P.R., Ehrlich, A.H. and J.P. Holdren. 1977. Ecoscience: Population, Resources, Environment. W.H. Freeman and Company, San Francisco. 1051pp.

FAO, 1985. Mangrove Management in Thailand, Malaysia and Indonesia. 60pp.

_____ .1986. Indonesia: Improvement of the small-scale fisheries. Report prepared by the Indonesian Fisheries Development Project (1984-1985). 14pp.

Goodland, R. 1981. Indonesia's environmental progress in economic development. PSPSL Research Report No. 8. Centre for Natural Resources Management and Environmental Studies. Bogor, Indonesia.

Grandperrin, R. 1978. Importance of reefs to ocean production. South Pac. Comm. Fish. Newsl. 16:11-13.

Greenwald, C. 1989. Director, Aquatic Farms. Jakarta, Indonesia Personal Communication.

Hamilton, L.S. and S.C. Snedaker., (eds). 1984. Handbook for mangrove area management. UNEP and East-West Center, Envrironment and Policy Institute. 123pp.

Hehanussa, P.E. 1981. Coastal zone management in Indonesia. In: M. Valencia (ed.), Proceedings of the Workshop on Coastal Development and Management in Asia and the Pacific. December 3-12, 1979. Manila, Philippines. 194pp.

Hutomo, M. 1987. Coral fish resources and their relation to reef condition: Some case studies in Indonesian waters. In: D. Soedharma, J. Purwanto, S. Rahardjo, and D.M. Sitompul (eds.). Proceedings of the Symposium on Coral Reef Management in Southeast Asia. April 22-24, 1986. Bogor, Indonesia. Biotrop Special Publications No. 29.

Jusuf, S. 1989. Director, Center of Research and Development. Department of Tourism, Posts and Telecommunications. Personal Communication.

Juyanto, S. R. 1979. LON LIPI: UDANG

Kent, G. and M.J. Valencia, (eds.) 1984. Marine policy and Southeast Asia. Berkeley: University of California Press.

Koesoebiono, Collier, W.L. and P.R. Burbridge. 1982. Indonesia: Resources use and management in the coastal zone. In: C. Soysa, L.S. Chia, and W.L. Collier (eds.), Man, Land and Sea: Coastal resource use and management in Asia and the Pacific. Bangkok: Agricultural Development Council, pp. 116-46.

Kuiter, R.H. 1988. Fishes of the Bay of Maumere. Department of Zoology, Museum of Victoria, Melbourne, Australia, unpublished manuscript.

Kvalvagnaes, K. and M.H. Halim. 1979a. Report on a preliminary survey on the Pulau Pombo and Pulau Kasa Marine Reserve, Maluku. UNDP/FAO National Parks Development Project, Bogor, Field Document No. 1. 29pp.

_____ 1979b. Report on a survey of marine areas of the proposed Komodo National Park. UNDP/FAO National Parks Development Project, Bogor, Field Report Document No. 4. 21 pp.

Luken, R.A. 1983. Environmental conditions and development trends in Asia and the Pacific. Economic and Social Commission for Asia and the Pacific. Bangkok, Thailand. December 14-17, 1982. 60pp.

MacDonald, E.H. 1981. Offshore minerals other than hydrocarbons in Southeast Asia. In: L.S. Chia and C. MacAndrews (eds.), The Southeast Asian Seas: Frontiers for development. Singapore: McGraw Hill. pp. 51-74.

Martopo, S. 1987. Penentuan Koordinat Lautan Dacrah Bebas Pencemaran di Teluk Jakarta. Laporan Pendahuluan. Yogyakarta: Biro Bina Kependudukan dan Lingkungan Hidup DKI Jakarta & Pusat Penelitian Lingkkungan Hidup UGM.

Martosubroto, P. and N. Naaiman. 1977. Relationship between tidal forests (mangroves) and commercial shrimp production in Indonesia. Marine Research in Indonesia. No. 18: 81-86.

Onkosongo, O.S., Hadi, S., Kartawiria, Y., Ariani, R. and S. Setiadi. 1987. The natural system and environmental quality aspects of Jakarta Bay. Workshop Working Papers. Workshop on Coastal Waters Management and the Bay of Jakarta. Jakarta: IFIAS and Centre for Research on Human Resources and the Environment, University of Indonesia.

Pardjaman, D. 1977. Akresi dan abrasi pantai Teluk Jakarta disebabkan oleth kondisi fisik dan sosial. In: M. Hutomo, K. Romimhtarto and Burhanudin (eds.), Teluk Jakarta: Sumberdaya, Sifat-Sifat Oseanologis, Dan Permasalahanya (LON-LIPI, Jakarta) pp. 83-106.

Petocz, R. 1988: Conservation in Indonesia: Current status and development of an action strategy. A report to the World Bank. 60 pp.

Saenger, P., Hegerl, E. J. and J.D.S. Davie. 1983. Global status of mangrove ecosystems. IUCN. 88 pp. Reprinted from The Environmentalist, Vol. 3 (1983) Supplement No. 3.

Salim, E. 1988. Towards sustainable development of aquatic resources. In: P. Burbridge, Koesoebiono, H. Dirschl, and B. Patton (eds.), Coastal Zone Management in the Strait of Malacca. Proceedings of a Symposium on Environmental Research and Coastal Zone Management in the Strait of Malacca. November 11-13, 1985. Medan, Indonesia. 317 pp.

Salm, R.V. 1984. Man's use of coral reefs. In: R.A. Kenchington and B.E.T. Hudson (eds.), Coral Reef Management Handbook. UNESCO. 281pp.

Samingan, T. 1989. Ecological Laboratory of FMIPA, IPB Bogor, Indonesia. Personal Communication.

Samsi, S. 1989. Agriculture Sub-Directorate, Directorate for Fisheries Production. Personal Communication.

Soegiarto, A. 1977. Impact of pollution on the fishing industry in Indonesia. In: Agr. Eco. Sco. SEA Second Biennial Meeting. November 3-6, 1977. Iloilo, Philippines, 17pp.

Soesanto, V. 1985. Indonesia small-scale fisheries development. Working paper, SCS/98/WP/122. Manila: South China Sea Fisheries Development and Coordinating Programme.

Soewardi, B. 1989. Institut Pertanian Bogor. Personal Communication.

Sujitno, S. 1974. Challenging elements in the offshore tin resource potential in Indonesia: Report of the 9th Session of CCOP, doc. 39. Bangkok: CCOP.

Sukardjo, S. 1980. The mangrove in new Cimanuk delta complex West Java, Indonesia. Paper presented at the Symposium on the Cimanuk Delta Resources, West Java, Jakarta. August 18, 1980.

Sukardjo, S. and S. Akhmad. 1982. The mangrove forest of Java and Bali. Biotrop Spec. Publ. No. 17: 113-1126.

Taufik, A.W. 1987. Coral reefs in Indonesia. In: D. Soedharma, J. Purwanto, S. Rahardjo, and D.M. Sitompul (eds.), Proceedings of the Symposium on Coral Reef Management in Southeast Asia. Bogor, Indonesia. April 22-24, 1986. Biotrop Special Publ. No. 29:169-174.

The Europa Year Book. 1988: A World Survey. Europa Publications Limited, London. Volume 1, p. 1373.

Turner, R.E. 1985. Coastal fisheries, agriculture and management in Indonesia: case studies for the future. In: J. Clark (ed.), Coastal resources Management: Development case studies. Coastal Publication No. 3, Renewable Resources Information Series. Research Planning Institute, Inc. in cooperation with the National Park Service - USDI, and the U.S. Agency for International Development. pp. 373-440.

Uktolseya, H. 1989. Marine and Coastal Affairs Coordinator. Ministry of State for Population and the Environment, Indonesia. Personal Communication.

Veron, J. E.N. 1989. Australia Institute of Marine Science. Personal communication.

Wiebe, W.J. 1988. Mangrove forest and seagrass meadows as biological water quality filters along tropical coasts. Unpublished manuscript, 13pp.

Whitten, A.J., Damanik, S.J., Anwar, J., and N. Hisyam. 1987. The Ecology of Sumatra. Gadjah Mada University Press, 583 pp.

Wiley, K. 1987. Lavilain, Inc. Personal Communication.

Wiroatmodjo, P. and D.M. Judi. 1978. Pengelolaan hutan Kayu di Indonesia. Bogor: Directorat Bina Program Kehutanan.

Wisaksono, W. and J. Bilal. 1988. Oil contamination in the Straits of Malacca and Singapore. In: P.R. Burbridge, Koesoebiono, H. Dirschl and B. Patton (eds.), Coastal Zone Management in the Strait of Malacca. Proceedings of a Symposium on Environmental Research and Coastal Zone Management in the Strait of Malacca. November 11-13, 1985. Medan, Indonesia. 317pp.

Zalinge, N.P. van and N. Naaiman. 1977. Report on the offshore shrimp fishery along with south coast of Java. Publ. Inst. Mar. Fishery. LPPL - Jakarta.

Zerner, C. 1987. The flying fishermen of Mandar. Cultural Survival Quarterly. 11(2):18-22.

APPENDIX I: LIST OF CONTACTS JANUARY 1989

Mr. Joop Ave
Director General of Tourism
Department of Tourism, Post and Telecommunications
Republic of Indonesia
Jalan Kramat Raya 81
Jakarta Pusat 10450

Dr. Shirley Conover
EMDI Project
Kantor Menteri Negara
Kependudukan dan Lingkungan Hidup
Medan Merdeka Barat 15
Jakarta Pusart

Dr. Hasjim Djalal
Head of the Agency for Resources & Development
Foreign Ministry - Departemen Luar Negeri
Taman Pejambon
Jakarta

Prof. Munadjat Danusaputro
Professor of Environmental Law &
Regional Governor of ICEL for Asia and the Pacific
University of Padjadjaran
Jalan Dipati Ukur 35
Bandung

Dr. Bahauddin Darus
Coastal Communities Development Consultant
Jalan Teuku Cik Ditiro No. 23
P.O. Box 3228
Jakarta 10350

Mr. Charles Greenwald
Director
Aquatic Farms
Jalan Garuda 80L
Jakarta Pusat 10620

Dr. Arthur Hansen
Director, EMDI Project
Kantor Menteri Negara
Kependudukan dan Kingkungan Hidup
Jalan Medan Merdeka Barat 15
Jakarta 10110

Dr. Sofyan Jusuf
Chariman
Research and Development Agency
Jalan Kebon Sirih
Jakarta

60

Dr. J.A. Katili
Director General of Geology and Mineral Resources
Jalan Jendral Gatot Subbroto
Kraveling No. 49
Jakarta

Dr. Purito Martosubroto
Directorate General of Fisheries
Director of Resources Management
Jalan Harsono Rm. No. 3
Pasar Minggu, Jakarta Selatan
Jakarta

Mr. Radinal Mochtar
Ministry of Public Works
Jalan Patimura No. 20
Jakarta

Dr. Tjahjono Samingan
Plant Ecologist
Lab Ekologi
Jurusan Biologi
FMIPA IPB.
Bogor

Dr. Soleh Samsi
Directorate for Fisheries Production
Aquaculture Sub-Directorate
Jalan Harsono Rm. No. 3
Pasar Minggu, Jakarta Selatan
Jakarta

Dr. Frans Seda
Presiden Kommisaris
Kantor Perwakilan
Rm 6 B. 2nd Floor Borobudur Offices
Hotel Borobudur Inter-Continental
Jalan Lap Banteng Selatan
Jakarta

Mr. Peter Soehardjo
Tourism Consultant
INKINDO
Jalan Tebet Barat 351
Jakarta 12810

Dr. Bedjo Soewardi
Bogor Agricultural University
Jl. Raya Pajajran
Bogor

61

Dr. Winarno Sudjas
Department of Tourism, Post and Telecommunications
Directorate General of Tourism
Jalan Kramat Raya 81
Jakarta Pusat 10450

Mr. Sunetja
President Director
Nusa Dua
P.T. Bali Tourism Development Corporation
Nusa Dua, Bali

Dr. Ir Machmud Thorari
Wildlife Ecologist
Faculty of Forestry
Department of Forest Resource Conservation
Bogor Agricultural University (IPB)
Bogor

Dr. John W. Turner
Entomology Consultant
Nusa Tenggara Agricultural Support Project
ACIL Australia Pty. Ltd.
PT Perkebunan XXVI
Jalan A.A. Gde Ngurah
Cakranegara, Lombok

Dr. Henk Uktolseya
Marine and Coastal Affairs Coordinator
Ministry of State
For Population and the Environment
Jalan Merdeka Barat 15
Jakarta

Dr. John Villamere
EMDI Project
Kantor Menteri Negara KLH
Medan Merdeka Barat 15,
Jakarta 10110

Dr. Untung Wahyono
Directorate General of Fisheries
Director of Fisheries Production
Jalan Harsono Rm. No. 3
Pasar Minggu
Jakarta Selatan

62