A variety of craft in an Indonesian fishing village in Langkat District.

Northern Sumatera, Indonesia

by

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4. *INTRODUCTION*

Marine fisheries play an important role in the economic development of Indonesia. They provide employment to thousands who live on the coasts, besides being a primary source of animal protein; fish is the most affordable source of animal protein in the diet of most people in the country.

This study is intended to collect baseline information on the present environmental situation in the Bay of Bengal region of Indonesia in order to assess whether any environmental threats exist to the marine fisheries in this area. The results of the study, it is expected, could be used as a basis for further detailed environmental research in relation to marine fisheries as well as for marine environmental management in Indonesia.

The area of this study covers the marine waters under the jurisdiction of three Indonesian provinces, namely Aceh, North Sumatera and West Sumatera (see Figure 2).

Environmental threats in three categories were apparent in the area studied. Namely:

- Pollution from both marine and land-based activities, particularly near industrial urban centres, which contribute substantial amounts of pollutants to the coast waters.
- Physical habitat degradation, such as coral mining, excessive mangrove conversions or cuttings, and fish blasting.
- Overexploitation of marine fisheries resources.

Fig. 2. Marine waters of northern Sumatera

5. *MARINE HABITATS*

Indonesia, the largest archipelagic state in the world, stretches 5,000 km from the Indian Ocean to the Pacific Ocean and straddles the equator over a north-south distance of *2,500* km. Indonesia has an area of *5* million km2, of which 62 per cent is sea area within the 12 m limit. Under the 1982 Law of the Sea Treaty, Indonesia's EEZ (Economic Exclusive Zone) has been increased by 2.7 million km2 of sea area. Almost half Indonesia's territorial seas are underlaid by the continental shelf (see table alongside).

Land and sea territorial area of Indonesia

No.	*Entity*	*Area (million km2)*	*Remarks*
1	Indonesian territory (12 nm limit)	5.0	
2.	Territorial seas	3.1	62 per cent of total Indonesian territory
3.	Territorial land	1.9	
4.	Enclosed marine waters	2.7	87 per cent of total seas
5.	Open ocean waters	0.4	13 per cent of total seas
6.	Continental shelf waters	1.5	47 per cent of total seas
7.	EEZ	2.7	

Source Polunin, (1983)

Indonesia's coast is 81,000 km long, the second longest coastline in the world after Canada's (Soegiarto and Polunin, 1982). The coast is endowed with rich and varied natural resources, including both living resources *(e.g.* fish, mangrove forests, seagrass beds and coral reefs) and nonliving ones, like oil and gas, iron ores, tin and bauxite.

As far as living resources are concerned, the Indonesian part of the Bay of Bengal is one of the richest coastal/marine areas in the country. Various marine habitats, such as mangroves, seagrass beds, coral reefs and estuaries exist along the Straits of Malacca as well as on the west coast of Sumatera.

5.1 Mangrove forests

Mangroves are found in nearly all parts of Indonesia (Burbridge and Maragos, 1985). The country has more mangroves than any other country (FAO, 1985). The total area of mangroves in Indonesia has been estimated at between 1.6 million ha and 6 million ha. It is generally accepted that Indonesia has approximately 4.25 million ha of mangroves (see table alongside), a substantial acreage considering that 6-8 million ha is the estimated acreage of mangroves worldwide (FAO, 1982).

Distribution of mangrove areas in Indonesia

Province	*Estimated*	*% of Total mang area*
SUMATERA		
Aceh	54,335	
North Sumatera	60,000	
Jambi	65,000	
Riau	276,000	
South Sumatera	195,000	
Lampung	17,000	
Subtotal	667,335	15.7
KALIMANTAN		
West Kalimantan	40,000	
Central Kalimantan	10,000	
East Kalirnantan	266,800	
South Kalimantan	66,650	
Subtotal	383,450	9.0
JAVA AND BALI		
DKI Jakarta	95	
Central Java	13,577	
West Java	28,513	
East Java	7,750	
Bat	1,950	
Subtotal	51,885	1.2
NUSA TENGGARA		
West Nusa Tenggara	3,678	
East Nusa Tenggara	1,830	
Subtotal	5,508	01
SULAWESI		
South Sulawesi	66,000	
Southeast Sulawesi	29,000	
North Sulawesi	4,833	
Subtotal	99,833	2.3
MALUKU	100,000	2.4
IRLkN JAVA	2,943,000	69,3
Total	4,251,011	100

Source; FAO, (1985)

Information on mangrove forests in the study area is still poor. Aceh and North Sumatera Provinces have *54,335* ha and 60,000 ha of mangrove forests respectively. Although there is no data for the extent of mangroves in West Sumatera Province, some coastal areas in Pesisir Selatan and Pasam Districts nurture mangroves.

In the island of Sumatera, most mangroves grow along the east coast, which is ecologically better suited for growth of mangroves than the west coast. One of the five basic requirements for mangrove growth is a deltaic coast with estuaries where soft mud, composed of fine silt, and clay rich in organic matter are available for the growth of seedlings (Walsh, 1974). Such conditions exist extensively on the east coast of Sumatera. However, in the study area, mangrove stands were found on both coasts (see Figure 3 on facing page).

Mangroves in Indonesia have a greater species diversity than in other tropical areas, about 90 species being found (Nontji, 1987). Mangrove species found in the study area mainly belong to the families *Rhizophoracea, A vicenniaceae* and *Sonneratiaceae* (field observation, 1992).

The mangroves are generally in good condition, except in coastal areas where oil and gas as well as *tam bak** development has taken place.

Activities that threaten the existence of mangroves in Sumatera include:

- Conversion of land for other purposes, like *tambaks,* industrial sites and settlements.
- Excessive harvesting of mangrove wood for fuel, poles, timber and chip production.
- Pollution from domestic, petrochemical and industrial wastes.
- Sedimentation, due to poor upland management.

* Brackishwater shrimp/fish ponds.

The most serious of these activities appear to be the conversion of mangrove areas, particularly into *tambaks,* and over harvesting. The table below shows estimated areas of *tambaks,* that were previously under mangrove in the three provinces under study. An extensive conversion of mangroves into *tambaks* has taken place in Aceh Province, particularly along its east coast. Almost 70 per cent (35,988 ha) of the total area of mangroves in Aceh had been converted into *tambaks* by the end of 1990. Whereas in 1979 the total *lambak* area in North Sumatera was only 839 ha (Burbridge *et a!.,* 1988), by 1990 it had become 7581 ha. In West Sumatera Province, *tambaks* only covered an area of 11 ha in 1990.

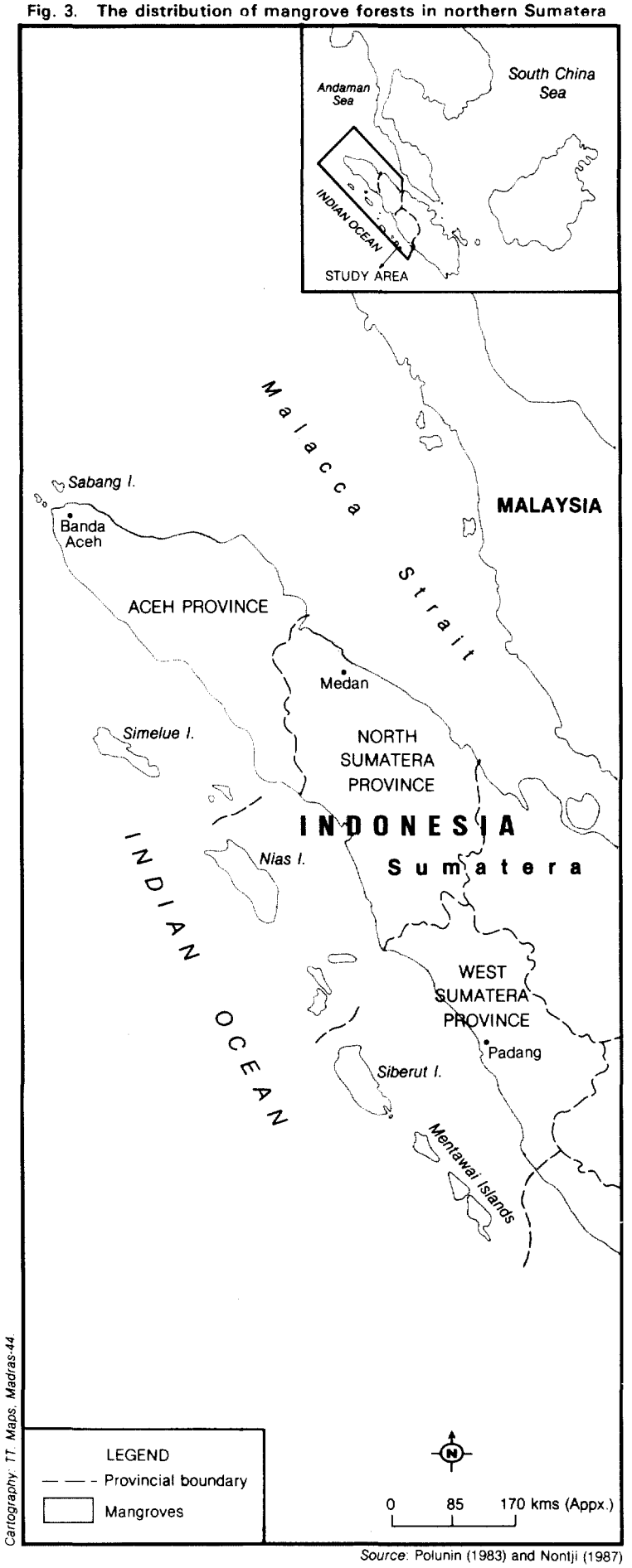
Estimated areas of brackishwater ponds in the study area, 1990

Province	*Estimated area (haj*
ACEH	35,998
East coast	**35,753**
Banda Aceh	538
Aceh Besar	573
Pidie	4,282
North Aceh	15,516
East Aceh	14,836
Sahang	9
West coast	245
West Aceh	238
South Aceh	
NORTH SUMATERA	7,851.1
East coast	7,354.8
Labuhan Bats	179
Asahan	1,966.7
Deli Serdang	1,705.1
Langkut	3,016.5
Medan	487.5
West **coast**	226.3
Central Tapanuli	226.3
WEST SLIMATERA	11.3
Pesisir Selatan	
Padang Pariaman	8.3

Source. Population and the Environment Bureaux: Aceh Prov. (1992), North Sumatera Pros. (1992), and West Sumatera Pros, (1992)

Mangroves are essential for the supply of nutrients, to serve as nursery and spawning grounds, and to protect coastal land from wave and storm actions. But the

Fig. 3. The distribution of mangrove forests in northern Sumatera



Cartography: TT. Maps, Madras-44

Source: Polunin (1983) and Nontji (1987)

local population values mangroves only for its produce that can be marketed, such as wood and crabs. Mangrove areas are, therefore, generally considered as low value or even 'waste land'. The actual value of mangroves has not been considered in any economic analysis or evaluation of development projects.

Pollution, particularly from oil and gas as well as petrochemical industries, have degraded mangrove ecosystems along the coast of the Straits of Malacca since the early 1970s. Extensive damage occurred after an oil tanker (*Sho wa Maru)* spill in the Straits in 1975 (Soegiarto, 1982).

5.2 Seagrass, algae beds and coral reefs

Seagrass and algae (seaweed) are deliberately lumped together, because seaweed are common in many seagrass beds, including such sandproducing genera of green algae, as *Halimeda* sp. and *Neomeris* sp. (Nontji, 1987). Green, red, brown or bluegreen algae are also common on shallow coral reef flats and frequently occur in mangroves, estuaries and even in brackishwater shrimp/ fish ponds (Burbridge and Maragos, *1985).* Seagrass beds frequently occur landward of coral reefs, where they are protected from heavy wave actions.

Information concerning both the extent and conditions (structure, species composition, ecology etc.) of seagrass and algae beds in Indonesia is very scarce. Fisheries Departments at the provincial level in Aceh, North Sumatera and West Sumatera, have neither the interest nor the capability to collect such data (due to constraints mainly on budget and human resources).

In interviews with the Provincial Fisheries Department and Environmental Studies Centres in these three provinces in 1992,

Fig. 4. The distribution of coral reefs and algae beds in northern Sumatera

Source: Nontji (1987)

it was learnt that nearly all seagrass and algae beds and coral reefs are on the west coast of the study area (see Figure 4 on facing page). Coral, seagrass and algae require clean (unturbid) waters, and these exist only there.

Most of the coral reefs around Sumatera are fringing reefs, *i.e.* growing out from the land. However, atolls and barrier reefs are found between the west coast of Sumatera and the islands of Simeulue, Nias and Mentawai (Whitten, et *a/., 1984).*

The coastal waters of West Sumatera Province have considerable potential for producing algae. *Gelidium* spp. (Nontji, 1987). *Eucheuma* sp. and *Gracilaria* sp. are found along the west coast of Aceh and North Sumatera Provinces.

Several human activities have been detrimental to coral reefs and the associated seagrass and algae beds. The use of explosives to capture reef fish and to mine coral are probably the most significant and widespread negative factors. The use of poisons, collecting coral rock from reef flats, sedimentation and pollution also have negative impacts.

In the Padang District of West Sumatera Province alone, coral reefs damaged due to coral-mining, fish-blasting and sedimentation on account of poor upland management practices amounted to about 64,000 ha in 1991 (Bureau for Population and the Environment of West Sumatera Province, 1992). Explosives have also been used to capture reef fish (Yellowtails) and ornamental fish as well as to mine coral along the west coast of Aceh Province, especially in the vicinity of Weh Island, one of the most popular tourist islands.

There has been no report, so far, about the damage to coral ecosystems by human activities in the marine waters of North Sumatera Province.

Unless more stringent regulations are implemented to ensure proper management of seagrass and algae beds, and coral reefs, these ecosystems will, with the increase in developmental activities, slowly but surely be threatened.

5.3 Estuaries

Extensive estuarine areas are found where the rainfall is high and the coastal plains gently slope to the coast — as along the east coast of Aceh and North Sumatera Provinces. Estuaries are also found on the west coast of Aceh Province, where the open areas are subject to significant seasonal salinity variation and several large rivers discharge their freshwater into the sea (Figure 5, overleaf). There are 75 rivers and streams in Aceh Province which can be grouped into five main watersheds. Four of them (Krueng Aceh, Peusangan, Jamboaye and Peureulik/Tamiang Rivers) flow into the Straits of Malacca, forming estuarine areas. The Wayla, Teripa, Simpang Kiri and Simpang Kanan Rivers, on the other hand, discharge their freshwater into the Indian Ocean and form a major estuarine area on the west coast of Aceh Province (Figure 5, overleaf).

Major estuarine areas along the coast of North Sumatera are formed in the Bampu, Asahan, Kuala, Bila and Barumun Rivers. Only two major rivers flow into the Indian Ocean, the Batangaris and the Batan Gadis (Figure 5, overleaf).

Because of the geological structure of Sumatera, there are no large rivers in West Sumatera Province that flow into the Indian Ocean (Figure 5, overleaf). As a consequence, there are no major estuarine areas here.

Estuaries are among the most productive ecosystems and valuable fishing grounds in Indonesia, supporting large fish and crustacean populations in the adjacent coastal waters (Soegiarto, 1989). Doty et *al.* (1983) reported a primary production twenty times higher in the Deli River Estuary (North Sumatera) than in the open water (20 km from the estuary).

In spite of the importance of estuaries, information on them is still very scanty.

In the study area, especially in the eastern part, estuaries are generally associated with other coastal landforms, such as deltas and embankments, as well as with highly valuable coastal ecosystems like mangroves and tidal swamp forests.

Environmental threats to estuaries by human activities are worse on the east coast of the study area than on the west. There are three major environmental threats:

- Sedimentation, causing highly turbid water.
- Changes in hydrological regime.
- Pollution.

Fig. 5. The distribution of main rivers and industries in the provinces of Aceh, North Sumatera and West Sumatera in northern Sumatera

Source: Pemda Dati I Sumut (1992)

Highly turbid water is common in many rivers, especially in areas where the uplands are intensively used for agriculture and plantation but with poor land management. Such areas are the Alas River in southeast Aceh (Whitten *et* al., 1984), and the Asahan River and Deli River regions of North Sumatera.

Changes in the salinity regime are caused by brackishwater entering further out to sea during the rainy season, while salt intrusion is more extensive in dry periods.

Pollution caused to estuarine ecosystems, by industrial and domestic waste (see Figure *5,* facing page, for major industrial and urban centres), pesticides and herbicides from intensive agriculture and other pollutants being discharged into the estuaries, is a growing problem. Some riverine estuaries, such as the Tamil River in Langsa, Aceh, and the Asahan River, North Sumatera, have frequently been found to be polluted by pesticides, herbicides and organic wastes from the oil palm industry.

6. MARINE POLLUTION

The marine environment of the west coast (Indian Ocean) is still relatively unpolluted by anthropogenic sources. An exception is the Teluk Bayur harbour of West Sumatera, which is polluted by oil and garbage.

The pristine west coast is a very valuable asset for the future and needs to be protected. The eastern coastal waters (the Malacca Strait), however, show signs of pollution (table below). In some locations, such as Lhokseumawe in North Aceh, and Asahan and Deli Serdang in North Sumatera, the concentrations of BOD and COD and heavy metals (mercury, lead, cadmium and copper) exceed the national environmental standards for bathing and swimming as well as for marine organisms and mariculture (Dardak *et* al., 1988; Sembiring *et* al., 1984; Simanjuntak *et* al., 1984; Harwinata *et* al., 1986; and Rozak *et* al., 1984). Moreover, concentrations of lead and cadmium in the tissue of molluscs are reported as exceeding environmental standards (Harwinata *et al.,* 1986).

Values and National Environmental Standards for some water quality parameters in the Straits of Malacca

Parameters	*Lowest (mg/l)*	*Highest (mg/l)*	*Environmental Standard - (mg/l)*	
			Required	*Allowable*
1. BOD	3.3	56.6	<25	≤ 45
2. COD	0.8	766.1	≤ 40	≤ 80
3. Hg	ad	0.013	<0.0001	≤ 0.0003
4. Pb	0.035	0.060	<0.00002	≤ 0.01
5. Cd	0.009	0.014	0.00002	≤ 0.01
6. Cu	0.07!	0.107	< 0.001	≤ 0.06

Source: Rozak *et al.* (1984).

= Based upon standard for fisheries uses of marine waters (Environmental Ministerial Decree No. 02/MENKLH/1988).

ud = undetected.

Five major sources of pollution in the marine environment have been identified

1. Domestic waste from major population centres.
2. Industrial waste.
3. Hydrocarbons, both from oil spills and landbased discharges.
4. Landbased sedimentation/siltation.
5. Pesticide compounds from agricultural and forestry activities.

6.1 Domestic wastes

Seventy per cent of the population of Aceh and North Sumatera live on the east coast. A consequence of this is that the waters here receive more organic substances and coliform bacteria originating from domestic waste than elsewhere.

6.2 Industrial waste

Most industrial activity takes place on the eastern coast, adjacent to the Malacca Straits (Dardak et ***al.,*** 1988 and Pian ***et al.,*** 1988). The distribution of industries and their potential environmental impact are shown in Figure 5 (see p. 20) and the table below.

Major industries and their potential impact on the marine environment in the study area

Type of industry	Location		Potenttial impact
ACEH			
Oil palm industry	East Aceh, east coast; West Aceh, west coast	–	Organic pollution
Lhokseumawe Industrial Zone (LNG fertilizer, LPG, paper kraft and olefin)	Lhokseurnawe, North Aceh, east coast	– –	Mercury pollution Ammonia pollution Sulphuric pollution
Oil and gas industry (drilling and processing)	Lhokseumawe, North Aceh, east coast	–	Oil pollution Organic pollution Heavy metal pollution
Forestry industry (sawmill, plywood)	Along the east coast, and West Aceh District	–	Organic pollution Chlorinated hydrocarbon
NORTH SUMATERA			
PLTU	Belawan, east coast	–	Thermal pollution, Oil discharge
Oil and gas industries	P. Brandan, east coast	–	Oil pollution, Sulphuric pollution
Aluminium smelter	Kuala Tanjung, east coast	–	Heavy metal pollution
Mining of sand quartz	Tanjung Tiram. east coast	–	Coastline erosion. Sedimentation
Oil palm and Crent processing plant	Lowland of east coast	–	Organic pollution
Forestry industry (pulp mills)	Spread in lowland areas	–	Organic pollution PCB
WEST SUMATERA			
Padang industrial complex	Padang, West Sumatera	–	Organic pollution Heavy metal pollution

Sources : Dardak et al., (1988); Pian et al., (1988); and Bappeda Propinsi D1. Aceh (1988).

One of the most polluted areas is the Lhokseumawe Industrial Zone (described by Burbridge ***et al.,*** 1988). The LNG (Liquified Natural Gas) plant faces problems in disposing of mercury solid waste extracted during the gas liquification process. In 1983, mercury waste at Lhoksuemawe was being stored in oil drums in an open, exposed location, 2 km from the nearest well and l km from the sea. A concrete bunker had been built to store the drums which were found to be rusting and with waste leaking out. The dump contained some 175 t of mercury waste, of which 10.5 t was mercury sulphide. At the moment (1992), the annual production of mercury waste is about 85 t/year. Unfortunately, there has been no analysis of mercury residues in fish and other organisms.

Other potential sources of pollution from the Lhokseumawe Industrial Zone are: carcinogenic smoke from gas flares at the LNG plant; various chlorinated organic substances, such as AOX, dioxins and furanes, from the kraft paper mill; urea dust from two fertilizer plants; and mercury and ethylene from the olefin plant which daily produces some 7 t of mercury-contaminated wastes. In addition, substantial quantities of wastewater containing urea, mercury and ammonia wastes are also discharged into the surrounding marine environment (Pusat Penelitian UNSYIAH, 1987 and 1989).

Information on the pollution load from Asahan, Medan, Meulabah, Padang and other industrial areas is scant. However, pollution problems, though local and accidental, have already occurred in these places.

6.3 Oil

The Malacca Strait is one of the world's major oil tanker routes. Figures from 1979 show an average concentration of hydrocarbon (oil) in the water column ranging from 0.1 to 6.3 ppm (Soegiarto, 1982). The environmental standard of oil concentration for marine organisms is 5 ppm. Many oil spill accidents have taken place in the straits. The largest oil spill occurred with the grounding of the 237,698 dwt *Showa Maru* on January 6, 1975, when more than 7,000 t of crude oil reached marine waters (Soegiarto, 1982). Since then, there have been many smaller oil spills in the straits.

6.4 Sedimentation

One of the most serious environmental problems is sedimentation in lowland and coastal areas due to soil erosion from poor upland management. In the Aceh Province, three watershed systems (i.e. Krueng Aceh, Jamboaye and Peusangan) out of five have been seriously damaged by sedimentation, partly due to land clearance for agriculture and plantations (Pian et *al.,* 1988).

Serious soil erosion problems have also occurred in the upper watersheds of North Sumatera Province due to uncontrolled conversion of upland areas with natural vegetation into agricultural use. Both flooding and siltation have been cited as having negative impacts on coastal ecosystems and fisheries. The rivers most severely affected were the Asahan, Bila, Kuala, Baruman, Silam, Percut and Bahbolan (Burbridge *et al., 1988).*

The impact of poor upland management on the lowland and coastal areas of West Sumatera has also been observable, but the effects here are less severe.

6.5 Agriculture

The eastern lowlands have been used intensively for agriculture and plantations, particularly oil palm cultivation, since the Dutch colonial period. North Sumatera now has the largest average of oil palm plantations in the country. The extent of use of herbicides, rodenticides, and fungicides in agricultural activity in the coastal districts of the study area is presented in the table alongside.

The pesticide residues mainly enter the river systems through run-off, and eventually reach the marine ecosystems. No analysis, however, has been made of residues in fish and other marine organisms.

The use of pesticide compounds in agricultural activities on the coasts of Aceh, North Sumatera and West Sumatera Provinces (kg)

Coastal area/district	*Insecticide*	*Fungicide*	*Rodenticide*	*Herbicide*
EAST COASI				
Aceh				
Banda Aceh	–	–	–	–
Pidie	2,000,295	100,200	-	–
North Aceh	585,704	142	–	1,100
East Aceh	239	6,100	–	2.305
Sabang	331	275	34	32
North Sumatera				
Langkat	129,050	362	3,329	3,770
Deli Serdang and Medan	856,461	3,183	283,813	- .712
Labuhan Batu	67,502	37	3,076	4,928
Asahan	140.463	175	1,138	6,450
Kodya Binjali	–	–	–	–
WEST COAST				
Aceh				
West Aceh	2,101		–	–
South Aceh	2,071,316	140,110	–	12
North Sumatera				
Central Tapanuli	33,736	29	623	1,483
South Tapanuli	93,553	725	2,994	1,127
Nias	11,790	37	890	409
West Sumatera				
Pasaman	112	161	25.531	–
Padang Pariaman	449	–	1,081	–
Kodya Padang	346	–	100	–
Pestsir Setatan	3,414	65	1,062	4,541
Total	5,996,866	251,601	323,671	33,869

Sources : Bureau for Population and the Environment. Provinces of Aceh. North Sumarera and West Sumarera (1992).

7. MARINE FISHERIES

Marine fisheries resources in Indonesia are usually classified into five major groups :

- Demersal;
- Small pelagic;
- Large pelagic, consisting of tuna and skipjack;
- Shrimp; and
- Others, which include molluscs, seagrass and jellyfish.

There has so far (1992) been no accurate data on the maximum sustainable yield (MSY) of the marine fisheries resources. MSY data are available only for the whole of the Straits of Malacca and the marine waters of West Sumatera, except for the small stretch of western Lampung Province.

The sustainable potential of fisheries resources in the Straits of Malacca and the west coast of Sumatera amount to 366,860 t/year and 211,330 t/year respectively (Naamin and Hardjamulia, 1990). With such potential, the Malacca Strait has the second largest fisheries resource in Indonesia, after the north coast of Java.

The Straits of Malacca, however, are already overfished (Naamin and Hardjamulia, 1990). But resources off the west coast of Sumatera have still not been fully utilized. This condition is also reflected by the CPUE (catch per unit of effort) figures of these two marine waters (see table below).

CPUE by number of fishing boats by year (1980 - 1990)

Year	CPUE by number of fishing boots (t/ no.)				
	A ceh Province east coast	Aceh Province west coast	N. Sumatera Province east coast	N.Sumatera Province west coast	W. Sumatera Provmce
1980	5.67	6.69	8.92	5.14	6.23
1981	6.65	5.44	5.72	2.87	6.74
1982	5.64	4.44	5.86	4.70	6.39
1983	6.69	5.49	8.05	4.94	4.38
1984	5.17	5.96	7.49	5.36	4.65
1985	10.88	5.27	7.04	5.21	4.84
1986	9.98	5.39	6.69	6.18	5.62
1987	9.48	5.35	6.51	5.46	5.70
1988	8.37	6.45	7.49	6.28	6.71
1989	12.82	7.06	7.58	6.73	8.87
1990	8.46	8.05	7.56	6.92	8.88

Source : Directorate General of Fisheries (1980-1991)

It is clear that the marine fisheries of the eastern part of the study area are threatened not only by physical degradation of habitats and pollution but also by overexploitation. Although environmental threats to marine fisheries in the western part of the study area are relatively minor, careful environmental management should be undertaken to ensure sustainable development of fisheries resources there.

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APPENDIX IV

Institutions engaged in environmental research, monitoring and enforcement

The following institutions and authorities are engaged in environmental research and monitoring as well as enforcement when violations of environmental regulations take place:

Institution	*Environmental management functions*		
	Research	*Monitoring*	*Law enforcement*
NATIONAL LEVEL			
Ministry of State for Population and the Environment	Yes	Yes	No
Agency for Environmental Impact Control (BAPEDAL)	Yes	Yes	Yes
Ministry of Communication and Transportation	No	Yes	Yes
Ministry of Public Works	No	Yes	No
Ministry of Industry	No	Yes	Yes
Ministry of Research and Technology	Yes	No	No
Directorate General of Fisheries	Yes	Yes	Yes
Minjstry of Defence	No	Yes	Yes
Research and Development Centre for Oceanology (P3O-LIPI)	Yes	Yes	No
Research Institute for Marine Fisheries, Dept. of Agriculture	Yes	Yes	No
Research Institute for Oil and Gas (LEMIGAS) Pertamina	Yes	No	No
Hydrooceanography Institution, Indonesian Navy (DISHIDROS)	Yes	No	No
Centre for Research, City Development and the Environment (P4L)	Yes	No	No
Environmental Research Centre (IPB)	Yes	No	No
Agency for National Survey and Mapping (BAKOSURTANAL)	Yes	No	No
Indonesian Environmental Forum (WAHLI, an NCO)	Yes	Yes	No
PROVINCIAL LEVEL			
Environmental Studies Centre, University of Syiah Kuala (UNSYIAH)	Yes	No	No
Environmental Studies Centre, University of North Sumatera (USU)	Yes	No	No
Environmental Studies Centre, University of Andalas (UNAND)	Yes	No	No
Bureaus for Population and the Environment, Provinces of Aceh. N. Sumatera and W. Sumatera	No	Yes	Yes
Governor's Offices. Aceh, N. Sumatera and W. Sumatera Provinces	No	No	Yes
Provincial Fisheries Departments, Aceh, N. Sumatera and W. Sumatera	Yes	Yes	Yes
Regional Offices of Ministry of Defence, Aceh, N. Sumatera and W. Sumatera Provinces	No	Yes	Yes
Regional Offices of Ministry of Justice, Aceh, N. Sumatera and W. Sumatera Provinces	No	No	Yes
Yasika (Environmental NGO) in Medan, N. Sumatera.	Yes	Yes	No

LABORATORIES UNDERTAKING ENVIRONMENTAL ANALYSES

Centre for lndustrial Research and Development, Banda Aceh, D.I. Aceh Province.

Overseas Development Administration Northeast Sumatera Prawn Project Laboratory, Medan, North Sumatera Province.

The Environmental Studies Centre of North Sumatera University, Medan, North Sumatera Province.

The Environmental Studies Centre of Syiah Kuala University, Banda Aceh, D.I. Aceh Province.

The Environmental Studies Centre of Andalas University, Padang, West Sumatera Province.

The Environmental Studies Centre of Bogor Agricultural University, Bogor, West Java Province.

SEAMEO-BIOTROP Bogor Laboratory, West Java Province.

Centre for Resources and Development of Oceanology, Indonesia Institute of Science, Jalan Pasir Putih l, Ancol. Jakarta.

Research Institute for Oil and Gas (LEMIGAS), Pertamina State Oil Company, Cileduk Raya Street, Cipulir, P 0 Box 89/Jkt, Jakarta 1002.

Centre for Research, City Development and the Environment (P4L), Jalan Casablanka No. 4, Kuningan, Jakarta.

Institute for Hydrooceanography *(DISHIDROS),* Indonesia Navy, Jakarta. Jalan Pasir Putih No. 2, Ancol, Jakarta.

APPENDIX V

Legislation against threats to the marine environment

Decree	*Subject matter*	*Enacting Institutions*
GENERAL		
Ministerial Decree No.03/MNKLH/11/1991	Issue guidance for standard of environmental quality	Ministry of State for Population and the Environment
Ministerial Regulation No. 5/PRT/1990	Water quality control on water resources.	Ministry of Public Works.
Ministerial Decree No. 02/MNKLH/1/1988	Guidance on standards of environmental quality	Ministry of State for Population and the Environment.
Government Regulation No. 29/1986	Environmental impact analysis.	President, Republic of Indonesia (R.I.)
Government Act No. 4/1982	Basic provisions for management of the living environment.	Parliament and President.
Joint Ministerial Decree No. 23/1979 and Decree No. 002/MNPPLH/2/1979.	Institutions managing natural resources at provincial levels.	Ministry of Home Affairs, and Ministry of State for Environment and Development Supervision.
Governor Decree No. 660/295/1991.	The establishment of a technical team for arranging NKLD of Aceh Province.	Governor's Office of Aceh.
Governor Decree No. 660/358/1989.	The implementation of sustainable development in Aceh Province.	Governor's Office of Aceh.
Governor Decree. No. 660/348/1989 *tahun* 1989.	The establishment of AMDAL (Env. Impact Analysis) committee in Aceh.	Governor's Office of Aceh.
Provincial Regulation No. 2/1985.	Management and preservation of the living environment.	Governor's Office of N. Sumatera.
Governor Decree No. 051 2134/ PLH-89/ 1989	AMDAL studies for industrial activities	Governor's Office of W. Sumatera.
POLLUTION		
Ministerial Decree No. I / 1985.	Procedures of pollution control for investing companies.	Ministry of Home Affairs.
Government Regulation No. 20/1990.	Water pollution control.	President, R.I.
Governor Decree No. 08/1991.	Management of water quality standard in Aceh Province.	Governor's Office of Aceh.
Ministerial Decree No. 12/M/SK/1978.	Prevention and mitigation of environmental pollution caused by industrial activities.	Ministry of Industry.
Ministerial Decree No. KM 86/1990.	Prevention of oil pollution caused by ships.	Ministry of Transportation.
Ministerial Decree No. KM 215/Al 506/ PHB.87.	The provision of waste reception facilities for ships.	Ministry of Transportation.
Presidential Decree No. 46/1986.	Ratification of international convention for the prevention of pollution from ships, 1973 and its protocol, 1978.	President. R.I.

Degree	*Subject matter*	*Enacrrng Institutions*
Ministerial Decree No. KM/167/HM/207	International certificate on prevention of pollution caused by liquid toxic substances.	Ministry of Transportation.
Director General Decree No. Py 69/ 1/1 1-86.	Implementation guidelines of Decree No. KM/167/ Decree No. KM/HM/207.	Directorate General for Marine Transportation.
Presidential Decree No. 19/1978.	Ratification of international convention on the establishment on international fund for compensation for oil pollution damage.	President, R.I.
Presidential Decree No. 18/1978.	Ratification of international convention on civil liability for oil pollution damage.	President, R.I
Governor Instruction No. 07/GSB/87/1987.	The obligation for industrial companies to conduct AMDAL and waste water monitoring.	Governor's Office of W. Sumatera
Governor Instruction No. 07/GSB/86/1986.	The obligation of industrial companies to analyze their industrial waste water.	Governor's Office of W. Sumatera
Governor Instruction No. 218/GSB/1985.	Regulation of quality standard of industrial waste water.	Governor's Office of W. Sumatera
CONSERVATION OF HABITAT AND RESOURCES		
Governor Decree No. 188. 341/01/K/1988.	Implementation guidelines of Provincial Regulation No. 2/1985.	Governor's Office of W. Sumatera.
Government Act. No. 5/1990.	The conservation of natural resources and its ecosystems.	Parliament and President, R.I.
Presidential Decree. No. 32/1990.	The management of protected areas.	President, R.I.
Presidential Decree No. 65/1980.	Ratification of international convention for safety of life at sea, 1974.	President, R.I.

Note : It is apparent from the above that sufficient laws and regulations exist to manage the utilization of the marine environment and its resources on a sustainable basis. The primary constraint, so far, has been in the implementation of most regulations; the implementation has been inconsistent.

APPENDIX VI

Other publications on the marine environment

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