

A Report on

THE STATUS OF COASTAL

AND MARINE RESOURCES OF THAILAND

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**THE STATUS OF COASTAL
AND MARINE RESOURCES OF THAILAND**

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RESEARCH TEAM

Project Advisors: Dr. Anat Arbhabhirama
 President
 Thailand Development Research Institute
 (TDRI)

 Dr. Pakit Kiravanich
 Deputy Secretary-General
 National Environment Board

Project Director: Dr. Dhira Phantumvanit
 Associate Director
 Natural Resources and Environment Program
 TDRI

Researchers : Dr. Mahunnop Bunpapong
 Department of Marine Sciences
 Chulalongkorn University

 Ms. Suthawan Sathirathai
 Research Associate
 TDRI

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LIST OF ACRONYMS

ADB	Asian Development Bank
BOD	Biochemical oxygen demand
CMD	Cubic meters per day
DOF	Department of Fisheries
EEZ	Exclusive Economic Zone
ESB	Eastern Seaboard
GDP	Gross Domestic Product
IEAT	Industrial Estate Authority of Thailand
JICA	Japan International Cooperation Agency
JTS	John Taylor and Sons
MSY	Maximum sustainable yield
NEB	National Environment Board
NESDB	National Economic and Social Development Board
NICA	National Institute for Coastal Aquaculture
PTT	Petroleum Authority of Thailand
RID	The Royal Irrigation Department
SRT	State Railway of Thailand
SLB	Songkhla Lake Basin
TAT	Tourism Authority of Thailand
TISTR	Thailand Institute of Scientific and Technological Research

Chapter 1

INTRODUCTION

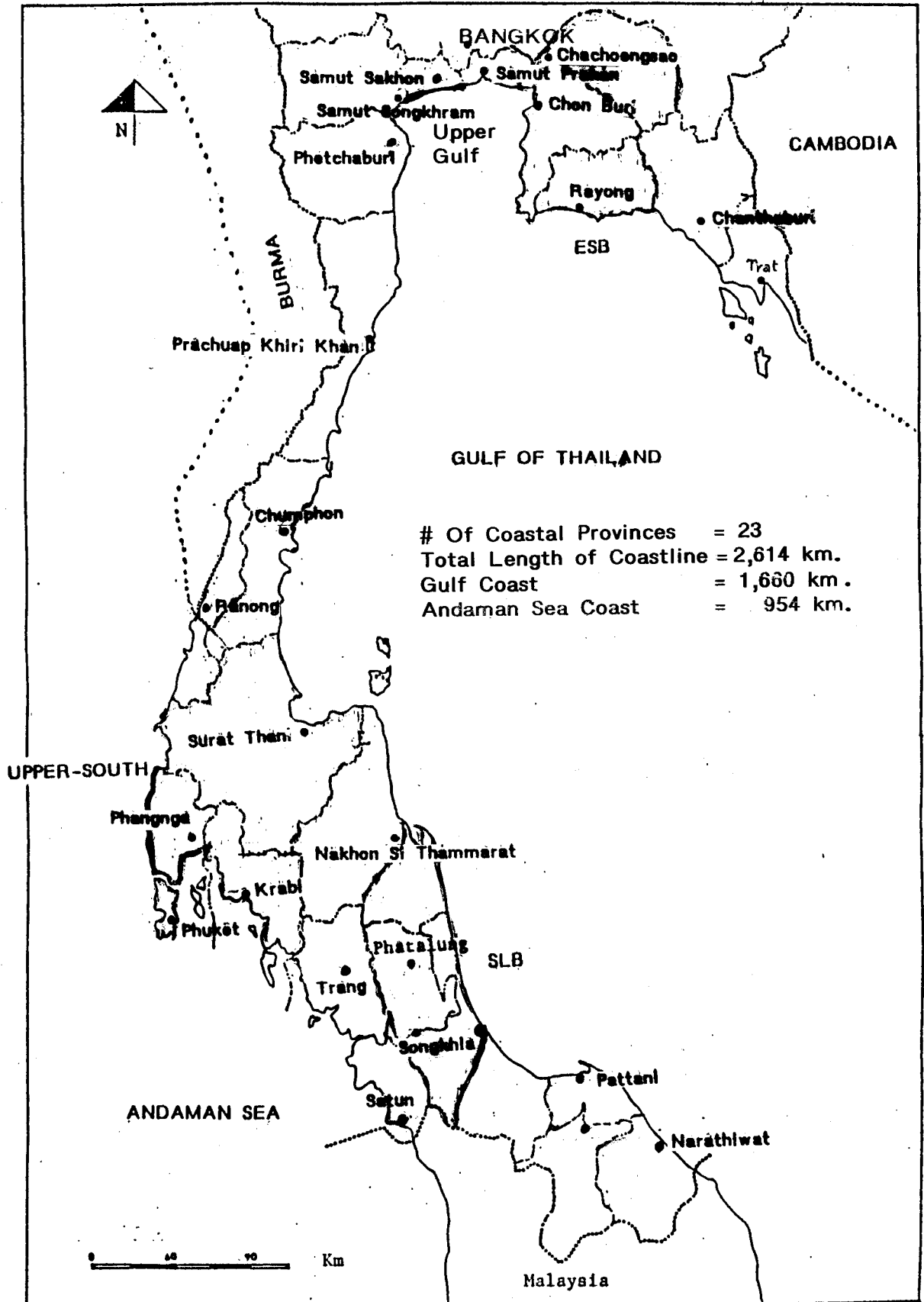
This study places the issues of Thailand's coastal and marine resources in perspective. It originated from the belief that Thailand, with 23 out of 73 of its provinces on the coast (Fig. 1), should benefit more from proper management of its coastal and marine resources. Traditionally, the Thai people look upon water resources as important sources of food. The rich seas of the Gulf of Thailand and the Andaman need to be harvested in a sustainable manner so that the renewable resources -- fish, mangrove -- will be available to both the present and the future generations.

Recent trends in fisheries show that Thailand has already crossed the threshold in terms of the maximum sustainable production capacity in the Gulf. Trash fish now represent more than 40 percent of the total marine capture from Thai waters with up to 50 percent of the trash fish being juveniles of valuable fish and shrimp species. These figures imply that the resiliency of the Gulf can no longer be taken for granted.

In recent years, any loss in the fish catch from within Thailand's Exclusive Economic Zone could be compensated by venturing into nearby countries' national waters. However, the record of Thailand's joint ventures with other countries in marine capture fisheries so far is mixed with both successes and failures.

In coastal areas, recent developments are changing the conventional land use pattern. In the Eastern Seaboard, emphasis is on heavy industries, mainly petrochemicals, whereas offshore tin mining is being practiced in the Andaman Sea off the coasts of Phuket and Phangnga. Aquaculture, particularly shrimp farming, is being expanded and is encroaching into the adjacent mangrove areas. This is prominent in the Upper Gulf provinces of Samut Prakan, Samut Sakhon and Samut Songkhram and the southern province of Nakorn Si Thammarat.

Figure 1 Coastal Zones of Thailand



1.1 Scope of the Study

This study was designed to be emphatic, covering specific topics which have already been identified as priorities by the Thai Government.

The scope of this study covers:

1) the review of the past and present status of coastal and marine resources development in Thailand, in particular marine fisheries, mangrove, and tourism;

2) the review of the trends in coastal area development in priority coastal regions of the country, namely the Eastern Seaboard, the Songkhla Lake Basin, and the Upper South;

3) the review of the present approach in the management and development of coastal and marine resources, emphasizing planning and permitting procedures;

4) the identification of policy issues vital to the successful development of a national strategy for the coastal and marine resources of Thailand.

1.2 Significance of Coastal and Marine Resources

Thailand has approximately 2,614 kilometers of coastline, 1,660 kilometers of which border the Gulf of Thailand with the rest facing the Andaman Sea. Coastal areas along the Andaman Sea are mainly mangrove forests, which constitute about 64 percent of the total available in the country. The Gulf coast has a combination of mangrove forests, mudflats, and sandy beaches.

Tropical mangrove forest is known to be one of the most productive ecological zones in terms of the living species of both fauna and flora. Its importance as a feeding and nursery ground for commercial marine species is well documented. The ability in maintaining the present technique of shrimp farming in Thailand, which relies on natural seeds from the sea, testifies to the importance of mangrove as a habitat for high economic value marine species. Mangrove also serves as a raw material for charcoal production. For low-income families, charcoal is still a major source of energy not only in coastal communities but also in other rural areas of the country.

The importance of tourism in the nation's economy is well recognized. Since 1982, tourism has become the top foreign exchange earner in comparison to other major exports. Naturally, three out of four major tourism resorts (excluding Bangkok) are on the coast. Pattaya, Phuket, Songkhla/Hat Yai are established international resorts well known to faraway travellers.

Coastal aquaculture is gaining credence as a viable substitution for marine capture fisheries. The introduction of coastal aquaculture not only improves the economic conditions of the farmers but also has a direct impact on the employment of the people in the coastal areas.

The Thai fishing industry is one of the ten largest in the world and the fifth largest in Asia. The industry grew rapidly from a fleet of 400 purse seines and 1500 fishing traps and a catch of 150,000 tons in 1960, to a fleet of over 45,000 trawlers and other large-scale gears and to a catch of over 2.26 million tons in recent years. The fishing industry in 1983 contributed around 1.6 percent to the Gross Domestic Product (GDP) and to about 7 percent of the total export earnings. The industry's contribution to employment was estimated at 280,000 or 1.3 percent of the total work force plus an equal number of jobs derived from secondary employment. The industry supplies about 22.5 kilograms of fish per head to a population of 52 million. Marine capture fisheries account for over 90 percent of Thailand's total fish production.

Despite its remarkable growth, the Thai fishing industry is beset with problems. First, parts of the industry, the small-scale coastal fishermen in particular, continue to use outdated technology; are in constant conflict with the large-scale trawlers; and live in poverty. Second, Thai fishery resources are believed to be heavily overfished with an annual catch that exceeds the maximum sustainable yield. Third, there is a problem of the loss of fishing grounds following the declaration of Exclusive Economic Zones (EEZs) by neighboring countries; about one-third of Thai catch is caught outside the national waters. Fourth, the continued encroachment onto neighboring countries' EEZs by Thai vessels is a source of constant tension in Thailand's relations with its neighbors; hundreds of Thai vessels and hundreds of fishermen are arrested annually in foreign waters. On the other hand, if encroachment could and was actually stopped, overfishing of Thai resources, and conflicts with small-scale fishermen would be exacerbated, because the distant water fleet would have to be accommodated within Thailand's limited fishing grounds. Fifth, coastal pollution, illegal trawling and pushnetting in near shore areas, use of destructive fishing methods such as explosives and mangrove felling, result in environmental degradation detrimental to fisheries' production.

The promise of and enthusiasm for joint fishing ventures as a way out of this predicament has not been matched by actual performance because of disputes over profit sharing arrangements, demands for employment and training of host country labor, and continued encroachment of host country fishing grounds by Thai vessels.

With this background, it is evident that if Thailand is to continue to reap the benefits from its rich coastal and marine resources, a better understanding of alternative options for coastal and marine resources development will be necessary.



Photo_1 Typical Fish Landing



Photo_2 Net-fishing near a Coast

Chapter 2

COASTAL AND MARINE RESOURCES DEVELOPMENT

2.1 Coastal and Marine Resources

The Gulf of Thailand is a large, nutrient rich, shallow body of water that has a high level of primary production and is an ideal breeding and nursery ground for marine organisms. The mangrove forests, estuaries and coastal waters fringing the Gulf are teeming with juvenile fish and shrimp species. Nutrient salts entering the Gulf are derived predominantly from the heavy runoff of four major rivers, viz. Chao Phya, Mae Klong, Ta Chin, and Bang Pakong. The nutrients tend to have a long residence time in the Gulf and have been estimated at 365 gram-carbon/cubic meter/year (FAO, 1981). The sea floor of the Gulf is generally well suited to trawling. In contrast to the Gulf, the Andaman Sea coast of Thailand is an open area with deep oceanic waters. Most of the sea floor on the continental shelf is rocky or coral studded which is not suitable for trawling. The trawl grounds with the highest catch rates in the Andaman Sea are in the northern part of Krabi.

2.1.1 Fisheries

Marine fishery resources consist of demersal fish, pelagic fish and other invertebrates, such as shrimp and squid. In 1983,^{1/} a total fish production of 2.26 million metric tons (mt), of which more than 90 percent was marine capture fish (DOF, 1986a), made Thailand's fishery one of the world's largest. The marine fish production in 1983 was valued at 15 billion baht or 1.6 percent of the Gross Domestic Product (ADB, 1985). Although the fishery sector represents a relatively small portion of Thailand's GDP, it contributes to export earning and employment and serves as a source of animal protein for the Thai people. Fishery product exports in 1985 totaled 10.59 billion baht, equivalent to about 12.6 percent of total agricultural exports (83.59 billion baht) (Bank of Thailand, March 1986). The positive balance in fish and fish products increased from 284 million baht in 1970 to 10,407 million baht in 1982. The number of fishermen and fish farmers as estimated by ADB in 1985 was 280,000 (Table 1).

^{1/} In this report, 1983 is often used as the base year. This is due to the paucity of printed documents which could supply more up-to-date information. However, best available statistics as compiled in this report are still valid, since there were no drastic economic and social changes in the last couple of years.

Table 1 Employment in the Fisheries Sector

Activity	Estimated Number of Fishermen and Fish Farmers
Marine capture	223,500
Mariculture	2,000
Brackish water culture	19,000
Freshwater culture	8,000
Freshwater capture	27,000
Total	279,500 =====

Source : ADB, 1985

a) Demersal Fisheries

Prior to the 1960s, demersal fisheries were very limited due to the lack of know-how and experience of local fishermen. Only beam trawling and pair trawling were employed and the production was not substantial. The demersal fisheries in Thailand were rapidly developed after the introduction of otter board for trawling in the Gulf of Thailand in the early 1960s. The total number of registered fishing vessels equipped with trawling nets has varied throughout the years as shown in Figure 2. The figures in Table 2 indicate a steady trend in the total demersal catch in the Gulf in recent years, while the catch rate has been decreasing from 297.6 kg/hr in 1961 to only 49.8 kg/hr in 1981. It was estimated from these data that the maximum sustainable yield (MSY) for demersal fish in the Gulf was reached somewhere between 1968 and 1971 (ADB, 1985). However, the MSY for demersal resources in the Gulf was estimated to be 750,000 mt (Boonyubol and Pramokchutina, 1982). According to this figure, the MSY was reached in the mid 1970's.

The demersal resources of the Andaman Sea have been much less intensively studied than those in the Gulf. The demersal trawlable stock was estimated by Hayase (1983) to be about 500,000 metric tons (mt) with the potential annual harvest of 120,000 mt. However Bhatia et al., (1983) estimated the potential to be 180,000 mt. Statistics of the demersal catch (Table 3) reveal that the catch in the Andaman fishing grounds has steadily declined since 1976 after it reached a peak of 230,496 mt. The catch rate compiled by the Department of Fisheries (DOF) in 1966 was 613 kg/hr while the approximate catch rate statistics from the fishermen compiled by DOF during the 1973 to 1980 period was in the range of 200 kg/hr. Based on these figures, the fishing effort can be assumed to be excessive (ADB, 1985).

Figure 2 Number of Registered Trawlers

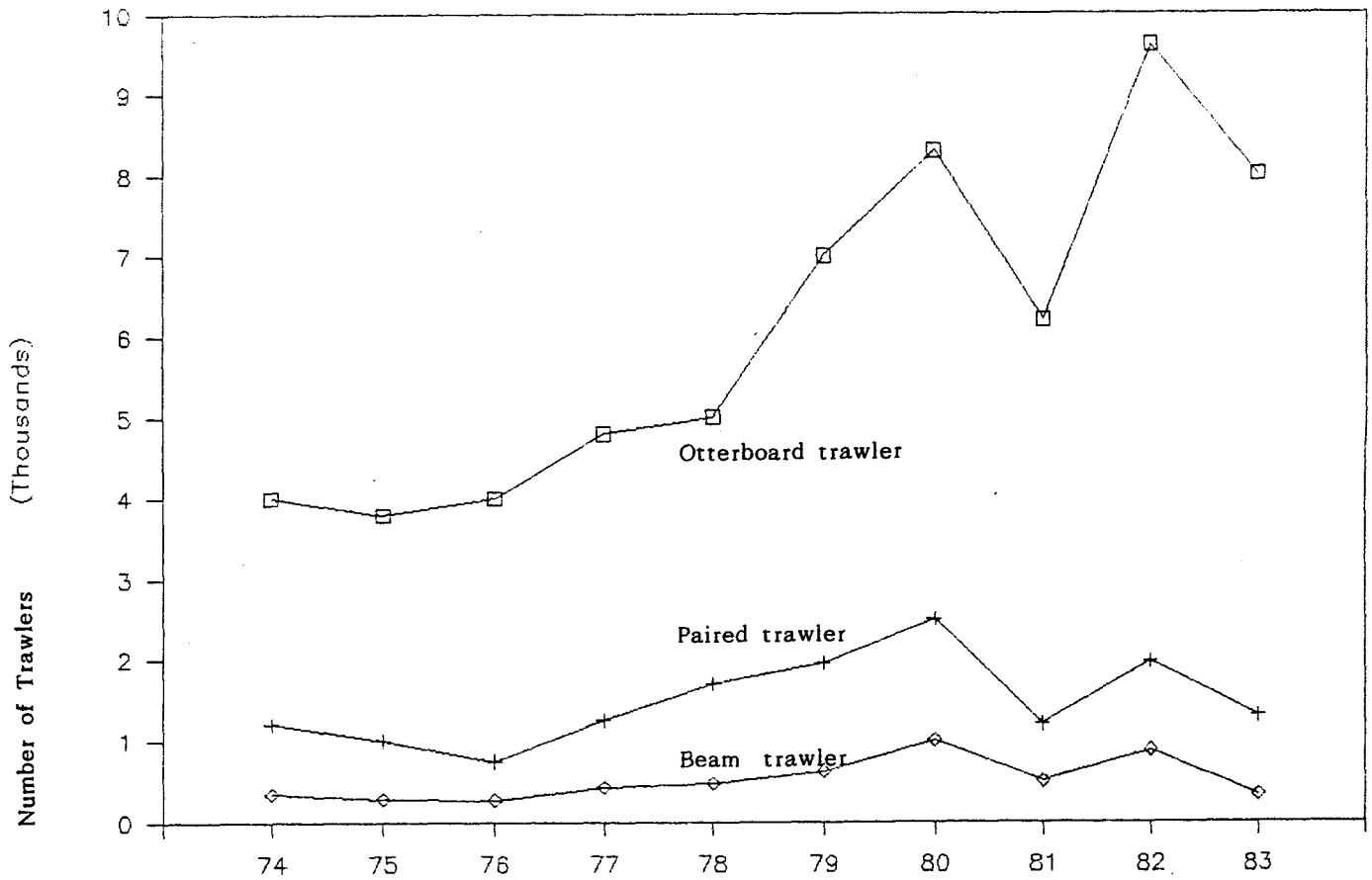


Table 2 Changes in Demersal Catch in the Gulf of Thailand

Year	Demersal Catch (mt)	Effort (1000 trawl hours)	Catch Rate (kg/hr)
1960	50,850	-	-
1961	106,550	358	297.6
1962	102,700	515	199.4
1963	198,200	672	294.9
1964	320,600	1,114	287.8
1965	343,100	1,471	233.2
1966	363,800	2,051	177.4
1967	437,420	2,773	157.7
1968	573,850	3,493	147.0
1969	518,650	3,621	143.2
1970	530,890	3,875	137.0
1971	608,580	6,065	100.3
1972	711,300	7,362	96.6
1973	829,150	5,810	142.7
1974	600,260	6,439	93.2
1975	746,240	9,683	77.1
1976	757,330	8,185	92.5
1977	841,290	11,216	75.0
1978	810,760	9,978	81.3
1979	791,490	9,932	79.7
1980	781,660	12,610	62.0
1981	780,000	15,672	49.8

Source: Boonyubol and Pramokchutina, 1982.

Table 3 Changes in Demersal Catch in the Andaman Sea, 1970-1980

Year	Demersal ^{1/} (mt)	No. of Trawlers
1971	191,936	270
1972	186,738	372
1973	234,229	553
1974	213,384	479
1975	186,314	421
1976	230,496	371
1977	185,268	456
1978	181,032	673
1979	184,965	817
1980	170,984	1077

Source : Adapted from Bhatia et al., 1983

^{1/} Includes shrimp, squid, and other invertebrates.

b) Pelagic Fisheries

Pelagic fisheries used to be the principal fishing practiced in Thailand. Its role has eventually been replaced by the successful development of demersal trawling fisheries. The major development in pelagic fishing techniques was the adoption of the luring purse seine in 1973. The total pelagic catch in the Gulf increased dramatically up to 1977 and declined thereafter despite the stable total effort in terms of the fishing gear (Table 4). The potential yield of pelagic fish was estimated by Menasveta et al., (1973) at 365,000 mt/yr. This is close to the 400,000 mt/yr estimated by Phasuk (1982). The decline in the total pelagic catch is attributed to over-exploitation of the resources after the introduction of the luring purse seine.

Table 4 Pelagic Catch in the Gulf of Thailand

Year	Pelagic catch (mt)	No. of registered ^{1/} gear units
1971	62,853	615
1972	80,171	620
1973	140,783	749
1974	170,430	670
1975	196,282	699
1976	308,967	833
1977	476,058	967
1978	393,147	978
1979	345,315	938
1980	285,594	942

Source: ADB, 1985

^{1/} Consisting of Thai purse seine, luring purse seine, anchovy purse seine, and encircling gill net.

As the figures indicate in Table 5, the catches of the pelagic fish in the Andaman Sea peaked during the 1971-1973 period and have fluctuated widely thereafter. Bhatia et al., (1983) estimated the potential harvest of pelagic fish and squid at about 71,000 mt/yr.

Table 5 Changes in Pelagic Catch in the Andaman Sea, 1970-1980

Year	Pelagic Catch (mt)	No. of Seines
1970	-	98
1971	45,632	106
1972	43,359	106
1973	56,965	155
1974	31,108	185
1975	35,874	112
1976	24,554	117
1977	33,593	144
1978	18,881	133
1979	34,551	94
1980	15,157	134

Source: Adapted from Bhatia et al., 1983.

Further development of marine capture fisheries is severely constrained by a number of factors, most notable is the over-exploitation of almost all local stocks within the national waters. Beyond these boundaries, there is potential for pelagic fisheries, especially skipjack tuna, in the Pacific Ocean. However, the reduced access of fisheries resources due to the declaration of the Exclusive Economic Zones (EEZs) of other coastal nations poses as another constraint to Thai fisheries.

c) Coastal Aquaculture

Brackish water pond culture. Coastal aquaculture in Thailand started with the shrimp farms on the coastal areas along the Upper Gulf. The technique used was simple in which sea water containing natural seed was pumped into paddy fields without additional feeding and predator elimination. The initial area of shrimp ponds recorded in 1971 was 57,447 rai, comprising 1,137 families. During mid 1967, DOF, recognizing the importance of shrimp farming, developed hatcheries to supply seeds to the farmers. The areas for brackish water ponds were steadily increased from 151,055 rai in 1978 to 192,453 rai in 1982 (Table 6). There were 3,943 family farms in 1982 and the total production was 12,842 mt, consisting of 10,091 mt of shrimp, 2,735 mt of fish, and 16 mt of crab (ADB, 1985). A recent development of brackish water cage culture of fish, predominantly

sea bass and grouper, was initiated by DOF in 1979. This was part of the development of small-scale fisheries located in the northern end of Phangnga Bay on the Andaman Sea coast. Progress has been visible since 1982; the number of cages had grown to over 1,000, operated by about 250 families (ADB, 1985).

Based on the suitability of land for brackish water ponds, DOF estimates that there are about 159,600 rai of potential expansion areas. Most of the land is located in mangrove forests mainly in the South.

Table 6 Brackish Water Pond Areas and Production

Year	Area (rai)	Production (mt)
1978	151,055	9,915
1979	154,222	10,659
1980	162,727	11,818
1981	171,619	13,579
1982	192,453	12,842
1983	-	14,064

Source : ADB, 1985

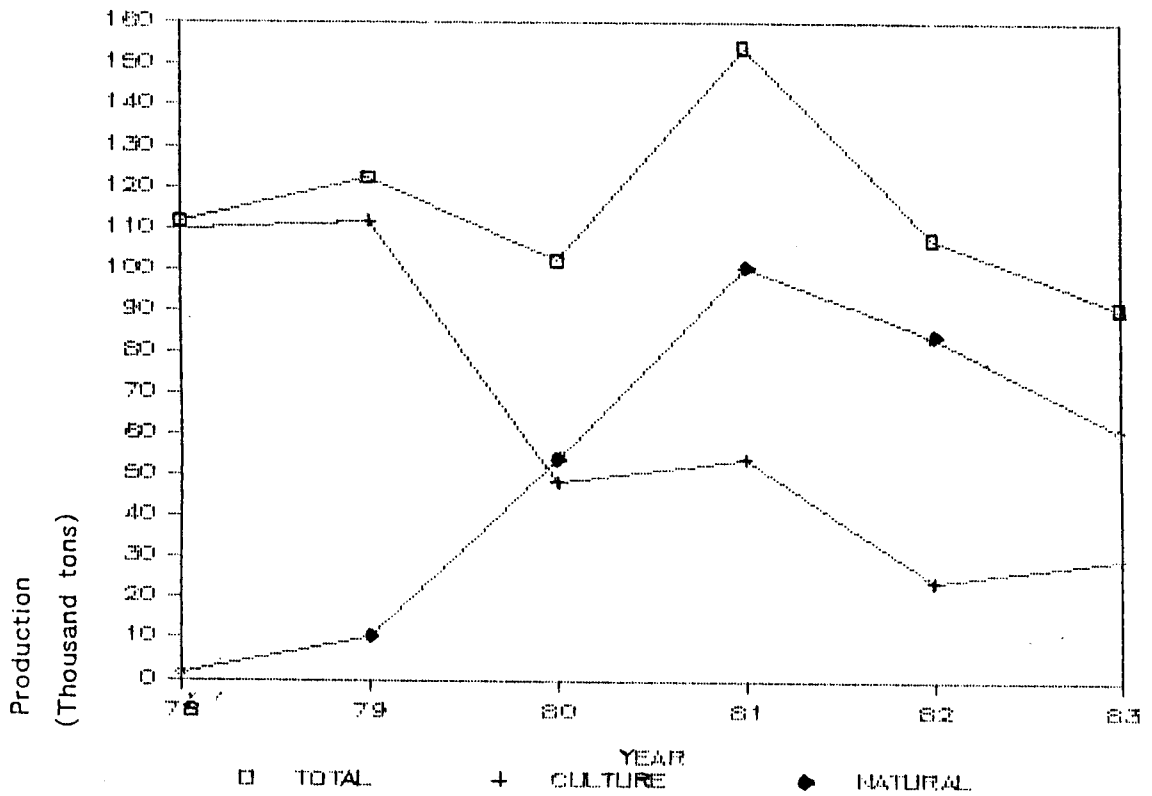
Bivalve mariculture. Four bivalve species are cultured in Thailand, namely cockle, oyster, green mussel, and horse mussel. Historical data on the production and areas employed in bivalve culturing are shown in Table 7. The total production of bivalve includes both those that are cultured and those raised naturally. In recent years the farmers have relied more on natural farming in the estuaries for their bivalve production (Figure 3).

Table 7 Areas and Production of Bivalve Mariculture

Year	Total Production (mt)	Sources of Production		Total Area (rai)
		Culture (mt)	Natural (mt)	
1978	111673	109929	1744	16755
1979	122235	111935	10300	17992
1980	102088	48176	53912	NA ^{1/}
1981	154281	53747	100534	15555
1982	107620	23902	83718	16512
1983	90899	29841	61058	19290

Source : Marine Fishery Statistics based on sample survey 1978-1983.
1/ not available

Figure 3 Trends in Bivalve Production



The figures in Table 8 indicate the potential expansion areas for bivalve mariculture, which is about 10 times the existing area and even higher than those for shrimp culture. The potential areas include the coastal provinces of the South.

Table 8 Existing (1983) Brackish Water Ponds and Bivalve Culture Areas and Potential for Expansion

Province	Brackish Water Pond Area (rai)	Potential Expansion Area (rai)	Bivalve Culture Area (rai)	Potential Expansion Area (rai)
Trat	51	20,000	-	-
Chanthaburi	5,424	3,000	2,900	9,522
Rayong	147	1,100	520	7,520
Chon Buri	3,400	2,000	4,614	10,114
Chachoengsao	4,257	3,000	1,500	10,700
Samut Prakan	49,006	1,000	-	-
Bangkok	18,008	-	-	-
Samut Sakhon	41,505	-	-	4,600
Samut Songkhram	31,606	3,000	2,000	9,300
Phetchaburi	7,566	4,000	1,100	7,425
Prachuap Khiri Khan	2,237	8,000	36	7,536
Chumphon	500	10,000	1,283	8,273
Surat Thani	9,952	20,000	4,019	28,831
Nakhon Si Thammarat	54,115	30,000	234	24,434
Songkhla	362	1,500	1	1,551
Pattani	100	16,000	200	6,700
Narathiwat	50	16,000	-	3,125
Ranong	67	3,600	625	22,375
Phangnga	620	4,500	628	37,878
Phuket	-	200	-	1,600
Krabi	101	2,200	10	9,690
Trang	5	6,500	100	12,325
Satun	1,800	4,000	1,875	15,250
Total	230,829	159,600	21,667	239,019

Source: ADB, 1985



Photo 3 Mangrove Forest



Photo 4 Making Charcoal out off Mangrove Woods

2.1.2 Mangrove

The mangrove ecosystem is rich and productive in terms of living resources. It serves as important feeding and nursery grounds for many commercial marine species. The other evident uses of the mangrove are as firewood in the form of charcoal and as timber for construction.

The total area of mangrove forests in Thailand, in 1975, from Vibulsresth et al., was 1,954,465 rai of which 535,525 rai were in the Upper Gulf of Thailand. The revised figures for 1986 (Table 9) show that the total mangrove areas were reduced to 1,679,335 rai or 268,694 hectares. Approximately 64 percent of

Table 9 Comparative areas of mangrove forest in Thailand between 1975 and 1986

Provinces	Areas of Mangrove Forest (rai)		
	1975 ^{1/}	1983 ^{2/}	1986 ^{3/}
Trat	66,500	61,500	58,241
Chanthaburi	163,325	150,400	145,967
Rayong	34,200	28,800	28,800
Chon Buri	23,750	20,700	20,700
Chachoengsao	19,000	14,500	14,480
Samut Prakan	4,000	6,500	6,500
Samut Sakhon	115,750	90,100	90,100
Samut Songkhram	51,500	47,800	47,800
Phetchaburi	55,250	48,700	48,700
Prachuap Kiri Khan	2,250	2,100	1,035
Chumphon	46,000	43,300	43,020
Surat Thani	23,000	36,300	8,414
Ranong	151,000	141,200	124,634
Nakhon Si Thammarat	96,750	80,000	44,190
Phangnga	391,438	304,475	290,479
Krabi	206,150	198,500	195,836
Phuket	19,177	17,800	15,110
Trang	212,700	205,400	203,980
Satun	289,475	246,100	241,033
Phatalung	11,750	10,200	10,200
Songkhla	37,000	32,400	31,888
Pattani	6,500	8,700	8,228
Total	1,954,465	1,795,675	1,679,335

Sources : 1/ Vibulsresth et. al. (1975)

2/ Boonyobhas, C (1982)

3/ Aksornkaeo, S (1986)

the mangrove forest is situated on the Andaman coast and the rest along the Gulf of Thailand (Figure 4). On the Andaman side, mangrove forests are of generally good quality where the productivity is recorded as high as 20 m³/rai/yr while those on the Gulf coast are in poor condition producing less than 10 m³/rai/yr. Cutting of mangroves for charcoal production, land reclamation for urban development, aquaculture and industrial sites, has diminished the size of mangrove forests in the Upper Gulf of Thailand. On the Andaman coastline, on the other hand, there is less threat from reclamation, with the exception of the impact from offshore tin mining.

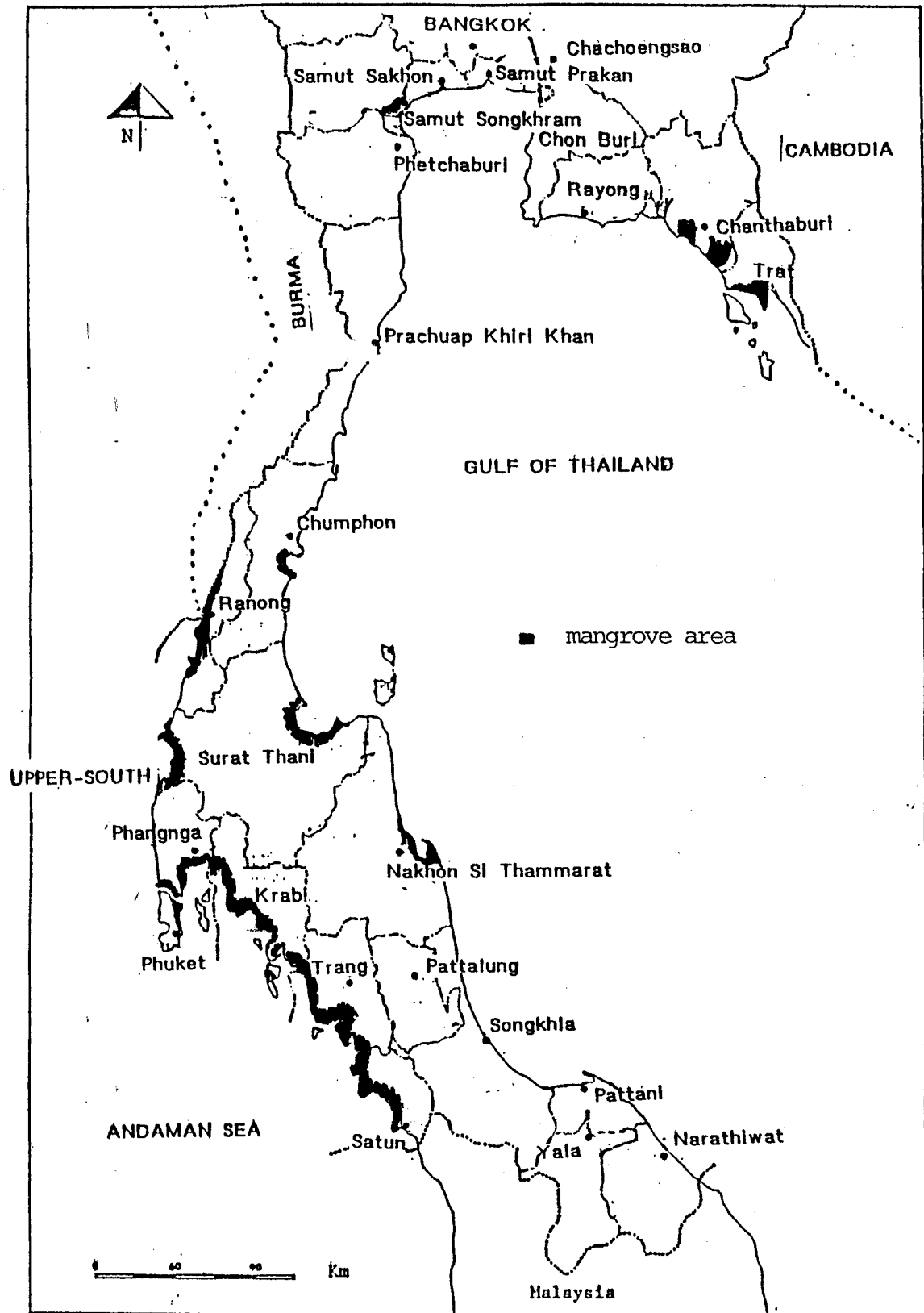
Management of the mangrove forests is the responsibility of the Royal Forest Department (RFD). There are 309 units of clear felling concessions covering a total area of 1,059,383 rai under the management of RFD (Table 10). Total wood production from concession forests is 952,846 m³ per annum (Klankamsorn and Charupatt, 1982).

Table 10 Mangrove Forest Area Under the Management of RFD

Province	Management Area under RFD	
	Unit : rai	
	Concession area	Nonconcession area
Trat	21,600	24,806
Chanthaburi	75,994	-
Rayong	14,237	-
Chon Buri	-	-
Samut Prakan	-	-
Samut Sakhon	-	-
Samut Songkhram	-	-
Phetchaburi	-	-
Prachuap Kiri Khan	-	-
Chumphon	44,443	-
Surat Thani	-	-
Ranong	145,595	-
Nakhon Si Thammarat	-	-
Phangnga	230,602	17,519
Krabi	193,960	-
Phuket	9,247	-
Trang	141,095	-
Satun	177,910	-
Phatalung	-	-
Songkhla	-	-
Pattani	4,700	-
Total	1,059,383	42,325

Source: Klankamsorn and Charupatt, 1982

Figure 4 Distribution of Mangrove Forests



There are a total of 1,256 charcoal kilns under license with the maximum capacity of 193,585 m³. At maximum capacity these charcoal kilns will require 1,548,682 m³/yr of firewood for their production (Table 11). This implies that poaching is rampant to meet the demand of the existing kilns. This does not take into consideration other uses of mangrove wood, such as for construction materials and for furniture production. In addition, wood distillation is increasingly practiced. Acetic acid, wood tar, tar oil, crude and refined methanol are being derived with a total production of 700-800 gallons/yr. Approximately 40,173 rai of mangrove forest mainly in Ranong and Phangnga provinces are being used for this purpose.

Table 11 Demand and Supply of Mangrove Wood for Charcoal Production

Province	Supply			Demand		
	Area (rai)	Felling Area (rai/yr)	Supply (m ³ /yr)	Kiln	Total Capacity (m ³)	Demand (m ³ /yr)
Trat	21,600	1,440	7,200	10	1,851.3	14,834.5
Chanthaburi	75,990	5,066	20,265	14	2,679.5	21,436.2
Rayong	14,240	919	3,797	2	137.7	1,101.7
Chumphon	44,440	2,963	21,925	13	551.5	4,412.3
Ranong	145,600	9,706	230,429	205	39,898.2	319,186.1
Phangnga	230,600	15,353	226,617	231	40,847.2	326,777.8
Krabi	193,960	12,931	157,495	303	35,022.9	280,183.3
Phuket	9,250	616	5,135	6	949.7	7,597.4
Trang	141,100	9,406	124,258	229	27,085.9	216,687.5
Satun	177,910	177,910	152,884	240	44,229.7	353,837.5
Pattani	4,700	313	2,886	3	331.5	2,652.0

Source: Adapted from Klankamsorn and Charupatt, 1982

Destruction of the mangrove forests due to urbanization and industrial expansion is one of the major problems in Thailand. Planners still fail to appreciate the significance of mangrove as an economically valuable resource. Urbanization and industrial expansion have placed tremendous stresses on the mangrove forests particularly, in the Upper Gulf. According to Aksornkaeo (1986), a total of 620,040 rai of mangrove forest was destroyed during 1961-1986. The figures in Table 12 illustrate the conversion of mangrove areas for other land uses.

Table 12 Conversion of Mangrove Areas for Other Land Uses

Land-use type	Area, rai			Percentage of the total area
	Prior to ^{1/} 1980	Between ^{2/} 1980-1986	Total	
Aquaculture	162,725	74,734	237,459	38.3
Mining	5,787	28,279	34,066	3.5
Salt pond	66,000	-	66,000	10.6
Others (Agriculture, urbanization, industrial site, harbors)	269,180	13,327	282,515	45.6
Total	503,700	116,340	620,040	100.0

Source: Aksornkaeo, 1986

^{1/} Klankamsorn and Charupatt, 1982

^{2/} National Forest Land Management Division, RFD, 1980 and Chantadisai and Apinan, 1985.

Approximately 1.8 percent of mangrove forests on the Andaman coastline, especially in Ranong, Phangnga and Phuket provinces, have been affected by mining amounting to 5,787 rai. Out of this total number, 4,279 rai are in Ranong province, 1,152 rai are in Phangnga, and 355 rai are in Phuket. It must be emphasized that mangrove forests in this region are in good condition compared to those on the Gulf coast.

The dominant effect of mining is due to the deposition of sediment. Excessive sedimentation is detrimental to mangroves by prohibiting exchanges of water, nutrients and gases within the substrate and between the substrate and the overlying water. Reforestation of denuded mangrove areas from mining is currently being implemented.

Extensive areas of mangrove forests have been converted to aquaculture ponds. These ponds are normally located on sites with sparse vegetation cover which will reduce the cost of clearance and are accessible to natural seeds. The landward fringe of the mangrove, where natural regeneration after logging is often insufficient, is less attractive to the farmers due to the high elevation which requires pumping. This was led to conflicting demands upon the use of mangrove areas for aquaculture and for wood production.

Shrimp and prawn farming is concentrated in the Upper Gulf coast, namely Samut Songkhram, Samut Prakan, and Chachoengsao provinces. In 1983, the total areas for shrimp and prawn farming in these three provinces were 41,505, 37,664, and 1,814 rai, respectively. Most of these areas are excluded from the RFD management plan. At the very beginning of mangrove forest management only short-term leases were issued mainly for local consumption of fuel wood. Due to the increasing exploitation of the mangrove forests, the policy of granting long-term concessions of 15 years was endorsed by the government in January 1966. The conditions of the concession dictated that the concessionaires had to protect the forests under concession and had to reforest the exploited areas by reforestation at their own expense. RFD is regulating the practices of the concessionaires including the provision of guidelines for reforestation. The first mangrove forest concession was issued in 1968 and up to now, 309 concessions have been issued with a total area of about 1,101,708 rai.



Photo 5 Pattaya Beach



Photo 6 Typical Local Beach for Domestic Tourists

2.1.3 Tourism

Tourism has become prominent as a major foreign exchange earner in the Thai economy since the 1960's. According to the statistics from the Tourism Authority of Thailand (TAT), the country's balance of tourism revenue rose from 12,776 million baht in 1980 to 24,180 million baht in 1985 (Table 13). The importance of tourism when compared to other exports is obvious from the figures in Tables 13 and 14. Since 1982, tourism has surpassed rice as the number one foreign exchange earner of the country.

Table 13 Balance of International Tourist Trade 1980-1985

Unit : million baht

Year	1980	1981	1982	1983	1984	1985 ^{1/}
Revenue	17,756	21,455	23,879	25,050	27,317	31,767
Expenditure	4,989	6,027	6,151	7,896	7,208	7,587
Balance	+12,776	+15,428	+17,728	+17,154	+20,109	+24,180

Source : TAT Statistical Report, 1984a
Other unpublished official records

^{1/} To be published by TAT

Table 14 Revenue from International Tourism and Other Major Exports of Thailand 1980-1985

Unit : billion baht

Rank	1980	1981	1982	1983	1984	1985 ^{1/}
1	Rice 19.6	Rice 26.4	Tourism 23.9	Tourism 25.0	Tourism 27.3	Tourism 31.8
2	Tourism 17.8	Tourism 21.4	Rice 22.5	Rice 20.1	Rice 25.9	Textile 23.6
3	Tapioca 14.8	Tapioca 16.4	Tapioca 19.9	Tapioca 15.4	Textile 19.1	Rice 22.5
4	Rubber 12.4	Textile 12.5	Textile 14.0	Textile 14.3	Tapioca 16.6	Tapioca 15.0
5	Tin 11.3	Rubber 10.8	Sugar 12.9	Rubber 11.8	Rubber 13.0	Rubber 13.6

Source : TAT Statistic Report, 1984a

^{1/} Data on tourism is obtained from TAT while other data are preliminary figures obtained from the Monthly Economic Report, Bank of Thailand, March, 1986.

a) Tourist Resorts of Thailand

Excluding Bangkok which is the main gateway to the country, there are four major tourist centers, namely Chiangmai, Pattaya, Hat Yai/Songkhla, and Phuket, all of which are well established. Out of these four, only Chiangmai is not on the coast (Figure 5).

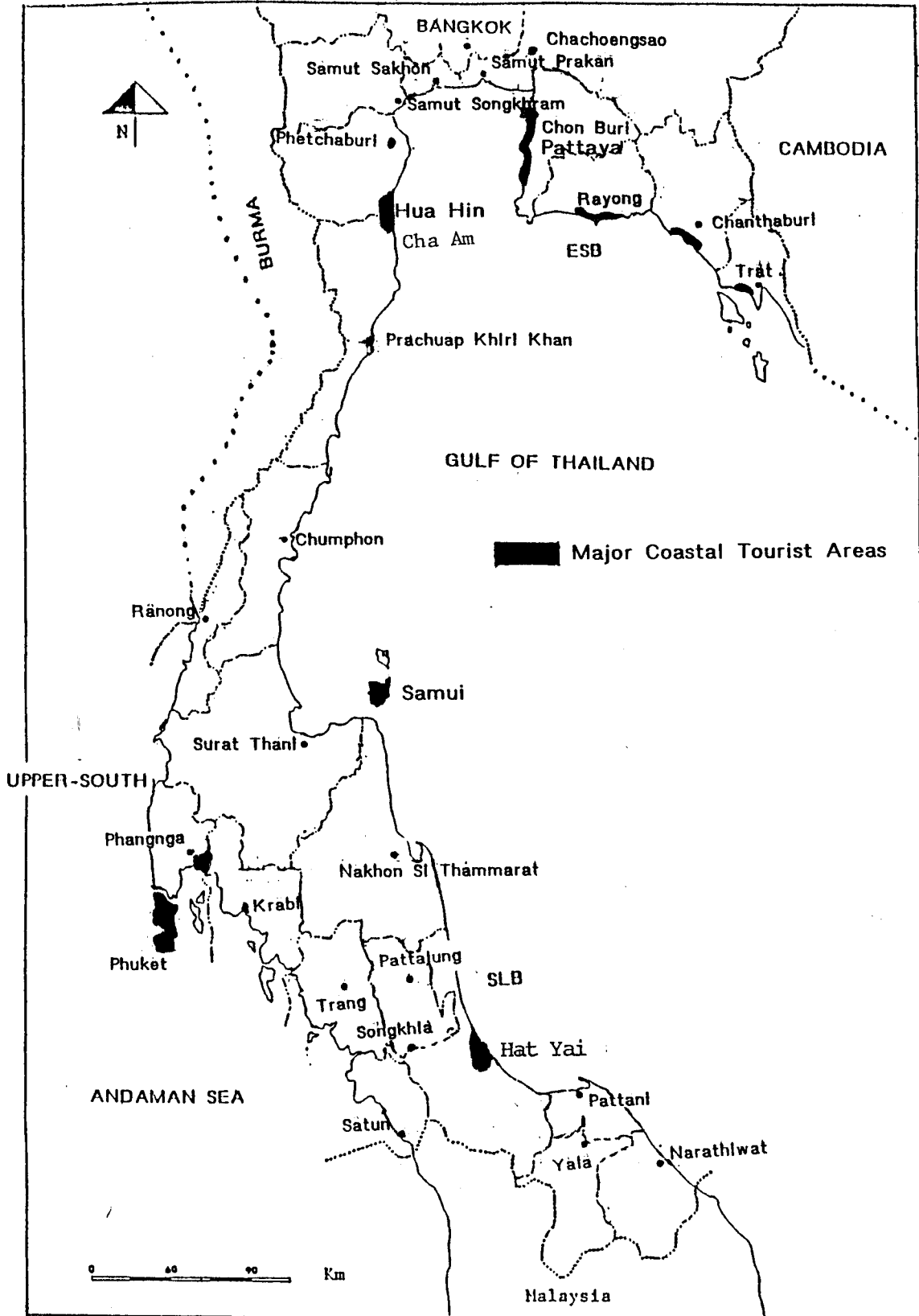
Pattaya which is a well known international beach resort has dominated Thailand's coastal tourism for the past ten years. It is located on the east coast of Chon Buri province as shown in Figure 5. Its proximity to Bangkok, good transportation, scenic beauty and extensive recreational facilities play an important role in drawing a large number of tourists. Table 15 gives the total number of tourists who have visited Pattaya in 1982 and 1983.

Table 15 Total Number of Domestic and International Tourists visited Pattaya and Number of International Tourist Arrivals to Thailand

Year	Number of tourists visited Pattaya ^{1/}		Number of International Tourist arrivals ^{2/} (whole country)
	Domestic	International	
1981	- 505,804	-	2,051,615
1982	149,527	450,008	2,218,429
1983	161,779	431,775	2,191,003

Source : 1/ TISTR, 1985
2/ TAT, 1984a

Figure 5 Tourism Resorts



Phuket is an island resort with appreciable beaches. It offers natural settings with extended trips to nearby islands. Most of the resorts on Phuket Island are categorized as scenic sites but some developments for entertainment similar to those at Pattaya have been introduced, especially at Patong Beach on the west coast of the island. The average percentage of foreign tourists visited Phuket is only 1.83 percent of the total number of arrivals as shown in Table 16. Comparatively, the number of domestic tourists is about twice this figure (2.88 percent). The potential for growth is still unbounded.

Table 16 Percentage of International Tourists Travelling to Major Tourism Resorts in Thailand

Resort	% International Tourists
Bangkok	57.02
Pattaya	8.67
Songkhla/Hat Yai	10.42
Chiangmai	4.93
Phuket	1.83
Northern region (other than Chiangmai)	1.55
Southern region (other than Songkhla/ Hat Yai, and Phuket)	2.26
Central region (other than Bangkok and Pattaya)	11.81
Northeastern region	0.86

Source : TAT 1984b

Hat Yai/Songkhla attracts more tourists from neighboring Malaysia and Singapore. In these twin cities, natural attractions are overtaken by other human pursuits.

There are other coastal tourism resorts around the Gulf of Thailand frequented by domestic tourists. For example Hua Hin/Cha Am on the west coast of the Upper Gulf of Thailand, Samui Island on the upper southern region, and Chanthaburi and Trat provinces beyond Pattaya on the east coast of the Gulf.

b) Tourism and Environment

Water pollution due to the lack of proper wastewater treatment systems for hotels in the resort areas is a primary concern. General environmental problems are related to sanitary issues similar to those in congested cities. Maintenance of cleanliness in harmony with the natural setting of Thai coastal beaches has been given increasing attention.

More serious degradations are due to offshore tin mining. Highly turbid water created by offshore tin mining on the west coast of Phuket, where a series of tourist beach resorts are located (Figure 6), is an example of the conflict between tourism and mining. A study on environmental impact from offshore tin mining in Phuket by the National Environment Board (NEB) in 1983 reported that the tailing water from offshore mining boats has an average suspended solid concentration as high as 30,000-40,000 mg/l.

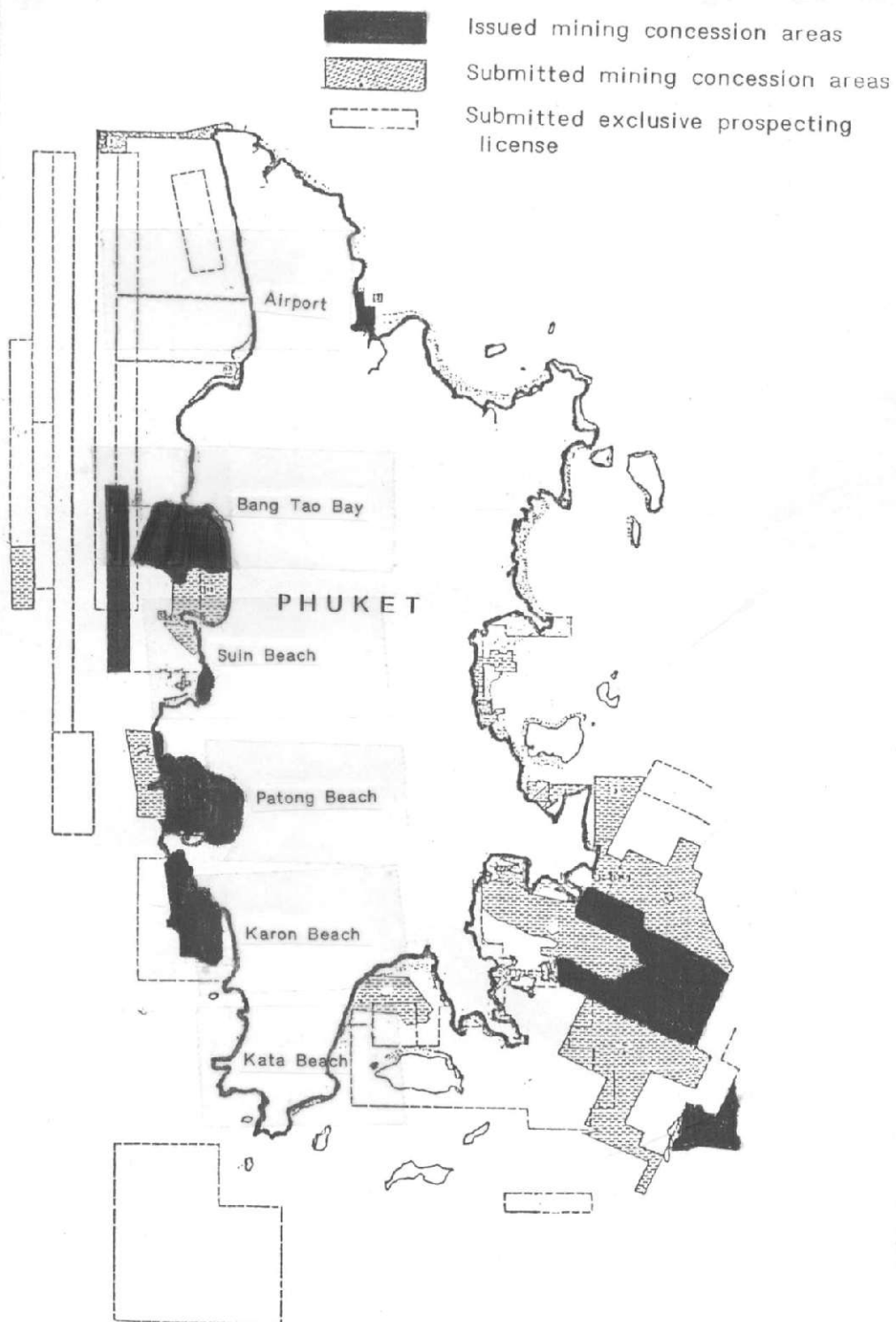
Coastal area development may either enhance or adversely affect tourism. An outstanding example is the urban/industrial development of the Eastern Seaboard (ESB). Transportation improvement as part of the project to accelerate industrial development is providing better accessibility from Bangkok, the main international entrance, to various tourism resorts on the east coast including Rayong, Chanthaburi and Trat provinces. Urbanization of coastal towns in the ESB region will induce more permanent settlements in the areas with facilities to accommodate more tourists, both domestic and international.

There is growing concern over the adverse impact to the environment as a result of major industrial development activities. In the case of the upcoming national fertilizer complex, wastewater to be generated will consist of storm water runoff and combined treated process waters. The latter wastewater will be discharged into the sea via a submerged pipe and will carry both organic wastes and heavy metals, such as lead, chromium and zinc. As for the petrochemical complex, the concern is more with the expected air emissions. Large quantities of CO₂, CO, NO_x, SO₂ and particulates will be added to the local environment.

The government approach is to set standards for emissions and effluents. Emphasis is given to the monitoring program of air and water quality both before and after the operation of these industrial complexes.

Infrastructure development in connection with the ESB program, particularly the dredging of navigation channels and the construction of deep sea ports may generate excessive sedimentation on the beaches. The concern is due to the proximity of these facilities to the tourist beaches. The proposed Map-Ta-Phut port is only a few kilometers from the natural Sai Thong (golden sand) beach and 30-40 kilometers from the Laem Ya-Samet

Figure 6 Offshore Mining Concession Areas in Phuket



National Park. In the case of the Laem Chabang port, its exact location is 15 kilometers from Pattaya. Due to the siting of these two ports and the expected volume of sea traffic using the port facilities, the potential impact to the beaches, particularly from sedimentation and oil spills, is genuine. This calls for a vigorous environmental monitoring and a quality control program as an integrated part of the Eastern Seaboard development.

c) Tourism Planning

In the past years, the Tourism Authority of Thailand (TAT) has prepared master tourism plans for all well established coastal resorts, namely Phuket, Songkhla/Hat Yai, Pattaya, Rayong-Chantaburi-Trat, and Surat Thani/Samui Island in the South. The major problem lies not with the lack of planning, but the lack of implementation. This is due to the fact that integrated tourism development has to rely on the full cooperation of quite a number of implementing agencies. Indeed, details of the tourism master plans normally include the expansion and the upgrading of infrastructure and accommodation facilities, such as water supply and hotels. Other social and environmental factors such as the provision of security in the tourist areas and the control of sedimentation from offshore tin mining are also beyond the mandates of TAT. Successful tourism development requires effective concerted effort by all concerned parties, both public and private.



Photo_7 A Petrochemical Plant in Operation, Rayong



Photo_8 A Pier on the Eastern Seaboard

2.2 Coastal Area Development

2.2.1 The Eastern Seaboard

The Eastern Seaboard Region (ESB) was designated as an urban and industrial development center. Its main asset is natural gas from the Gulf of Thailand which comes ashore at Map-Ta-Phut. The Eastern Seaboard region covers three coastal provinces bordering the east coast of the Upper Gulf of Thailand, namely Chachoengsao, Chon Buri and Rayong (Figure 7). The total area of the region is approximately 13,212 km².

a) Main Development Activities

The strategy in promoting ESB is to expedite import substitution by establishing the petrochemical industry in Thailand taking advantage of the availability of offshore natural gas. The development scheme which is under implementation will propel ESB into one of the fastest growing areas of the country, aside from Bangkok.

Main development activities include:

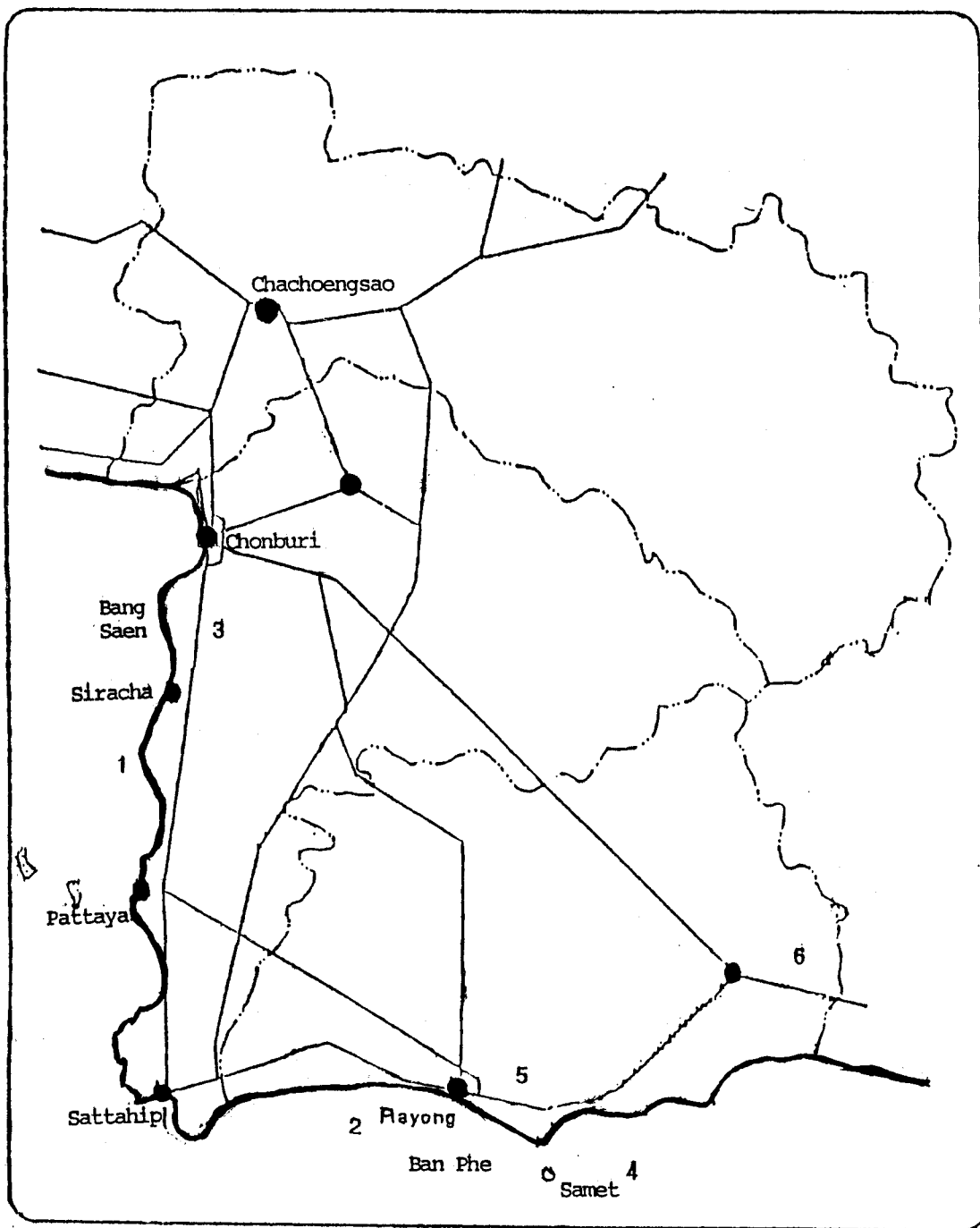
- The establishment of a heavy industrial zone, mainly petrochemical, at Map-Ta-Phut, where a gas landing station has already been in operation.
- The construction of a deep sea port and the promotion of light industries at Laem Chabang.
- The construction of affiliated transportation and infrastructure facilities such as the rail-link between Bangkok and ESB.

b) Emerging Pattern of Resource Consumption

Natural gas. The gas separation plant at Map-Ta-Phut has been in operation since November 1984. It can process up to 350 million cubic feet per day of natural gas, supplying:

- i) about 450,000 tons of propane and butane annually for the production of LPG;

Figure 7 Eastern Seaboard Region Showing Locations of the Proposed Deep Sea Ports and Some Tourist Resorts



1. Proposed Laem Chabang Deep Sea Port
2. Proposed Map-Ta-Phut Deep Sea Port
3. Khao Khiew Reserve
4. Laem Ya-Samet National Park
5. Saunson Reserve
6. Khao Wong National Park

- ii) about 74,000 million cubic feet of methane annually which will be principally used as a substitute for fuel oil. It will also be used as a feedstock for the production of chemical fertilizer, synthetic gasoline and methanol;
- iii) about 350,000 tons per year of ethane for downstream petrochemical industries; and
- iv) liquid natural gas of 66,000 tons annually for local oil refineries.

Tourism. Pattaya, Bang Saen - Sriracha and Ban Phe are the three main tourists resorts in the region. Pattaya is a well recognized international beach resort. Bang Saen - Sriracha, an older discovery, is now geared mainly to domestic tourists. Within its vicinity is the Bang Phra reservoir and the Khao Khiew wildlife sanctuary. Beyond Pattaya, further along the coast, is the Ban Phe area with the unspoiled beaches of the Laem Ya - Samet National Park, Suanson, Wang Kaew and Laem Mae Phim.

Statistics in 1983 showed that there were about 600,000 overnight visitors to Pattaya, three-fourths of which were foreigners. It is estimated that more than 10,000 persons are employed directly by the hotel industry there. Local revenues generated by tourism are more than 3,000 million baht with more than 90 percent from foreign tourists.

With tourism playing a significant role in the regional economy and with more room for growth in the future, it is important that the Eastern Seaboard development give due attention to conserving the coastal environment so that tourism can continue to be promoted in harmony with industrial development.

c) Main Environmental Concerns and Potential Conflicts of Interest

The development activities under the ESB program are of such a magnitude that they may create a profound impact on the environment. The anticipated major issues are:

- pollution from the development and operation of the Laem Chabang and Map-Ta-Phut ports; and
- water quality deterioration caused by domestic and industrial wastes.

As mentioned in the earlier section, Map-Ta-Phut port will be constructed out of a coastal front adjacent to nearby pristine beaches, whereas the location of the Laem Chabang port is only 15 kilometers away from the well-developed tourist resort of Pattaya. The potential hazards from increasing turbidity, sedimentation, and coastal erosion due to construction activities have often been voiced. More realistic, however, is the concern over oil spills from the uncontrolled discharge of bilge water from the increasing number of cargo vessels and tankers that visit these ports. Careful monitoring and control of oil spill must be strictly implemented.

When the various activities under ESB become fully operational, the number of inhabitants in the area will sharply increase. In addition, with better service facilities developed to support the ESB program, there will likely be more domestic and international tourists.

Not uncommon to the situation in cities of developing countries, the availability of a proper sewerage system for domestic wastes is still an exception rather than the norm. In the Eastern Seaboard area, only the city of Pattaya operates a sewage treatment system covering 80 percent of its hotels and 20 percent of the commercial areas. The system was designed to treat 6,000 cmd of wastewater with BOD of 150 mg/l.

As for industrial wastes, there are mainly two industrial categories in the region: (1) agro-industry, namely cane-sugar mills, tapioca starch and tapioca pellet plants, a hardboard factory, fish-processing plants, etc., and (2) petrochemical plants for the production of fertilizer, plastic resins and other petrochemicals. There also exist two oil refineries in the Sri Racha district near Laem Chabang.

The National Environment Board (NEB) requires that an environmental assessment be conducted for major petrochemical projects. In the case of the proposed chemical fertilizer complex, a submerged outfall will be built to carry treated wastes for discharge out in the Gulf. The constituents of the wastes consist of both organic loads and heavy metals, such as iron, lead, chromium, and zinc.

For the upstream petrochemical plant producing olefin, emission of gases and dust will be the main concern including CO₂, CO, NO_x, SO₂, and particulates. The standard practice is to control emissions at their sources as prescribed by standards set by the Ministry of Industry.

d) Administrative Structure

Due to the importance accorded to the ESB, the government has set up a multi-ministerial committee chaired by the Prime Minister to oversee major development activities within this

program, in line with the financial resources of the country. This committee has been effective in expediting the development of ESB. Table 17 lists the major activities and their up-to-date status.

Table 17 Status of Major Eastern Seaboard Projects.

	Responsible agency	Status
<u>Deep Sea Port</u> Laem Chabang	Port Authority of Thailand (PAT)	detailed design completed
Map-Ta-Phut	Industrial Estate Authority of Thailand (IEAT)	detailed design completed
<u>Industrial Estate</u> Laem Chabang	IEAT	in progress
Map-Ta-Phut	IEAT	in progress
<u>Water Supply</u> Dok-Krai reservoir	Royal Irrigation Development (RID)	construction of pipeline from Dok-Krai to Map-Ta-Phut completed
Nong Koh reservoir	RID	under construction to provide water supply to Laem Chabang area
<u>Transportation</u> Railway construction	State Railway of Thailand (SRT)	construction of railroad from Chachoengsao to Sattahip completed and under construction from Sattahip to Map-Ta-Phut.
<u>Heavy Industry</u> Gas separation plant	Petroleum Authority of Thailand (PTT)	operational since 1984
National Fertilizer Complex	independent company with government serving as a major shareholder	under construction
National Petrochemical Complex	" "	financial investment under negotiation

At the local level, the administration of the city of Pattaya is governed by a separate act promulgated in 1978. The objective is to facilitate local participation in tourism development. This is an extension to the normal provincial administration, where governors of all other provinces, aside from Bangkok, are appointed by the Ministry of Interior.



Photo_9 Aquaculture, Songkhla Lake



Photo_10 A Natural Part of Songkhla Lake

2.2.2 The Songkhla Lake Basin

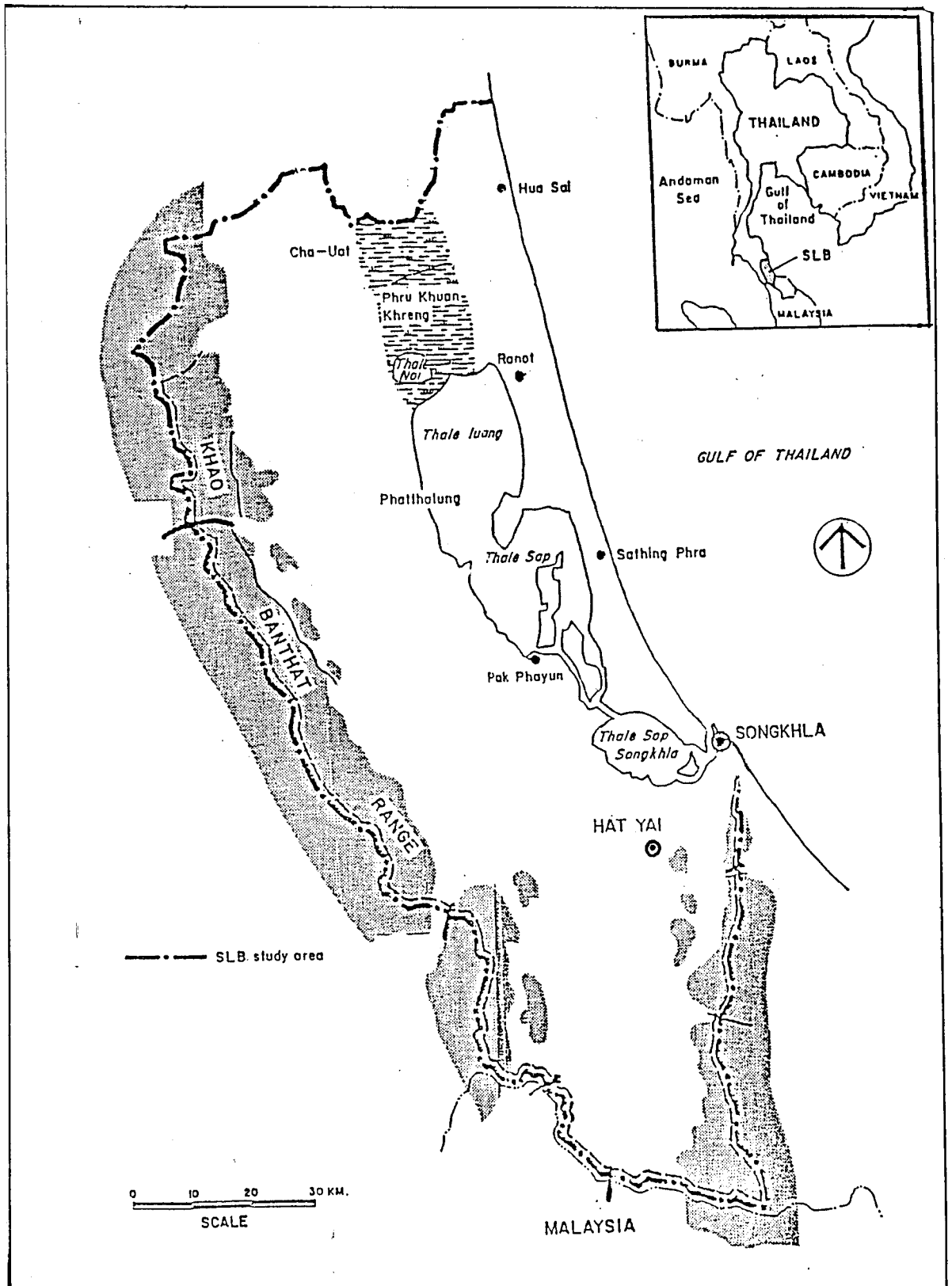
The Songkhla Lake Basin (SLB) covers an area of 8,020 km² of the eastern part of Southern Thailand (see Figure 8). On the sea front, it covers the coastline of Songkhla and part of Nakhon Si Thammarat province. Prominent in the basin is Songkhla Lake, a misnomer since it actually is a lagoon linked to the sea and covering an area of 1,082 km². The lake itself is divided into four zones, namely the marine zone of Thale-Sap Songkhla inward from the sea end, Thale-Sap which is the transition between marine and freshwater, Thale Luang which is a large body of mainly fresh water, and Thale-Noi, a small inland freshwater lake at the upper east corner of the Lake.

An SLB Planning Study was commissioned by the government in 1984. This regional planning is unique since it emphasizes the management of natural resources as the foundation for regional economic and social progress. The study resulted in three integrated plans: the natural resources management plan, the socioeconomic development plan, and the environmental management plan. The objectives of the integrated master plan are: (1) to develop natural resources to their optimum sustainable yield with equitable distribution of generated benefits to local and national economies, and (2) to generate sustainable economic growth above the national average without adverse effect to the environment.

a) Coastal and Marine Resources of the SLB

Fishery resources. Due to the unique combination of both fresh water and brackish water in the Songkhla Lake, the lake has served as an important fishing ground for the Southern region. Both capture fisheries and aquaculture are practiced in the lake which involves the livelihood of 700 fishermen. The most important capture fishery is brackish water shrimp (*Metapenaeus* spp.) which constitutes about 50 percent of the reported fishery production of Thale-Sap and 70-80 percent of the reported fishery production of Thale-Sap Songkhla (JTS et al., 1985). Approximately 30 percent of the total number of fishermen are lakeside families operating sea bass fish cages. The present aquaculture production in the Songkhla Lake is less than 250 tons per annum valued at 10.5 million baht (Table 18). Catfish aquaculture is also available. Brackish water aquaculture is seen more as a cash crop while freshwater fish culture is generally considered to be a subsistence activity. An exception is the freshwater prawn *Macrobrachium rosenbergii* culture which is often classed as a brackish water species due to its need for salt water during its larval stage. About 125 tons of freshwater prawn are captured annually by part-time and artisanal fishermen.

Figure 8 Songkhla Lake Basin Area.



The DOF is expanding aquaculture in the Songkhla Lake. Both sea bass and freshwater prawn, which command high economic values, are the targets. The National Institute for Coastal Aquaculture (NICA) was established in 1978 to upgrade the Fishery Research Station at Kao Seng. Approximately 70 percent of the research at NICA is applied investigations focused on commercial development of aquaculture or studies to solve specific problems related to disease, nutrition, water quality, and site selection.

Table 18 Estimated Fisheries Production and Fishing Effort in Songkhla Lake Basin, 1984

Location	Fishing Gear	Landings (tons) ^{1/}
Thale Sap Songkhla	fixed nets	3500 ⁺ 1000
Thale Sap	fixed nets	2000 ⁺ 350
Thale Luang	seines, gill nets	1000 ⁺ 150
Thale Noi	gill nets and seines	500 ⁺ 100
Streams/ Klongs	traps, gill	1500 ⁺ 500
Lower Lake ^{2/}	fish cages	84
SLB farms ^{2/}	ponds	142

Source: JTS et al, 1985 V. 6

^{1/} Landings are based on provincial statistics with confidence limits based on personal observations and range of landings during most recent 5 year period.

^{2/} aquaculture

Tourism resources. Table 19 shows the number of tourist arrivals in the Songkhla province from 1980 to 1984.

Table 19 Tourist Arrivals in Songkhla Province

Unit : 1000					
Nationality	1980	1981	1982	1983	1984
Malaysian	198.3	187.1	276.9	299.8	300.3
Singapore	23.9	37.0	40.1	48.6	57.8
Thai	19.5	40.5	46.5	46.5	45.9
Others	62.4	87.3	113.3	153.4	73.5
Total	304.1	351.9	476.8	548.3	477.5

Source: Immigration Headquarters, Hat Yai, 1984

In the city of Hat Yai foreign tourists are mainly after recreation and rest. Tourism has become the main source of revenue for the Songkhla province, generating about 2,649 million baht in 1983.

It is well recognized that tourism can be further expanded beyond the city of Hat Yai. Accessible attractions in the vicinity include beaches, islands, wildlife sanctuaries, natural parks and non-hunting areas.

b) Main Environmental Problem

The main environmental problem is pollution caused by untreated domestic wastes from the twin cities of Hat Yai and Songkhla. Due to the lack of sewerage treatment systems, part of the estimated 1.8 million m³ of waste loads generated annually will ultimately find its way to the lake. This is contrary to the intentions of the government to develop the lake as an aquaculture ground. As for wastes from industrial sources, it is fortunate that the existing industries there are agro-based. No toxic wastes of conspicuous adverse quality has been identified in the region.

c) Main Development Activities

Based on the basin study referred to earlier, the government has selected four priority concentration areas as follows:

1) A commercial aquaculture project, particularly for freshwater prawn and sea bass in the lake.

2) The construction of a saltwater barrier in the lake which will enlarge the irrigated area up to almost 199,000 rai.

3) Provision of an adequate water supply to serve the projected increasing demand of Hat Yai/Songkhla. This includes the construction of new reservoirs, distribution pipelines, and water treatment plants.

4) The establishment of a management information system for natural resources development -- a systematic compilation and analysis of information on resources of the basin, namely water, land, forest, fisheries, and minerals.

d) Administrative Structure

The planning and development of the SLB has followed the conventional approach by which the central planning agencies, in this case the National Economic and Social Development Board (NESDB) and the National Environment Board (NEB), secured a loan from a development bank (Asian Development Bank) for the commission of the basin-wide study. A committee chaired by the Secretary-General of NESDB was established. Its members are the representatives of related line ministries. This committee was responsible for approving the priority projects selected for the master plan. NESDB itself bears the responsibility to include the endorsed projects into the National Economic and Social Development Plan. Once accepted as part of the national plan, governmental budget can then be requested by implanting agencies to execute the selected priority projects.

Such an approach has often proved to be cumbersome and time-consuming. However, this fact is accepted and government agencies are accustomed to it.



Photo 11 Offshore Tin Mining

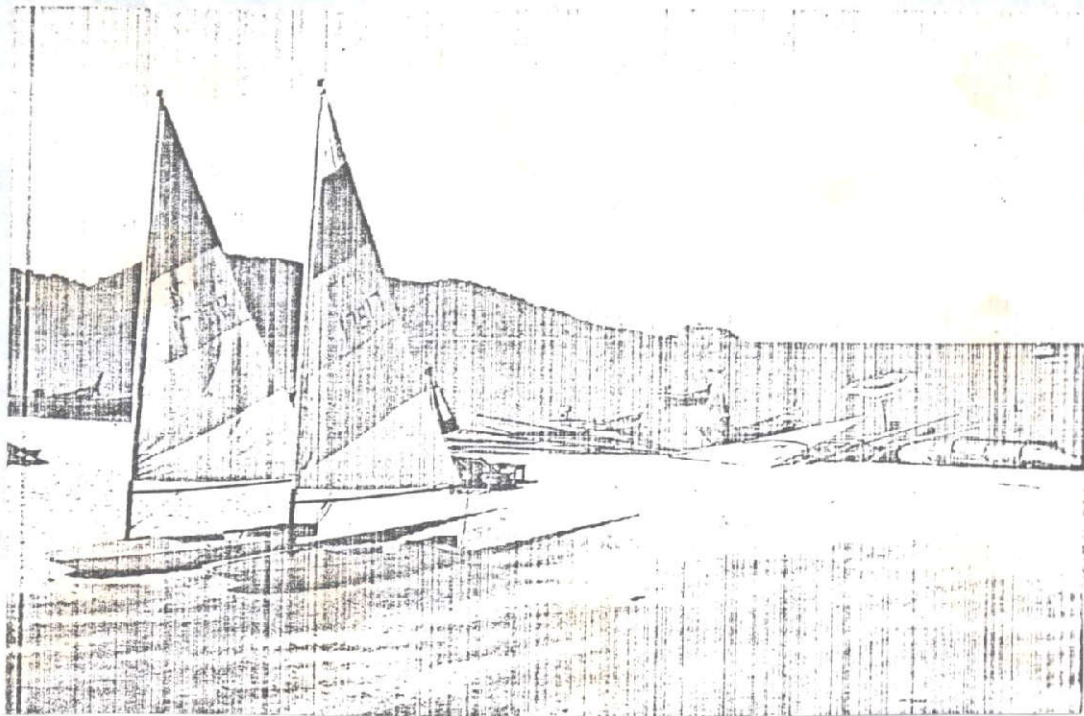


Photo 12 Pa Tong Beach, Phuket

2.2.3 The Upper-South Region

The upper southern part of Thailand is considered as the unspoiled region, rich in natural resources. The Sub-Regional Development Study for this area was initiated by NESDB in 1982 with the following objectives:

- to prepare a sub-regional development master plan for the socioeconomic and physical development with particular emphasis on urban and industrial development and major transport and communications networks within the study area, taking into account existing plans and programs;
- to identify within the context of the master plan, priority programs and projects; and
- to prepare prefeasibility studies of high priority projects.

The study area of 22,300 km² covers the whole provinces of Phangnga, Phuket and Krabi, and parts of Surat Thani and Trang as shown in Figure 9.

a) Coastal and Marine Resources

Fisheries resources. Marine fisheries production in the Upper South region in 1982 amounted to 175,000 tons which was about 8.75 per cent of the total production of the country. In Surat Thani province, the area around Samui Island is recognized as a fertile fishing ground particularly for shrimp and the high-value Indo-Pacific mackerel. About 20,000 rai of coastal areas in the upper southern provinces are presently used for aquaculture. Ban Don bay in Surat Thani is the main center with 13,500 rai for shrimp and 4,000 rai for cockle and oyster farming. The figures in Table 20 indicate the existing and potential areas for aquaculture in the Upper South region.

Two strategies for fisheries development recommended by the study are:

1) To maintain and increase marine fish resources of the Upper South seas by preserving the region's coastal and adjacent marine areas for small-scale fisheries and aquaculture.

2) To promote deep sea fisheries and improve the local practices in fish preservation and processing.

Figure 9 Upper South Regional Study Area

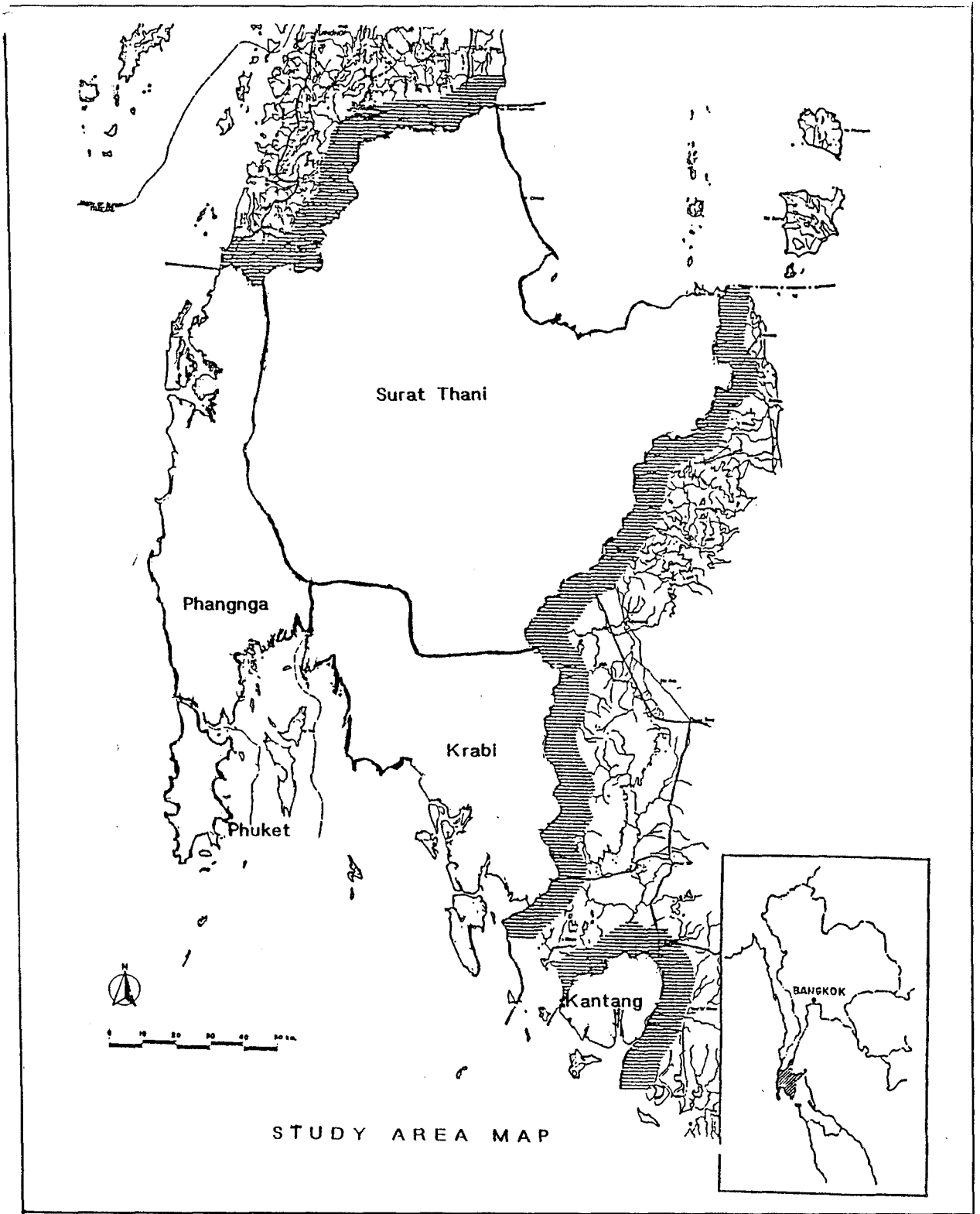


Table 20 Existing and Potential Areas for Aquaculture

Unit : rai

Province	Existing Aquaculture Area					Potential Area				
	Cockle	Oyster	Green Mussel	Horse Mussel	Shrimp	Cockle	Oyster	Mussel	Horse Mussel	Shrimp
Surat Thani	3,525	494	-	-	13,456	18,000	1,562	4,000	1,250	22,500
Phangnga	1,530	1	67	-	-	12,500	6,250	6,000	12,500	4,500
Phuket	-	-	-	-	-	600	-	1,000	-	200
Krabi	1,000	10	-	-	-	4,700	1,256	3,000	1,000	2,200
Total	6,055	505	67	-	13,456	35,800	9,068	14,000	14,750	26,900

Source : JICA, 1985 V.6

Tourism resources. The upper southern region is rich in tourism assets including not only beaches and coastal resorts in Phuket, Phangnga, Krabi, and Surat Thani provinces, but also historical and cultural sites inland. At present, however, both domestic and international tourists that travel to this region represent only a small percentage of the total market share as shown in Table 21. At least four problems were identified: (1) poor transportation linkages to some of the potential attraction sites, such as Krabi, (2) climatic changes during the monsoon season, (3) inadequate urban services and utilities in some locations, and (4) the lack of a cohesive and coherent local administration system to promote tourism.

Table 21 Percentage of Domestic and International Tourism Resorts in the Upper Southern Part of Thailand.

Destination	% International Tourist	% Domestic tourist
Phuket	1.83	2.88
Surat Thani	1.61	1.34
Phangnga	0.04	1.54
Krabi	-	1.02
Nakhon Si Thammarat	-	0.37
Trang	-	0.32

Source : TAT 1984

For a highly populated country like Thailand with more than 52 million inhabitants, it is well recognized that tourism is an effective means both in generating economic growth and also for employment, particularly in the local communities. Although the master plan for the Upper South is not in operation, due to lack of governmental budget, tourism in Phuket is being promoted independently to serve the increasing demand.

Mangrove forests. The western part of the Upper South is one of the major mangrove forest areas of the country accounting for about 30 percent of the national mangrove area. These mangrove forests not only are in abundance but also of high quality in terms of wood production. Mangrove forest areas in this region, especially in Phangnga province, has been decreasing by almost 90,000 rai during the eight-year period between 1975 and 1983 (see Table 9). Similar situations also apply to other provinces of the region. The management and development of mangrove forests is under the responsibility of the Royal Forestry Department as reviewed in Section 2.1.2. For this region, results from the Sub-Regional Development Study indicated that the major causes of mangrove forest destruction are due to: (1) replacement by mining, (2) sediment discharged from mining, (3) cutting for building materials, firewood, and charcoal, and (4) coastal shrimp farming. The master plan advocates the classification of mangrove areas into management zones for conservation and development so that mangrove areas can be properly protected.

Mineral resources. The Upper South region is the largest tin mining area of the country. In addition, it produces many other minerals including rare metals of tantalite, zircon, columbium, and monazite. In 1983, the total national production of tin (concentrates) was 27,225 tons of which approximately 16,000 tons were from the Upper South and about 15.3 percent from offshore mining in Phangnga and Phuket provinces.

b) Main Development Activities

Due to other priorities of the government, there has yet to be a concerted regional development effort devoted to the Upper South. However, local provincial development closely follows the national trends and is mainly in the hands of the private sector. In particular, tourism in Phuket has continued to grow unabated particularly for international visitors from Western Europe and Singapore.

In order to safeguard against future deterioration of the marine environment in the region, the National Environment Board has initiated a series of scientific investigations on the marine environment of the region -- mangroves and coral reefs in particular and their impact on fisheries in the area.

Chapter 3

PLANNING AND DEVELOPMENT PROCEDURES AND MAJOR POLICY ISSUES

3.1 Procedures in Coastal and Marine Resources Planning and Development

In Thailand, the government plays a leading role in directing major development activities. As the overall framework, Thailand has adopted the five-year development cycle since 1962. Development projects identified and accepted into the National Development Plan are given priority in the allocation of the governmental budget.

The regional development and planning studies referred to in the previous Chapter were mostly initiated by NESDB. Once a master plan is developed either for a specific area or for a specific sector, it will then be the responsibility of the relevant implementing agencies to ensure that activities are carried out according to the plan. In the process, the private sector will then move in, expand its business and become an integrated part of the development process.

3.1.1 Regional Planning

The three coastal areas covered in this report, namely the Eastern Seaboard (ESB), the Songkhla Lake Basin and the Upper South, all follow the above approach, only their patterns are somewhat different. ESB has received national recognition as the promotion zone for the petrochemical industry coupled with the construction of deep sea ports as viable alternatives to reduce the congestion of the Bangkok port. In the case of the Songkhla Lake Basin, the government looks toward the twin cities of Songkhla/Hat Yai as an emerging growth center for southern Thailand. As for the Upper South, the Sub-Regional Development Study provides detailed information for the future development of the city of Phuket and its tourism industry.

Aside from the master plan initiated by NESDB, each implementing agency may also come up with its own initiatives. For example, provincial master plans for coastal land use of all 23 coastal provinces are being formulated by the Land Development Department. A Coastal Land Development Committee under the Ministry of Agriculture and Cooperatives was established to coordinate this effort. However, the emphasis is on soil suitability study and land classification. At the provincial level, a Subcommittee on Land Classification and Coastal Land Development under the chairmanship of the provincial governor supervises the field survey of local geographical conditions. So far 13 of the provincial plans have been completed. However

since these plans are not binding to the operations of other governmental agencies, they are mainly used as background references. As a result, only one plan has been formally adopted up to the present time.

The Town and City Planning Office under the Ministry of Interior also conducts land use planning for towns and cities all over the country including those in coastal areas. The main objective is to prepare land use zoning so that a systematic and orderly growth can be attained. Under this system, a novel approach of allowing public hearings in advance of the actual promulgation of city zoning plans is followed. This has led to prolonged delay due to the vested interest of both local residents and authorities in Bangkok.

3.1.2 Project Evaluation

For a development project which involves governmental funding, the prerequisite is to enlist it in the National Economic and Social Development Plan, after which financial requirements will be allocated. NESDB plays the crucial role in evaluating the feasibility of each project, both economically and socially, to fit in the guidelines of its Five-Year Plan.

For both governmental and nongovernmental projects which may cause adverse impact to the environment, an environmental impact assessment is required for submission to the National Environment Board for evaluation. Table 22 lists the types and sizes of projects which require environmental impact assessment.

For industrial plants, the control mechanism lies with the issuance of an operating license which is under the control of the Ministry of Industry. It is to be noted that all these regulatory functions are under the control of line agencies which have their headquarters in Bangkok.

Local authorities in Thailand retain a limited role. In each province, there is an elected provincial council which may consider any development issue within the provincial boundary. However, the provincial councils are not involved in permit or license granting.

Once an enterprise is in operation, its license may be revoked if it does not conform to the established ministerial regulations. Such action is the responsibility of the local police who have to bring each case to court.

Table 22 Types and Sizes of Projects and Activities
Requiring Environmental Impact Assessment

Types of projects or activities	Size
Dam or Reservoir	storage volume greater than 100,000,000 cubic meters or storage surface area greater than 15 square kilometers
Irrigation	irrigated area greater than 80,000 rai (12,800 hectares)
Commercial Airport	all sizes
Hotel or Resort facilities in environmentally sensitive areas, such as areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks	greater than 80 rooms
Mass Transit System and Expressway as defined by the Announcement of the Revolutionary Party No. 290, 24 November B.E. 2515	all sizes
Mining as defined by the Mineral Act No. 1 B.E. 2510, No. 2 B.E. 2516 and No. 3 B.E. 2522	all sizes
Industrial Estate as defined by the Industrial Estate Authority of Thailand Act, B.E. 2522	all sizes
Commercial Port and Harbor	with capacity for vessels of greater than 500 ton-gross
Thermal Power Plant	capacity greater than 10MW

Table 22 continued

Types of projects or activities	Size
Industries	
1) Petrochemical Industry	greater than 100 tons/day of raw materials required in production processes of oil refinery and/or natural gas separation
2) Oil Refinery	all sizes
3) Natural Gas Separation or Processing	all sizes
4) Chlor-Alkaline Industry requiring NaCl as raw material for production of Na ₂ CO ₃ , NaOH, HCl, Cl ₂ , NaOCl & Bleaching Powder	production capacity of combined products greater than 100 tons/day
5) Iron and/or Steel Industry	requiring iron ore and/or scrap iron as raw material for production greater than 100 tons/day or using furnaces with combined capacity greater 5 tons/batch
6) Cement Industry	all sizes
7) Smelting Industry other than Iron and Steel	production capacity greater than 50 tons/day
8) Pulp Industry	production capacity greater than 50 tons/day

3.2 Major Policy Issues

As part of the Pacific-rim Basin, Thailand belongs to the fastest growing region of the world. The country has managed to achieve a steady growth rate of almost 7 percent per annum during the 1960s and 1970s. Despite two oil crises and the world recession in the 1970s, recent economic growth in the last 15 years has still averaged close to 5 percent per annum.

To sustain this growth, Thailand has relied on its rich natural resources. Fish catch from the seas, both within Thailand's exclusive economic zone (EEZ) and beyond, nets in more than 2.26 million tons per annum. Tourism resorts on Thailand's long coastline are being further promoted for both domestic and international visitors.

The potential for growth is still evident particularly in coastal tourism. What is required is the wise management of the country's coastal and marine resources so that they can be harnessed in a sustainable manner. To augment such an approach, proper planning for coastal areas, taking into consideration the needs of the local inhabitants and making use of modern technology, such as coastal mapping from satellite imageries, could serve as the basis for coordination among various governmental agencies.

3.2.1 Marine Capture Fisheries

From available figures as reported in the previous Chapter, the Gulf of Thailand is overfished and only the pelagic resources of the Andaman Sea offer room for expansion. Overfishing is a result of various factors including excessive use of fishing vessels and gears. Increasing fishing costs, particularly fuel prices, have put pressure on the fishermen which has resulted in the illegal use of smaller meshes in order to catch more. On top of this, the development of fish meal and animal food industries induces the harvesting of trash fish. In addition, near shore push-netting is another practice that damages the resources because of the high percentage of juvenile shrimp and fish species netted.

A solution to the problem is joint-venture deep sea fishing with other coastal nations. However, unless better terms can be agreed upon with potential fishing partners, it is unlikely that this approach will increase the amount of marine catch landing in Thailand's ports. The host countries normally demand that the catch must be landed in their territories.

A two-pronged approach is thus warranted. Firstly, better management of marine capture fisheries in Thailand's EEZ is a prerequisite to any improvement in the existing situation. Emphasis should be given to the use of economic incentives to self-regulate the trawling practices in consonance with the maximum sustainable yields. On this issue, a better understanding of imminent changes due to the introduction of new marine capture fishery technologies and the expansion of the marine product industry is needed. The ultimate objective is to arrest overfishing in Thailand's waters which is now the case.

Secondly, beyond Thailand's EEZs, there are now sufficient cases of past successes and failures in Thailand's joint-ventures in marine capture fisheries. In-depth analysis of past experiences would be valuable to the formulation of any new viable strategy. It is well recognized that the government and the private sector must work in tandem to promote future joint-ventures. Changes which need to be introduced should rely on a better understanding of the situation of the fishing industry in Thailand and those of its partners. In addition, the issue of sustainable yields of different fish species in international waters should be given due attention.

3.2.2 Coastal Zone Development

It has been mentioned earlier that any hindrance to the progress in coastal tourism development is not due to the lack of tourism development plans but rather to the lack of implementing existing plans. Yet it is well recognized that the potential for progress in this area is immense and the economic return which could be further generated is still unlimited.

As identified in this report, the key to a successful tourism development program goes beyond the mandate of the tourism authority alone. First and foremost, the private tourism sector -- hoteliers, the service businessmen, etc.-- must recognize the value of systematic development in line with the projected growth rate of tourists. Second, infrastructure development, i.e., the provision of an adequate water supply, electricity and other utilities, must be planned in advance and coordinated so that investment funds can be allocated accordingly. Third, the local community itself must enjoy the benefits of tourism development and become an active partner in the process.

Administratively, the traditional approach in Thailand is to refer to the policy decided by the headquarters of line agencies in Bangkok. For example, when a new hotel is contemplated in a resort area, the investor will normally apply for privileges

granted by the Board of Investment in Bangkok. Authority at the provincial level is rather limited. This is due to the tax system of the country by which revenues collected by the government are appropriated in Bangkok leaving insufficient income at the disposal of local authorities.

Yet, for successful and lasting coastal development, the active role of the local authorities is the prerequisite. Consensus building among governmental agencies responsible for various uses of the same coastal areas is the key. Decisions on the best use of coastal areas should rely on technical mapping of various uses and continuing dialogue among interested parties, both within the government and the private sector. Emphasis should be given to the pronounced conflicts of interest, such as the use of mangrove for aquaculture vis-a-vis wood production for charcoal, and tourism vis-a-vis industrial development. The ultimate objective is to formulate coastal land and water use plans which are acceptable to all.

3.3 Conclusion

Thailand has already crossed the threshold in terms of the maximum sustainable yield of marine capture fisheries within her own seas. At present, the replenishment of the marine fish stock is left entirely in the hands of nature. The only condolence is that somehow the total amount of catch has not been drastically reduced. Up to now, any deficit from the reduction in the fish catch can be compensated by those captured from neighboring territories. However, such a situation can not last forever.

On coastal development in general, a more rosy picture can be painted. Thailand has yet to take full benefit from her rich coastal resources. Coastal tourism development, in particular, has ample room for growth. With 2,614 kilometers of coastline, development can be achieved while conservation for important coastal areas, such as mangroves, can also be secured. Economic growth can be promoted and sustained. The key pending question is how to share the generated wealth so that the coastal inhabitants can also harvest the fruits of their land.

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