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THAILAND

ENVIRONMENT

MONITOR 2006



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Thailand Environment Monitor 2000

Presented a snapshot of general environmental trends in the country.

Thailand Environment Monitor 2001

Assessed the status of water quality management.

Thailand Environment Monitor 2002

Assessed the status of air quality management.

Thailand Environment Monitor 2003

Assessed the status of solid and hazardous waste management.

Thailand Environment Monitor 2004

Assessed the status of biodiversity management.

Thailand Environment Monitors are available in both English and Thai online at: <http://www.worldbank.or.th>

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TABLE OF CONTENTS

Foreword.....	ii
Abbreviations and Acronyms.....	iii
Map of Coastal and Marine Resources and Threats.....	iv
Priority Areas.....	vi
EXECUTIVE SUMMARY: BLUE WATERS IN PERIL.....	1
CHAPTER 1: THAILAND'S MARINE AND COASTAL RESOURCES: STATUS AND TRENDS.....	4
Overview.....	4
Wetlands and Mangroves.....	4
Coral Reefs.....	5
Sea Grasses.....	6
Endangered Species.....	7
Fisheries and Aquaculture.....	8
Water Quality and Beaches.....	10
Freshwater Supply.....	11
Erosion and Natural Hazards.....	11
Climate Change.....	14
CHAPTER 2: MARINE AND COASTAL RESOURCES UNDER PRESSURE.....	16
Population and Economic Growth.....	16
Urban and Industrial Development.....	17
Tourism and Recreation.....	18
Fisheries and Aquaculture.....	18
Marine Transportation.....	20
Extractive Industries and Sand Mining.....	22
Illegal Activities.....	22
Towards a Quality of Growth.....	22
CHAPTER 3: POLICIES, INSTITUTIONS AND MANAGEMENT.....	24
National and Sector Policies.....	24
Institutions and Regulations.....	25
Financial Resources.....	28
Coastal and Marine Area Management.....	29
Community and Other Partners.....	31
CHAPTER 4: CHALLENGES.....	33
Challenge 1: Coastal Erosion.....	33
Challenge 2: Fisheries.....	34
Challenge 3: Area Development.....	35
Challenge 4: Public Participation.....	36
Challenge 5: Integrated Management.....	36
The Way Forward.....	37
References.....	38
Glossary of Terms.....	39
Online Resources.....	40
Acknowledgements.....	41
Thailand-at-a-Glance.....	42



FOREWORD

Exploitation of Thailand's marine and coastal resources during the past four decades has harmed the environment and affected livelihoods. While the Royal Thai Government, local community groups, and NGOs have undertaken measures to protect and rehabilitate natural habitats, more effective administration and greater cooperation among key stakeholders is needed to ensure a sustainable management of these resources that protects and preserves them for current and future uses.

The Thailand Environment Monitor series tracks key environmental trends in the country. Its aim is to engage and inform stakeholders on key environmental changes and challenges as they occur. This Monitor focuses on marine and coastal resource management, while previous issues have provided a benchmark for general environmental indicators (2000) and have featured water quality (2001), air pollution (2002), solid waste (2003), and biodiversity (2004).

This 2006 Monitor consists of four chapters. The first describes the current state and overall trends in the environmental quality of Thailand's marine and coastal resources. Chapter 2 describes the use of these resources and the pressures they are under. Chapter 3 gives an overview of the various policies and regulations, institutional arrangements, and budget allocations in place that relate

to marine and coastal resources management in Thailand, including those of the government and local community and other non-governmental organizations. Chapter 4, in conclusion, builds on the other chapters to present the main challenges for sustainable management of these resources under threat.

This Monitor is the outcome of a joint exercise between the Department of Marine and Coastal Resources (DMCR), the Office of Natural Resources and Environmental Policy and Planning (ONEP), and the World Bank. The data and information in this report came from a variety of sources, including published and unpublished reports of government agencies, universities, NGOs, individuals, and international partners. The analysis and consultation for this Monitor involved several national agencies, academics, civil society, and local community groups. Results from these consultations are integrated throughout and highlighted in Chapter 4.

The Tsunami of December 2004 had severe socio-economic and environmental impacts and made all too clear the need for and importance of coastal and marine resources planning and management. This Monitor underscores that need and invites all stakeholders to step up their active participation in the effective management and stewardship of Thailand's marine and coastal resources.



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ABBREVIATIONS AND ACRONYMS

BGO	Botanical Garden Organization	MOInd	Ministry of Industry
BMA	Bangkok Metropolitan Administration	MOI	Ministry of Interior
BOB	Bureau of Budget	MD	Marine Department
CBD	Convention on Biological Diversity	MOAC	Ministry of Agriculture and Cooperatives
DASTA	Designated Area for Sustainable Tourism Administration	MONRE	Ministry of Natural Resources and Environment
DEQP	Department of Environmental Quality Promotion	MOPH	Ministry of Public Health
DGR	Department of Groundwater Resources	MOT	Ministry of Transport
DIW	Department of Industrial Works	MOTS	Ministry of Tourism and Sports
DLD	Department of Livestock Development	NESDB	Office of National Economic and Social Development Board
DMCR	Department of Marine and Coastal Resources	NSO	National Statistical Office
DMF	Department of Mineral Fuels	ONEP	Office of Natural Resources and Environmental Policy and Planning
DMR	Department of Mineral Resources	OPM	Office of the Prime Minister
DNP	Department of National Parks, Wildlife and Plant Conservation	OPS	Office of Permanent Secretary
DOA	Department of Agriculture	PAO	Provincial Administrative Organization
DOF	Department of Fisheries	PCD	Pollution Control Department
DOH	Department of Highways	PMBC	Phuket Marine Biological Center
DOL	Department of Lands	RFD	Royal Forest Department
DOLA	Department of Local Administration	RID	Royal Irrigation Department
DPA	Department of Provincial Administration	TAO	Tambon Administrative Organization
DPT	Department of Public Works and Town and Country Planning	TAT	Tourism Authority of Thailand
DWR	Department of Water Resources	TEI	Thailand Environment Institute
EGAT	Electricity Generating Authority of Thailand	TTD	The Treasury Department
FAD	Fine Arts Department	UNEP	United Nations Environment Program
FAO	Food and Agriculture Organization	WMA	Wastewater Management Authority
FIO	Forest Industry Organization	WRI	World Resources Institute
GDP	Gross Domestic Product	ZPO	Zoological Park Organization
IUCN	World Conservation Union		
LDD	Land Development Department		
MOC	Ministry of Culture		
MOE	Ministry of Energy		
MOF	Ministry of Finance		

Units:

1 rai = 1,600 square meters = 0.16 hectares;

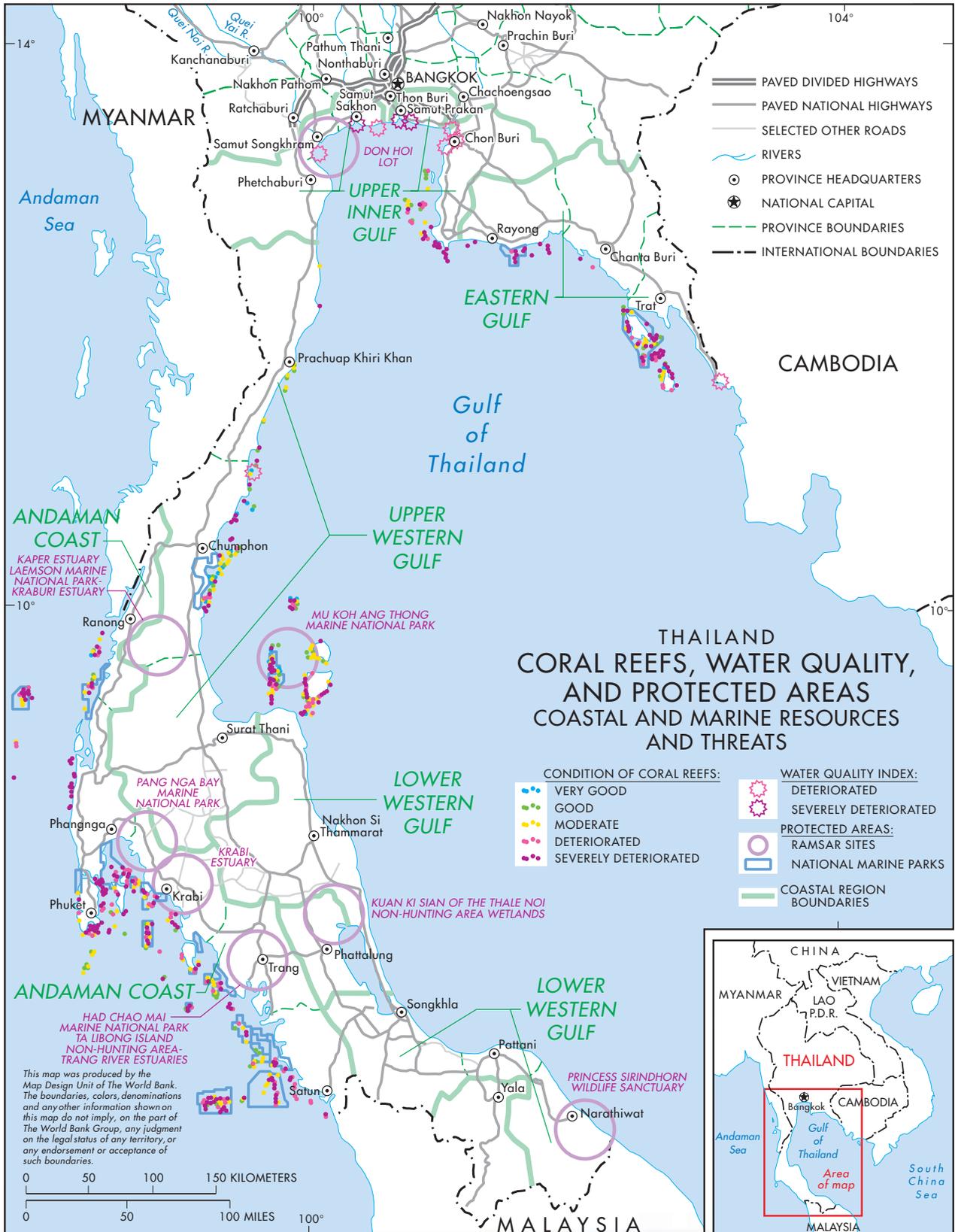
1 hectare = 6.25 rai; 1 square kilometer = 625 rai

Exchange Rate: US\$ 1 = THB 39.98 (January 11, 2006)



MAP OF COASTAL AND MARINE RESOURCES AND THREATS

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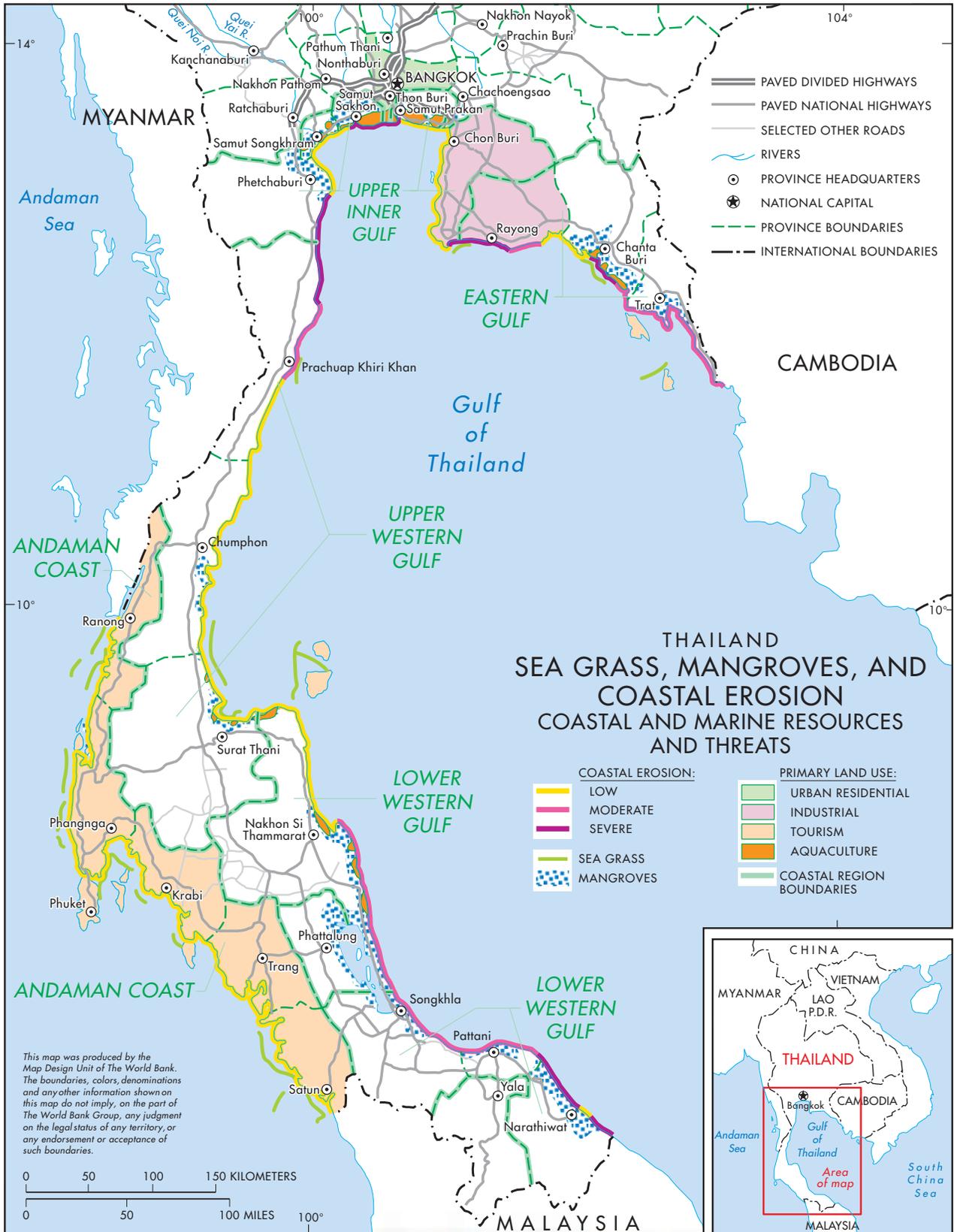
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MARCH 2007



MAP OF COASTAL AND MARINE RESOURCES AND THREATS

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PRIORITY AREAS

Status and trends	<p>Wetlands: Coastal wetlands are under threat. Special protection is granted to ten coastal RAMSAR sites.</p> <p>Mangroves: The decline in mangrove coverage, mainly a result from the conversion of mangroves to shrimp farms, has stopped. Replanting efforts are ongoing, but the biodiversity value of replanted areas remains unknown. Overall status of mangroves in Thailand is better than in other countries in the region.</p> <p>Sea grass beds: Sea grass beds in Thailand remain healthy. Local threats remain.</p> <p>Coral reefs: Over 80 percent of reefs along the Andaman Coast and over 50 percent of reefs along the Gulf of Thailand are in a “fair”, “bad” or “very bad” condition and are at risk of continued degradation.</p> <p>Endangered species: Dugongs continue to be killed for meat or die as a result of inappropriate and destructive fishing practices. Dugongs, whale sharks and sea turtles need stepped up protection and law enforcement.</p> <p>Fisheries and aquaculture: Thailand’s productive coastal habitats play important roles in the fisheries sector and for coastal aquaculture. In 2003, marine fisheries catch was 2.7 million tons and coastal aquaculture was 0.7 tons, together worth about THB 112 billion. The production of aquaculture has been growing, shrimp farming has reached its area limit, and marine fish stocks are under threat.</p> <p>Water quality and beaches: Water quality in select locations is degraded or severely degraded and red tides are yearly events in Thai waters. Beaches in general are in good condition.</p> <p>Freshwater supply: Freshwater in the coastal areas is limited and average water demand in most regions exceeds average water storage. The use of groundwater as a freshwater source needs to be carefully monitored to avoid land subsidence.</p> <p>Erosion and natural hazards: Each year, 600 kilometers of coastline experience erosion levels greater than one meter. Erosion is causing a loss of land and utilities and affecting local communities. Natural hazards also frequently occur and can cause severe damages.</p> <p>Climate change: Global climate change and a resulting rise in sea level are expected to have a strong impact on Thailand’s coastal areas. Bangkok is a hotspot area.</p>	<p>While performance in a few areas, in particular related to the recovery of mangroves and the status of sea grasses, Thailand performs reasonably well, overall resources are under serious threat.</p> <p>Coastal erosion has become one of the key issues in the coastal provinces, resulting in high monetary and social costs for people and communities involved.</p>
Pressures	<p>Population and economic growth: Thirteen million people, nearly a quarter of the Thai population, live in the 22 coastal provinces (not including Bangkok). Economic and population growth in the coastal provinces are higher than the national average. Manufacturing is a major industry and has grown rapidly over the past five years.</p> <p>Urban and industrial development: Development has led to increased demands for freshwater and urban and industrial waste. Reliable data on waste generation and treatment are needed.</p> <p>Tourism and recreation: Tourism in the coastal areas continues to grow and revenue is substantial: 10 percent of the national GDP stems from tourism and supporting industries. Environmental impacts, however, are also substantial and need to be addressed. Tourism revenue may be used for environmental protection.</p> <p>Fisheries and aquaculture: Fish stocks are not managed sustainably. Total catch in Thailand has grown the least compared to other countries. Catch per unit effort is decreasing while the amount of trash fish per catch remains high. Shrimp farming needs effective management and monitoring.</p> <p>Marine transportation: The number of ocean going vessels is increasing. Port operations and marine transportation continue to be sources of pollution, including from the coating on vessels, the transportation of invasive species, and accidents resulting in oil spills.</p> <p>Extractive industries and sand mining: Mineral mining and oil and gas production are important uses of natural resources for Thailand. Effective pollution control for all extractive industries is needed. Sand mining needs to be monitored to avoid increased erosion.</p> <p>Illegal activities: Illegal and unregulated activities represent significant losses and pose a threat to the sustainable management of resources.</p>	<p>High rates of economic growth in Thailand have been accompanied by high environmental and social costs. Despite overall growth, pockets of poverty continue to exist. Environmental impacts also impact the economy, creating a need for a stepped-up management of resources.</p>
Institutional capacity	<p>National and sector policies: Overlapping and outdated policies and regulations remain the barrier for effective implementation of an integrated management approach. Coordination among agencies is needed.</p> <p>Financial resources: Budget allocations are complex. Potential exist for the use of economic instruments.</p> <p>Coastal and marine area management: Where designated, Thailand’s Marine Protected Areas are managed reasonably well. Only about 6.8 percent of all reefs, however, are under good MPA management.</p> <p>Community partners: Communities increasingly play a role in the management of resources. Especially in the South, community organizations, Civil Society Organizations, and NGOs are active partners for resource management.</p>	<p>Important initiatives are in place, but strong leadership from the government and effective cooperation of key stakeholders are required.</p>
Challenges	<p>Key challenges and the way forward: Key challenges relate to preventing coastal erosion, establishing sustainable fisheries, stepping up the oversight and monitoring of development activities, increasing local capacity and participation, and strengthening the institutional framework to establish integrated management.</p>	<p>Moving forward requires specific actions, commitment, and an increased awareness of the impacts of environmental degradation on people and the economy.</p>

CHAPTER 1: STATUS AND TRENDS

Thailand's marine and coastal resources are abundant and unique. This Chapter gives a quick overview of those resources and highlights the current status and overall trends for wetlands and mangroves, coral reefs, sea grass beds, and endangered species. It further describes the status of marine fisheries and aquaculture, freshwater supply and demand, the conditions of beaches, local water quality, coastal erosion, natural hazards, and climate change.

OVERVIEW

Twenty-three, or almost a third of the country's 76 provinces, are located in coastal areas. The total coastline is 2,880 kilometers long, with 1,920 kilometers along the Gulf of Thailand and 960 kilometers along the Andaman Sea (See maps on pages iv and v). The Gulf is part of the South China Sea and connected to the territorial waters of Malaysia, Cambodia, and Vietnam. It is characterized by relatively shallow waters of 45 to 80 meters deep, a level sea floor, and a high influx of nutrients and freshwaters from rivers. On the other side of the country, the Andaman Sea features coral reefs, dense mangrove forests, karst limestone islands, and pristine beaches with deep oceanic waters.

Thailand's rich marine and coastal resources form the basis of a productive fisheries industry, and marine fisheries is one of the primary sources of income in the country. In 2003, Thailand accounted for three percent of the world's total fish catch and nearly two percent of global aquaculture production. Marine fisheries catch that year was 2.7 million tons, while aquaculture production in the coastal areas generated 0.7 million tons, together worth about THB 112 billion¹ (See also Tables 1.1 and 1.2).

Coastal resource benefits... The importance of Thailand's coastal resources extends beyond the commercial value of its marine products. The resources provide sustenance to local communities and are important for tourism and recreation. Further, coastal areas in general are important locations for growing industrial activities and urban development. Coastal states, including Thailand, increasingly turn to their coastal areas, territorial seas, and exclusive economic zones (EEZ) to enhance economic development. Finally, coastal and marine resources provide many



Had Nopparathara in Krabi Province is part of Thailand's 2,880 kilometers of coastline.

Source: World Bank, 2005.

ecosystem services that cannot or would be very expensive to be replaced. They help, for example, protect shorelines against erosion and mitigate or limit the impacts of natural disasters.

WETLANDS AND MANGROVES

Thailand has 1,256 coastal wetland sites, covering an area of about 20,184 square kilometers, including 2,661 square kilometers of mangroves². Other types of coastal wetlands include river deltas or estuaries, mudflats, marshes, beach forests, and beaches. Wetlands stabilize coastal ecosystems and play an important role in the livelihoods of local communities.

Wetlands under threat... Many coastal wetlands in Thailand are under threat. Agriculture and irrigation, fisheries and aquaculture, tourism and recreation, urban and industrial development, and the indirect effects of climate change are affecting the status of coastal wetlands. In 1998, Thailand became a signatory to the RAMSAR convention, which protects wetlands of international importance, and inaugurated its first RAMSAR site, a peat swamp called Pru Kuen Khee Sean, in Pattalung Province. Today, Thailand has ten RAMSAR sites, eight of which are located in coastal provinces.

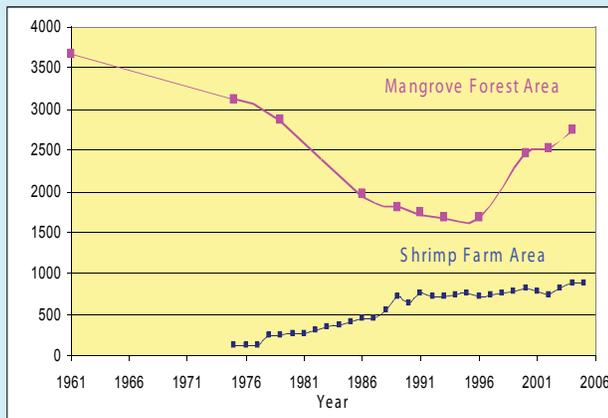
Mangrove forests... Mangrove forests are wetlands, which, together with sea grasses and coral reefs, form

¹DOF, 2003.

²RFD, Forestry Statistics, 2004.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Fig. 1.1: Shrimp Farms and Mangrove Forests



Source: DOF, 2005 and RFD, 2004.

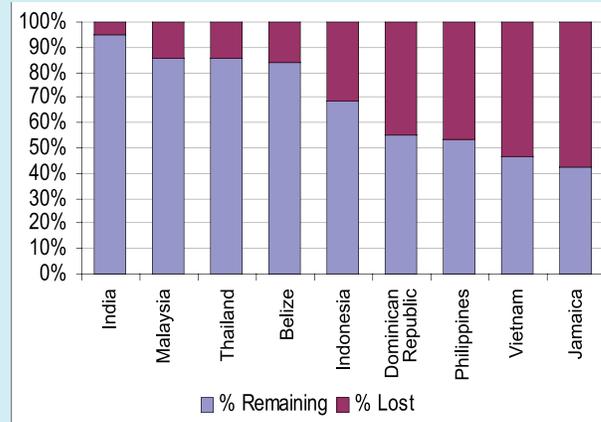
an integral part of Thailand's coastal ecosystems. Mangroves are found along both coastlines where they stabilize the shoreline, protect against waves and storms, and provide a nursery and feeding ground for many species, including commercially important fish. Thailand's mangroves are also important on a global scale as the country is home to 35 of a total of 50 species found worldwide.

Mangrove losses followed by reforestation... Between 1975 and the mid-1990s, mangrove forests were in rapid decline. While in 1975 total coverage had been 3,108 square kilometers, this number had dropped to about a little over half by 1993, leaving about 1,674 square kilometers. Losses were most severe along the Gulf, with about 70 and 25 percent lost along the Gulf and Andaman Sea, respectively.

The rapid loss of mangroves over those years coincided with a period of double-digit annual economic growth. Along the Gulf of Thailand and in particular the Upper Gulf and Eastern Gulf, mangroves were rapidly converted for alternative uses including salt production, shrimp farming, urbanization, tourism and industrial activities. Between 1975 and 1995, the area under shrimp farming grew by more than 620 square kilometers while nearly 1,500 square kilometers of mangrove forest were lost (Figure 1.1). More than half of all mangrove losses occurred in just three provinces: Samut Sakhon, Chanthaburi, and Phang-Nga.

In response to the rapid decline in mangrove areas, the government in the early 1990s began to regulate concessions and replant mangroves. Specified in the DMCR Mangrove

Fig. 1.2: Change in Mangrove Area, 1980-2000



Source: FAO statistics.

Management Plan 2004-2008, the government intends to plant, enrich, and conserve another 1,152 square kilometers by the end of the current decade. However, the aspect on biodiversity value of replanting mangrove needs to be researched.

International comparison... Despite significant losses, Thailand has a relatively large area of mangrove forests remaining when compared to other countries (Figure 1.2).

CORAL REEFS

Coral reefs are an important tourism attraction and are found along the entire coast. In total, Thailand features an estimated 153 square kilometers of reefs, 51 percent of which are found in the Andaman Sea and 49 percent in the



Coral reefs are rich in biodiversity and important for fisheries, tourism, coastal protection, natural product industries, and research and education.

Source: DMCR.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Gulf³. Created over millions of years, the coral reefs are rich in biodiversity and of major importance for fisheries, tourism, coastal protection, natural product industries, and research and education. Five particularly important and well-known coral reef sites are Samui, Tao, and Chang Islands in the Gulf and Surin and Similan Islands in the Andaman Sea, which 25.6 square kilometers of reef along the Andaman Coast are the largest in the country.

Many reefs at risk of continued degradation... A recent assessment of coral reefs classified over 80 percent of reefs along the Andaman Coast and over 50 percent of reefs along the Gulf as either in “fair,” “bad,” or “very bad” condition (Figure 1.3) and concluded these reefs are at risk of continued degradation⁴. Storms, coral bleaching, diving, fishing gear, blast fishing, dredging, and land-based pollutants are the main factors. An international comparative study also indicated that at least 50 percent of all coral reefs in Thailand experience “high” or “very high” threats (Figure 1.4).

Ecosystems and services lost... With about 57 square kilometers (or 37 percent of the total coral reef area) of rich coral reef categorized as degraded or very degraded, coral reef deterioration represents a loss in potential value of about THB 340 million or US\$ 8.5 million per year⁵. The continuing degradation of the reefs is expected to impact tourism and fishing industries, exacerbate coastal erosion, and lessen the coastline’s protection against natural disasters.

SEA GRASSES

Sea grasses play a lesser known but nonetheless important ecological role. The grasses, which most often grow in relatively shallow waters, form a key feeding, breeding, and nursery ground for many species of fish, turtles, lobsters, and dugong. Moreover, sea grasses improve water quality and their root-like stems stabilize the sea bottom.

Of a total of 104 square kilometers of sea grass habitats, about 79 square kilometers are located in the Andaman Sea. Sea grasses are found in 19 of the 23 coastal provinces and the country is home to 12 of the approximately 58 species of sea grasses found worldwide⁶.

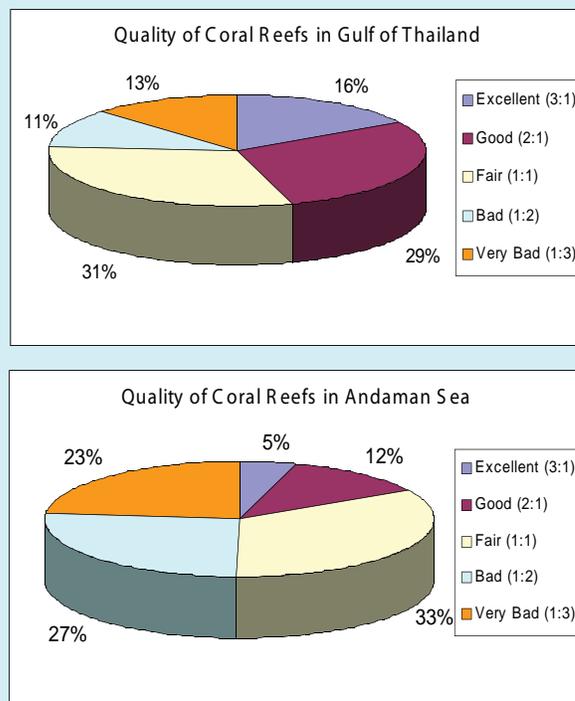
³MONRE, 2004.

⁴ONEP, 2004.

⁵Task Team estimates.

⁶UNEP/GEF, 2005.

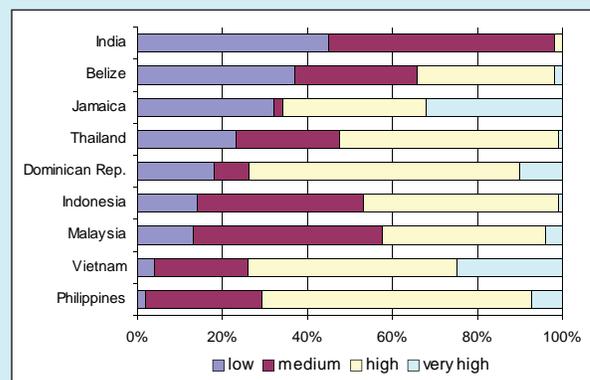
Fig. 1.3: Quality of Coral Reefs in the Gulf of Thailand and Andaman Sea



Note: Quality is measured by the ratio of live to dead corals (live: dead).

Source: ONEP, 2004.

Fig. 1.4: Level of Threat to Coral Reefs in Select Countries



Source: WRI 2002, 2004.

Sea grass beds are very healthy, but local threats remain... Sea grass beds in Thailand remain very healthy, with 60 percent in a “very healthy” or “healthy” condition⁷. While 20 percent is in “fair” condition, another 20 percent is qualified as “degraded”. Threats to sea grass meadows

⁷PMBC, 2004.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Box 1.1: Sea Turtles Are Being Protected...But Need Law Enforcement

Thailand is home to five of a total of just seven species of sea turtles that exist worldwide. Green, hawksbill and loggerhead turtles are found along the Gulf of Thailand, while leatherback and olive ridley turtles have been recorded on several locations in the Andaman Sea.

Sea turtles are fully adept at sea, but have close ties to the land. Females lay their eggs ashore and the tiny hatchlings begin their lives on land. The adult sea turtles often return to the same beaches where they were born to lay eggs for a new generation.

Over the past 15 years, the number of sea turtles laying eggs has been reduced by 90 percent. This drastic decline stems in part from over fishing and the capture of females that are preparing to nest. In addition, habitat destruction and the collection and sale of turtle eggs pose significant threats. The decline in the number of nesting sea turtles comes despite the fact that since 1981 the consumption and trade of sea turtles and their products has been prohibited in Thailand. Several nesting sites have also been declared National Parks and Fisheries Preservation Zones, and the Government, in cooperation with the private sector and local communities, supports programs to each year release baby turtles in the Eastern Seaboard and Andaman Sea. While programs and regulations are in place, enforcement is weak. To benefit the turtles, as well as tourism and communities, protection and enforcement need to be improved.

Source: Southeast Asian Fisheries Development Center, 2004 and ONEP, 2004.



The green sea turtle is found along the Gulf of Thailand.
Source: PMBC.

include the use of push nets and trawlers for fishing, wastewater discharges from shrimp farms, urban and industrial pollution, and salinity variations caused by irrigation and land clearing.

ENDANGERED SPECIES

Several endangered species live in the Thai coastal waters. Dugong is one such species. These marine mammals live in the country's shallow tropical waters where they primarily feed on sea grass beds. Since 1979, an average of 15 dugongs has been killed each year. The dugongs, considered a delicacy, are hunted for their meat or die as a result of inappropriate and destructive fishing practices. This despite dugongs being listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which forbids the use of fishing gear that could potentially harm the species. If this trend continues, dugong could be eliminated from Thai waters.

Another marine species under threat is the whale shark. Whale sharks—the largest fish ever recorded—can grow to be 12-18 meters long. They are found in both the Gulf



Sea-grass beds are a key feeding ground and breeding habitat for many species of fish, turtles, lobsters, and dugongs.

Source: PMBC, 2004.

of Thailand and the Andaman Sea. Declared as protected species in 2000, the hunting of whale sharks is strictly prohibited.

Several species of sea turtles are also under threat from local and commercial fishing activities (Box 1.1).



MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Table 1.1: Production And Value Of Marine Fisheries, 2003

Production type	Production (Tons)	Value (in THB millions)
Coastal aquaculture	703,300	47,517
Marine capture	2,651,200	64,169
Total	3,354,500	111,686

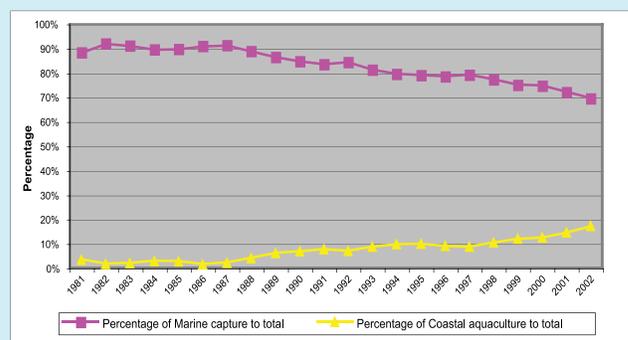
Source: DOF, 2003.

FISHERIES AND AQUACULTURE

Historically, Thailand's coastal waters have been rich and productive, featuring an abundance of fish, high biodiversity, and healthy populations. Naturally, these resources have come to play an important role in the fisheries sector, supporting a sector that contributes significantly to the national economy.

Marine fisheries—wild capture and farm production combined—contribute about 70 to 80 percent of the total fisheries production in the country and the coastal provinces account for 85 percent of the Thai fishery's contribution to the GDP. Of the total marine fish catch, about 70 percent comes from the Gulf of Thailand and 30

Fig. 1.5: Marine Fisheries and Aquaculture Production, 1981-2003



Note: Percentages calculated as part of total fishery production in Thailand, which also includes freshwater production.

Source: DOF, Fisheries Statistics of Thailand, 2003.

percent from the Andaman Sea. Aquaculture production and the number of fishery establishments are also higher in the Gulf (Table 1.2).

Aquaculture continues to grow... Coastal aquaculture production has been growing rapidly and increased from 62 thousand tons (worth THB 1,261 million) in 1984 to 703 thousand tons (THB 47,517 million) in 2003. This

TABLE 1.2: FISHERY ESTABLISHMENTS AND PRODUCTION

ESTABLISHMENTS AND BOATS (2000)					
Number of fishery establishments	Total	Gulf of Thailand		Andaman Sea	
Marine capture fisheries	55,981	35,268	63%	20,713	37%
Coastal aquaculture	35,711	31,783	89%	3,928	11%
Marine capture and aquaculture combined	1,820	1,110	61%	710	39%
Total number of fishery establishments	93,512	68,264	73%	25,248	27%
Number of fishing boats	58,119	37,196	64%	20,923	36%
Number of fishermen during peak season	168,140	121,061	72%	47,079	28%
PRODUCTION AND AREA (2003)					
Marine fisheries catch	Total	Gulf of Thailand		Andaman Sea	
Production (in thousand tons)	2,651	1,860	70%	791	30%
Shrimp culture					
Production (in thousand tons)	331	235	71%	35	11%*
Area (hectares)	82,019	66,435	81%	4,101	5%*
Fish culture					
Production (in thousand tons)	15	12	78%	3	19%
Area (hectares)	1,060	1,010	95%	50	5%
Shellfish culture					
Production (in thousand tons)	357	334	94%	23	6%
Area (hectares)	949	765	80%	184	20%
Total culture (in thousand tons)	703	581	82%	61	8%*
Total production (in thousand tons)	3,354	2,441	313	852	66

Note: * Remainder is in other areas.

Source: DOF, Intercensal Survey of Marine Fishery 2000 and DOF, Fisheries Statistics of Thailand, 2003.

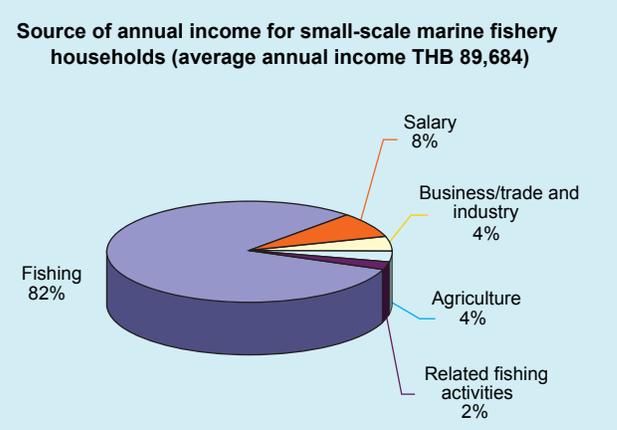
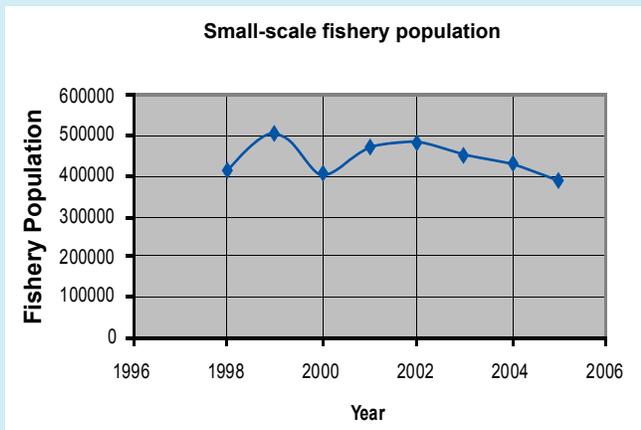
MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Box 1.2: Resource Conflicts: Small Fisher Folk vs. Commercial Operators

“Who is fishing the Thai waters?” Just a decade ago, the answer to this question would have been very different from today. Over the past five to fifteen years, two structural changes have taken place in Thailand’s fisheries sector. The first is a dramatic increase in the number of coastal households depending on aquaculture as opposed to marine capture fisheries. While the number of households depending on marine capture fisheries increased from about 52,000 to 70,000 since 1985, the number of households depending on aquaculture grew from about 6000 to 30,000 – a five-fold increase – over the same period. The percentage of those depending on marine capture fisheries had dropped from about 90 percent to less than 70.

The second structural change is the decline in the number of small-scale fishery households and their contribution to the total fisheries catch. While small-scale artisan fishers still account for about 80 percent of the total number of fishery establishments, their output is just five percent of total production. Marine fisheries are now dominated by a small, but well-equipped, number of big commercial operators, with bigger vessels and modern technologies, who catch 95 percent of the total production. Intensified by the declining availability of fish, the competition between the small-scale fisher households and the commercial operators is driving out small fisher folk and causing social conflicts in the coastal areas.

The fishery conflict contributes to existing poverty among small coastal communities. Most of the coastal fishers are Buddhist Thai or Muslim Thai or belong to one of several indigenous groups such as the Moken, Moklen, and Urak Lawoi. The fishery households are typically poor and the competition with the big operators has a direct impact on their incomes, as 84 percent of their household income stems from fishing and related activities. While prospects for other employment are bleak – this segment of the population generally lacks education – other forms of aquaculture, such as marine shellfish and seaweed culture, could provide alternative employment and be implemented in an environmentally and socially acceptable way.



Source: Bank of Thailand, Labor Force Survey, 2005 and DOF, Marine Fishery Census, 2000.

increase was dominated by a growth in shrimp culture, which grew from 26 percent of total coastal aquaculture products to 47 percent (or 331 thousand tons) over the same period. Aquaculture products are most valuable. While representing about a quarter of the total marine production in tons per year, their total value is about the same (Table 1.1)

Figure 1.5 illustrates the growing importance of coastal aquaculture in Thailand.

Shrimp farming is reaching its limit... The government has a policy to limit the total area for shrimp farming to less than 500,000 rai (about 80,000 hectares), and this limit has been reached. Of the 512,620 rai of land currently used for shrimp farming, most, or 442,620 rai, is located in the

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

coastal area. The majority of these coastal shrimp farms are located along Chonburi to Petchaburi (45 percent) and Prachaubkirikhan to Narathiwat (35 percent). The remainder is along Trad to Rayong (14 percent) and the Andaman Sea (5 percent) (See also the map on page *v*).

Government efforts to control pollution from shrimp farms through farm registration, effluent standards, and the use of Good Aquaculture Practice (GAP) and Code of Conduct (CoC) standards can be effective, but need enforcement and monitoring.

Declining fish stocks... Thailand's marine fish stocks are depleting. The catch per unit effort, the total number of fish caught per unit of time and an indicator of fish abundance, has been declining steadily and decreased by 87 percent between 1966 and 2003. Other parameters—low growth in total catch and increased catch of trash or low-value fish—also indicate fish resources in Thailand are under threat and not managed in a sustainable way. (See also Chapter 2 and Box 2.1). This trend is not unique; stocks in nearly one-third of sea fisheries have collapsed and the rate of decline is accelerating. According to a recent study, the decline in fisheries is closely tied to a broader loss of marine biodiversity, the results of which could be a collapse of global fish stocks by the year 2050⁸.

Poverty among fisher folk... The declining fish stocks put additional pressure on small fisher folks, who are always vulnerable to changes in coastal resources and now find themselves competing with commercial fishers for a declining supply of fish. Although efforts have been made for more than 20 years to address conflicts between small fisher folks and commercial fishers, the issue remains a challenge (Box 1.2).

WATER QUALITY AND BEACHES

Water quality is measured at 240 monitoring stations of the Pollution Control Department (PCD). Between 2003 and 2004, water quality at several stations was considered either “degraded” or “severely degraded” (Figure 1.6 and maps on pages *iv* and *v*). Poor water quality exists near the Inner Gulf and at the mouths of Pak Panang, Pattani and Ranong rivers. In about 10 to 25 percent of the monitoring stations, the level of contamination with total coliform bacteria—an indication of pollution from human waste—was above standard.

⁸Worm et al, 2006.



Beach quality is important for tourism, such as here at Patong Beach, Phuket.

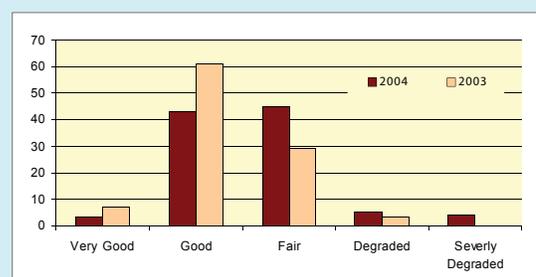
Source: World Bank, 2007.

Red tides and toxic substances... Red tides, caused by excessive growth of certain algae species, are increasingly common in Thai waters. They are generally caused by high influxes of nutrients and can have adverse effects on fish, shellfish, and humans. Between 1981 and 1993, red tides were often observed along the Inner and Eastern Gulf coasts from Hua Hin to Rayong. During 2000-2001, none were observed in Hua Hin and Phetchaburi, and one each in Samut Songkhram and Samut Prakan. Red tides along Chonburi and Rayong are observed every year.

Heavy metals... Concentrations of heavy metals in sediment, fish, and shellfish are measured periodically and were relatively high in areas that receive industrial waste. Metal concentrations of cadmium, chromium, lead, and mercury in fish and shellfish, however, were within acceptable standards.

Beach quality... Clean and well-managed beaches are important for water quality and tourism. Table 1.3 illustrates that beaches in general are in good condition.

Fig. 1.6: Coastal Water Quality



Source: PCD, 2004.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

FRESHWATER SUPPLY

Thailand has a limited supply of freshwater, mostly due to the topography of its river basins. Most rivers in the country are short and small, and all are under the influence of the ocean tide. Four of the major rivers—the Bang Pakong, the Chao Phraya, the Thachin, and the Mae Klong—drain into the Upper Gulf, while the Tapi River drains into Surathani Bay. Average rainfall varies among areas and ranges from 1,000 to more than 4,000 millimeters per year, but most of the runoff drains quickly to the sea. Because large reservoirs are infeasible in the relatively short river basins, most of the runoff cannot be stored for future use. As a result, groundwater resources are used to meet demand. Thailand has 12 groundwater basins with a total yield of about 3,161 million cubic meters per year. Of this amount, about 51 percent (or about 4 million cubic meters per day) is available along the coast. Nearly 90 percent of this available groundwater for the coastal area is located in the lower Chao Phraya.

Figure 1.7 illustrates the water situation in Thailand and shows that in most regions the maximum storage capacity is much lower than the amount of runoff per year. Average water demand in three of six regions exceeds usable storage. To meet increasing demands, smaller reservoirs and alternative ways to capture rainwater need to be explored (See also Chapter 2).

EROSION AND NATURAL HAZARDS

Coastal erosion and natural hazards have become one of the most pressing issues along the coast of Thailand. Coastal erosion can stem from natural processes—in particular wind, waves, and currents—but is severely enhanced by human influences, such as changes in land use.

While on the Andaman Coast, natural causes are the main force behind the erosion, on the Gulf side—where erosion rates are highest—the main cause is human activities.

Specifically sand mining, the construction of coastal structures such as jetties or breakwaters, land subsidence from groundwater usage, and rising sea levels increase erosion (Box 1.4). In addition, changes in land use, such as the conversion of mangroves to shrimp and fish farms, may reduce an area's capacity to mitigate erosion.

Erosion rates... Each year, 600 kilometers of coastline experience erosion levels greater than one meter. A 2005 study shows that 11 and 2 percent of Gulf and Andaman

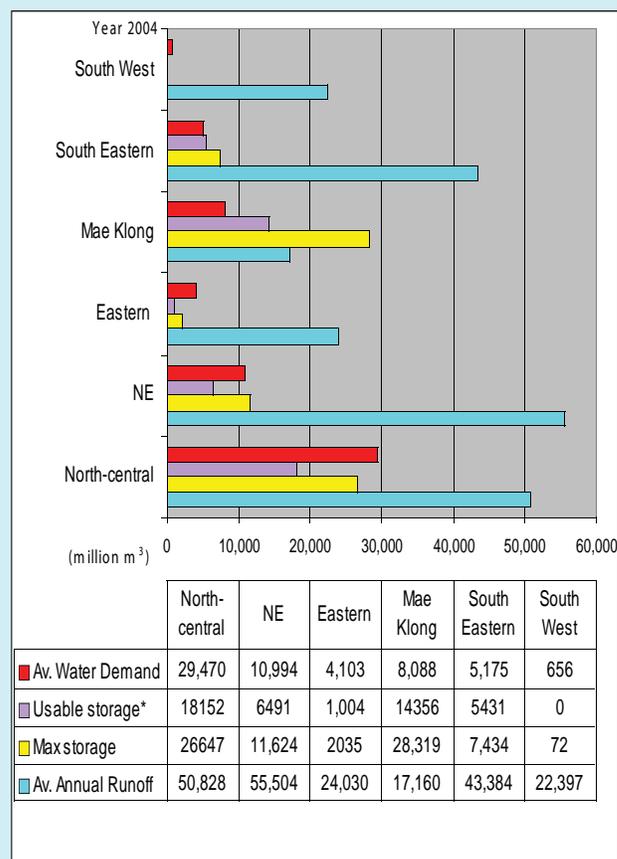
Table 1.3: Beach Quality Index, 2005

Index	Rating	Beaches
★★★★★	Very Good	Had Adang, Had Yao, Had Bilae
★★★★☆	Very Good -Good	Had Karon, Had Klong Dao, Had Rai Lay, Had Thung Wua Lan
★★★★	Good	Had Patthaya, Had Sai Kaew, Had Wong Duen, Had Mae Rampheng, Had Cha-am, Had Hua Hin, Had Chaweng, Had Patong, Had Nopparatthara, Had Ao Nang, Had Surin, Had Nai Yang, Had Chaomai, Had Yong Ling
★★★☆☆	Good - Fair	Had Bangsan, Had Cheng Mon, Had Pak Meng
★★★	Fair	Had Wornnapa, Had Jomtien, Had Banchean, Had Lamai

Note: The Beach Quality Index is based on water quality, counts for total coliform bacteria, and suspended solids and waste management.

Source: PCD, 2006.

Fig. 1.7: Water Situation in Thailand, 2004



Note: *Large dam only

Source: DWR, 2006.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

coastlines respectively are eroding at a rate of more than five meters a year (Table 1.4). This is equivalent to two square kilometers of coastal real estate, valued at around US\$ 156 million, being lost each year. If the current trend continues, an area of land larger than Samet Island will be permanently lost in four years.

The most industrialized areas in the country experience the highest levels of erosion and thirty priority areas have been identified. Critical areas include Trat-Chanthaburi, Samut Prakan to Thachin River (Inner Gulf), Phetchaburi-Prachuap Kiri Khan, and Nakhon Si Thammarat.

Table 1.4: Coastal Erosion and Deposition, Gulf of Thailand and Andaman Sea (Percentage of Total Coastline)

Coastal process	Gulf of Thailand (%)	Andaman Coast (%)
Stable coast	63	84
Deposition coast	8	4
Erosion: More than 5 meters per year	11	2
Erosion: 1-5 meters per year	18	10

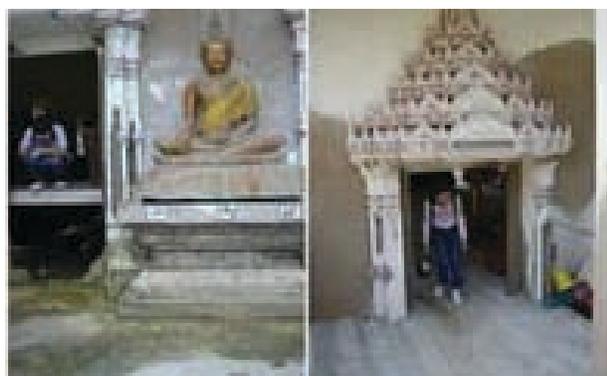
Source: Chulalongkorn University, 2005.

Box 1.3: Coastal Erosion: A Village No More

Ban Khun Samutchin village, Samut Prakarn province is located in a coastal erosion hot spot. Over the past 28 years, erosion and subsidence have decreased the village shoreline by more than one kilometer. Local impacts are considerable: Schools, government offices, and households are continuously moving inland. Over the past two and half decades, a community school moved four times, the Village Head moved her house seven times, and many community members are choosing to simply leave the town.

The increased erosion at Ban Khun Samutchin village is attributed to a loss in mangrove coverage along the shoreline. Without the mangrove roots stabilizing the shoreline and increasing sedimentation, the shoreline is no match for the constant forces of wind, waves and currents.

Today, Ban Khun Samutchin is rallying to save its temple, Wat Khun Samut Taraward, which was once far away from the shoreline but today is half below sea level. While the villagers are using their personal savings to save the temple, they cannot change the underlying causes of the erosion. Without comprehensive action and support from the national government, Ban Khun Samutchin and other villages like it will keep moving until no land... and no village remains.



Coastal erosion at Wat Khun Samut Taraward has eroded more than 1,000 meters of land.

Source: Jarupongsakul and Suphawajraksakul, 2005.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Box 1.4: Causes of Coastal Erosion

Severe coastal erosion along the Andaman Sea and the Gulf of Thailand poses many risks for local communities. While some changes to shorelines are natural and unavoidable, human activities have caused dramatic shifts in natural erosion and sedimentation patterns that negatively impact the shoreline areas.

Natural causes:

Waves, wind and currents: Waves, wind and currents are the natural causes of coastal erosion. The movement of wind and water washes away sand in unprotected areas. This form of erosion is enhanced by seasonal monsoons, typhoon, and other weather events.

Rising sea level: Relative rises in sea level, due to either land subsidence, climate change, or both, increase coastal erosion by exposing a larger area to waves and currents.

Human factors:

Groundwater usage and land subsidence: Land subsidence—a gradual lowering of land surface levels—exposes a larger area to natural erosion by allowing tides to move into low-lying areas. Inappropriate land uses such as fish ponds or shrimp farms would further accelerate the erosion process. The most common cause of land subsidence from human activity is the over-exploitation of groundwater.

Shoreline development: Shoreline development without comprehensive planning and enforcement accelerates coastal erosion. Harmful activities include sand mining, dune alterations, and the construction of structures such as seawalls, harbors, and navigational channels that obstruct the natural pattern of erosion and sedimentation.

Reef degradation and mangrove losses: Mangrove forests, together with coral reefs and sea grass beds, protect against erosion by reducing the height of the waves reaching the shore and holding down or collecting sediments.

Decreased sediment dischargers from rivers: Dams and some agriculture development projects create barriers that limit the natural flow of sediments into estuaries by delta-forming rivers. While too much sediment is a form of pollution, a certain degree of sediment flow is required for stable shorelines.

Sources: School of Ocean and Earth Science and Technology, 2006.



The construction of man-made structures along the shoreline and the destruction of mangrove are increasing erosion.

Source: Jarupongsakul, 2005.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Loss of land and utilities... More than a simple loss of land, coastal erosion leads to a loss of roads, electricity systems, lands for aquaculture, and farmlands and associated infrastructure. While the monetary costs are very high, they are not the only costs associated with coastal erosion, as is illustrated by the story of Ban Khun Samutchin village in Box 1.3.

Natural hazards... With a long coastline and so many coastal provinces, Thailand is exposed to many water-related natural disasters. Natural hazards occur frequently and can cause severe damages. While the Gulf can be subject to landslides, flashfloods, and typhoons, the Andaman Sea is more likely to experience a Tsunami or other impact of a large earthquake, such as sinkholes or changes in shoreline. Table 1.5 gives an overview of major landslides and floods in recent years.

Table 1.5: Landslides and Floods

Date	Event
22 Nov. 1988	Landslides at Ban Kathoon Neou Piboon district, Nakhon Si Thammarat, lead to the death or injury of 230 people and damage 1,500 houses and 984 hectares (6,150 rai) of crops. Total estimated costs are about THB 1,000 million. A landslide at Ban Keree Wong Lansaka, Nakhon Si Thammarat, results in the death or injury of 12 people. In the same event, 362 houses are partly or completely destroyed.
29 Nov. 1993	A depression causes floods at Nakhon Si Thammarat.
4 Nov. 1997	Typhoon Linda causes a flood at Nakhon Si Thammarat.
30 July 1999	Landslides at Kao Kichakood Chanthaburi damage houses, livestock, and crops. People are evacuated before the event.
20-22 Nov. 2000	Flood in Songkhla.
17 Oct. 2004	A landslide at Ban Huaysom, Kao Kram district, Muang Krabi, results in the death of three people, injures one, and damages 25 houses.
26 Dec. 2004	Large earthquake in Indonesia causes a Tsunami along the Andaman Coast.
Dec. 2005	Heavy rains cause floods in Songkhla and many areas in the South.

Source: ONEP and MOI.

CLIMATE CHANGE

Global climate change and its expected consequences are likely to have a strong impact on Thailand's coastal areas, in particular the flat and low-lying areas close to the Gulf of Thailand. Combined with large population numbers, this topography increases the risk of serious impacts from rising sea levels. Local situations also play a role. In the Chao Phraya basin, for example, land subsidence from the over-exploitation of groundwater will increase the impacts of rising sea levels.

Table 1.6 presents two estimates of sea level rises in the Gulf of Thailand by the year 2100, based on four different scenarios for a global sea level rise. More data and modeling efforts can improve the accuracy of these projections and help prepare for an effective response.

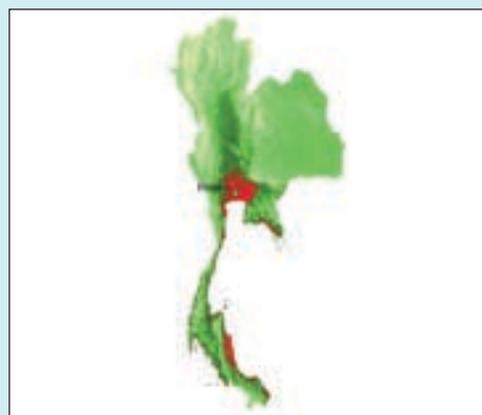
Table 1.6: Sea Level Rise Estimates for 2100

Scenario	Estimated sea level rise (centimeters)		
	Global	Gulf (Estimate a)	Gulf (Estimate b)
Baseline	56.2	13.0	3.3
Low	144.0	101.0	17.3
Medium	216.0	189.0	28.0
High	345.0	319.0	48.9

Note: Gulf estimates a and b are from two different studies from 1990 and 2000 respectively. The four regional projections are based on the four scenarios for global sea level rises combined with information on the sedimentation rate (2-2.5 millimeters per year) and average land subsidence (about 0.5 millimeters per year) in the Gulf. The historical local sea level change is 12 to 18 centimeters (extrapolation).

Source: Jarupongsakul and Suphawajruksakul, 2005.

Fig. 1.8: Estimated Inundation Area in Thailand with a Sea Level Rise of Five Meters



Source: World Bank, Comparative Analysis, 2006.

MARINE AND COASTAL RESOURCES: STATUS AND TRENDS

Bangkok among the hot spots... A World Bank study in 84 developing countries found that the East Asia region will be significantly affected by a rise in sea level (Figure 1.10). Figures 1.8 and 1.9 illustrate the estimated inundation area and other impacts for Thailand following a one or five-meter rise in sea level.

The study, which assessed impact based on six indicators—land, population, GDP, urban extent, agricultural extent, and wetlands—indicated that when sea levels rise five meters, the East Asia region would be most severely impacted and of the 13 East Asian countries included in this study, Vietnam would be most affected, followed by Thailand and Myanmar. With a sea-level rise of five meters, about 12 percent of the Thai population would be impacted, in addition to 23 percent of GDP, 17 percent of urban extent, 4 percent of agricultural extent, and 36 percent of wetlands.

According to the study, the most affected areas would include the lower Chao Phraya delta and Nakorn Srithammarat, Rayong, Trad, and Chantaburi provinces.

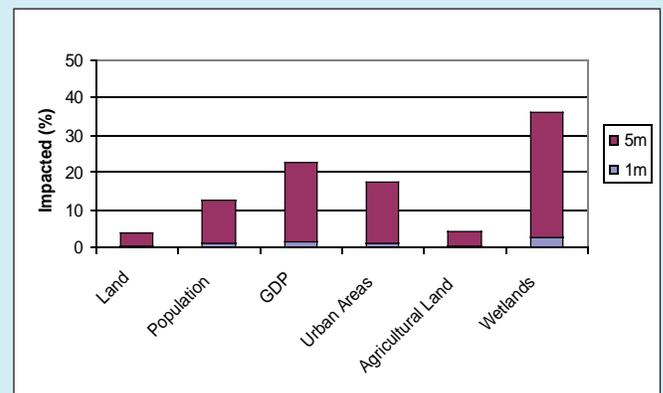
Impacts on reefs and oceans... Climate change is also expected to strongly affect coral reefs through a changing marine biochemistry. As the ocean warms, its capacity to dissolve carbon dioxide could decrease by 14 to 30 percent, leading to a decrease in biological carbonate formation that

is essential for reef building⁹. Rising carbon dioxide levels in the atmosphere—responsible for climate change—are also having a more direct impact on marine resources as oceans are absorbing the carbon dioxide, which is making them more acidic. The impacts of this are expected to be most severe for the Southern Ocean and coral reefs¹⁰.

⁹Hardy, 2003.

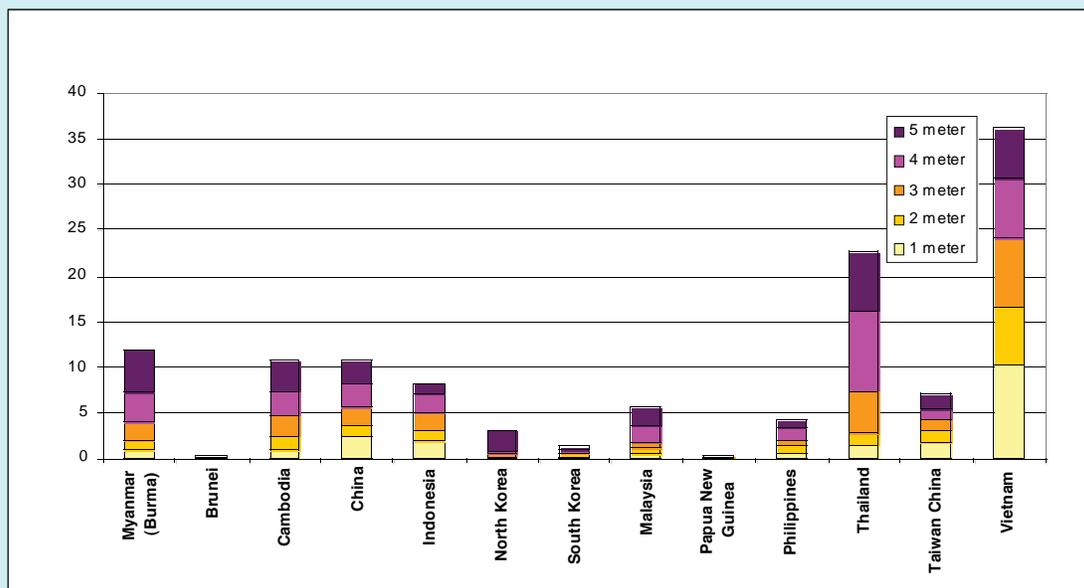
¹⁰The Royal Society, 2005.

Fig. 1.9: Impacts of Sea Level Rise in Thailand



Source: World Bank, Comparative Analysis, 2006.

Fig. 1.10: Impact of Sea Level Rise to GDP of East Asia Countries



Source: World Bank, Comparative Analysis, 2006.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

CHAPTER 2: MARINE AND COASTAL RESOURCES UNDER PRESSURE

Thailand's once abundant and healthy marine and coastal resources are under significant pressures. Urban and industrial development, tourism and recreation, fisheries, aquaculture, marine transportation, and extractive industries have led to increasing demands for natural resources and contribute to the pollution of coastal areas and ecosystems. After a brief overview of population and economic growth rates, this chapter outlines these individual pressures. A final section explores linkages between economic growth and environmental degradation and describes a need to work towards a "quality of growth."

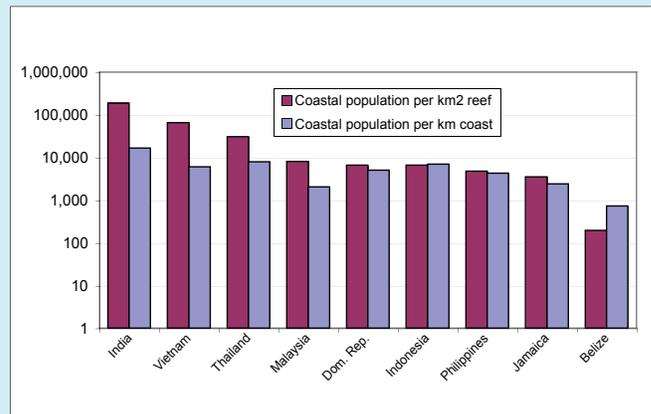
POPULATION & ECONOMIC GROWTH

Nearly a quarter of Thailand's population, or 13 of the 62 million people, live in the 22 coastal provinces (not including Bangkok). The average annual population growth in the coastal provinces has been one percent over the last five years, compared to the national average of 0.8 percent. Employment opportunities in services and manufacturing sectors have attracted large numbers to the coastal provinces, including migrant workers from neighboring countries. Thailand's population per square kilometer of reef or kilometer of coastline is relatively high (Figure 2.1). With the increase in population, the dependency on and exploitation of coastal resources has increased.

High economic growth rates... Economic growth rates in the 22 coastal provinces have been higher than the national average, at about seven percent over the past five years (Figure 2.2). Much of this growth has taken place along the Upper and Eastern Gulf of Thailand, close to Bangkok. Growth in the Southern part of the Gulf and the areas along the Andaman Sea has been between three and four percent.

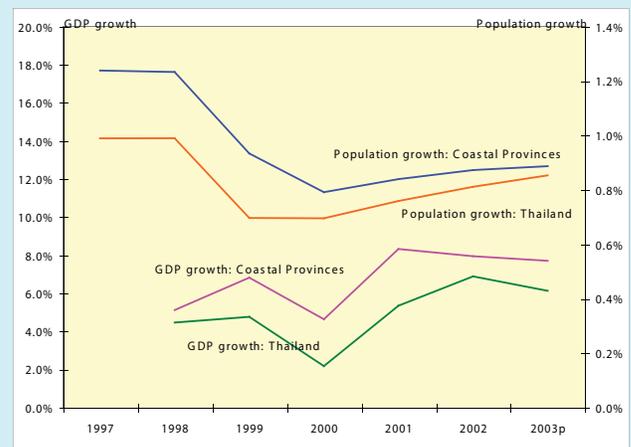
The sectors with the highest rates of economic growth are tourism and manufacturing, which account for 3.4 and 19 percent of the GDP, respectively. Manufacturing, in particular, is a major industry. Almost half of the total workforce is employed by manufacturing factories located along the coast, which also together contribute half of the sector's total contribution to the GDP. The vast majority of manufacturing output is produced in the Eastern Seaboard along the Eastern and Upper Gulf. In response to

Fig. 2.1: Coastal Resource Population Intensity



Source: Reefbase, World Fact Book, WRI 2005.

Fig. 2.2: Population and Economic Growth Rates



Source: NESDB and NSO.

increasing demands for export and local consumption, the manufacturing sector along the coast has grown rapidly over the past five years, averaging a growth rate of 7.5 percent per year, compared to the national average of 6.6 percent.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

URBAN AND INDUSTRIAL DEVELOPMENT

Industrial development in the coastal provinces and in particular the expansion of the manufacturing industry generates employment for a large percentage of the population. Industrial and urban development, however, has led to increased demands for freshwater and the generation of industrial and urban waste.

Freshwater demand larger than supply... As described in Chapter 1, the supply of freshwater in Thailand is limited by the topography of its river basins and groundwater is used to meet ever increasing demands, especially in the rapidly developing areas in the coastal zone. The total demand for freshwater in Thailand is an estimated 67 billion cubic meters per year, the majority of which (64 percent) occurs in the coastal provinces. The Eastern Gulf region, where most industries are located, experiences the largest gap between supply and demand (See Figure 1.7).

The use of groundwater to supplement freshwater supplies has to be carefully monitored because excessive groundwater extraction can cause sea water intrusion and land subsidence, which can increase erosion. Between 1960 and 1999, for example, extensive water extraction for industries and urban growth in Bangkok created serious land subsidence. The problem has since been solved by using surface water instead of groundwater.

To increase the supply of freshwater, smaller reservoirs may be used and alternative ways to capture water, such as rainwater collection, must be explored. At the same time, new developments should be carefully monitored for opportunities to limit the increase in freshwater demand.



Shrimp farming contributes to BOD pollution in the coastal area.

Source: World Bank, 2007.

Urban and industrial waste... While only about a quarter of the Thai population lives in the coastal areas, coastal areas in 1999 accounted for more than half of the total amount of biological oxygen demand (BOD)—an indicator of water pollution—measured in surface waters across the country. Of the total amount of BOD measured in the coastal areas, 43 percent was contributed by domestic sources, 24 percent by industrial, and 33 percent by agricultural sources. Of the total BOD loading in the country, coastal areas receive most (87 percent) of the pollution coming from industries, as well as 51 percent of all agricultural BOD and 43 percent of BOD from domestic sources (Table 2.1).

Table 2.1: Biological Oxygen Demand (BOD) by Region, 1999 (Tons per Day)

Region	Source						Total
	Domestic		Industry		Agriculture		
Central	376	(39%)	232	(24%)	357	(37%)	964
Eastern	85	(50%)	56	(33%)	29	(17%)	170
Southern	68	(63%)	12	(11%)	28	(26%)	108
North	189	(83%)	25	(11%)	14	(6%)	228
Northeast	526	(57%)	18	(2%)	377	(41%)	920
All areas	1,242		343		805		2,390
Coastal areas	530	(43%)	300	(24%)	412	(33%)	1,242

Note: The BOD for “coastal areas” combines Central, East and South.

Source: Thailand Environment Monitor 2001.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

Treatment of domestic wastewater... New wastewater treatment plants for domestic waste water have been built or are under construction, but problems with the construction or operation of the plants is undermining their planned capacity. Twenty-six new treatment plants with a combined total capacity of about 1.1 million cubic meters per day have been completed, and the construction of nine others (with a total combined capacity of 1.15 million cubic meters per day) is ongoing. When completed, the total treatment capacity for domestic wastewater would be about 2.2 million cubic meters per day or about 400 tons of BOD. Of the currently existing 95 plants, however, only 65 are actually in operation, and attention should go to making them operational. This effort should be combined with scaling up existing pilot projects with wastewater treatment using constructed wetlands, such as the one at Koh Phi Phi island in the South.

Treatment of industrial wastewater... The treatment of industrial wastewater is required by law. Of the tons of BOD discharged each day, 65 percent is discharged into the Upper Gulf, 25 percent into the Eastern Seaboard, and 10 percent into the West Coast of the Gulf. About 4.4 tons of nitrogen and 0.8 tons of phosphorus are also discharged each day.

Need for reliable data... Reliable data on waste generation and treatment is currently lacking, but needs to be collected and used. The quality of coastal and marine resources, and in particular water quality and beaches, depends on how well the pollution from various sources is minimized and treated, but reliable data is necessary to monitor improvements.

TOURISM AND RECREATION

Coastal areas are important tourism destinations for the Thai population as well as international travelers. Tourism revenues are also substantial: Ten percent of the national GDP stems from tourism and supporting industries, and tourism revenues in the coastal areas form a third of the national tourism revenues each year. Tourism, however, creates severe and increasing pressures on local marine and coastal resources.

Tourism numbers... Since 2000, more than 100 million tourists have visited the coastal provinces. More than half of them were foreigners. In 2004 alone, 11 million foreign tourists visited Thailand. Nine million, or about 84 percent, of tourist visits were accounted for in just five coastal provinces:

Phuket and Krabi along the Andaman Sea, Surat Thani and Songkhla along the Southern Gulf, and Chonburi along the Eastern Gulf.

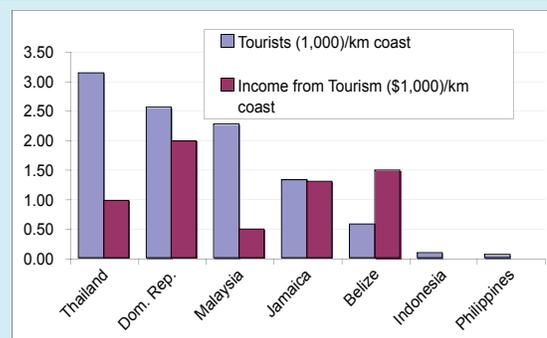
Tourism pressures and income... Figure 2.3 illustrates that the pressure from coastal tourism in Thailand, expressed as the number of tourists per kilometer of coastline, is relatively high. Specific pressures from tourism on coastal resources include the damage or loss of resources during construction, increased pollution from tourism waste, changes in freshwater runoff and sedimentation rates, and near-shore constructions that increase erosion (Table 2.2). While pressures are high, Figure 2.3 also shows income from tourism per kilometer of coastline is relatively low compared to other coastal tourism destinations, suggesting it may be possible to capture more income from tourism and use it to protect and preserve the resources on which it depends.

A public organization – the Designated Area for Sustainable Tourism Administration or DASTA – was established in 2002 to promote sustainable tourism (See also Chapter 3).

FISHERIES AND AQUACULTURE

As described in Chapter 1, Thailand historically has had very productive marine waters, supporting a fishing industry that contributes significantly to the GDP as well as providing sustenance to local communities. Increasing evidence, however, indicates these once healthy populations are not managed sustainably and fishing resources in Thailand are under pressure. Indicators include a low growth in total catch, reduced output along the Andaman Coast, decreasing catch per unit effort, and an increase in the amount of “trash fish” in each catch.

Fig. 2.3: Coastal Tourism Pressure, 2003



Source: World Tourism Organization, 2005.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

Overall growth slowing down... Thailand's freshwater and marine export has grown rapidly over the last decade and had reached 1.66 million tons in 2004¹¹. This amount accounted for nearly half of the national fisheries production and it was exported to countries in Asia and Europe. Modernization of catch methods, strengthening of market networks, and improved logistics were important factors in the production increase. Since 1997, however, the fisheries sector overall has only enjoyed modest growth, averaging one percent annually. On the Andaman side, output has even been reduced by about 10 percent between 1997 and 2004 (Figure 2.4). A comparison of total marine catch between 1989 and 2003 shows that total marine catch in Thailand has grown the least compared to other countries in the region (Figure 2.5).

Decreasing catch per unit effort... Catch per unit effort (CPUE) – the total number of fish caught per unit of time, an indicator of fish abundance – has been declining steadily by more than 87 percent between 1966 and 2003 (Figure 2.6). This means that fisher folk have to spend more time to reach the same yields. A typical fisherman now spends an estimated seven extra hours per unit effort to catch the same amount of fish and other marine products.

Increased catch of "trash fish" ... Fish that have little or no commercial value – trash fish – today form a considerable percentage of fisheries catch. For the Andaman Sea and Gulf of Thailand respectively, 36 and 48 percent of catch is considered trash fish¹². This increased rate not only causes hardship for local fisher folk because of income loss, it also indicates fish stocks are over-harvested (Box 2.1).

Pressure in numbers... The number of fishers per kilometer of coastline is relatively high (Figure 2.7). With so many fishers depending on the resources for their livelihoods, a sustainable management of fish and other marine species is required. A combination of new legislation, economic incentives, rational allocation of fishing rights, and better enforcement can support fishers who want to leave the sector, as well as support those who stay.

Impacts of shrimp farming... As described in Chapter 1, the number and size of shrimp farms has been growing rapidly. Most were created in mangrove areas, replacing the original ecosystem. Government efforts to replant mangroves are ongoing and should be continued.

¹¹ DOF, 2004.

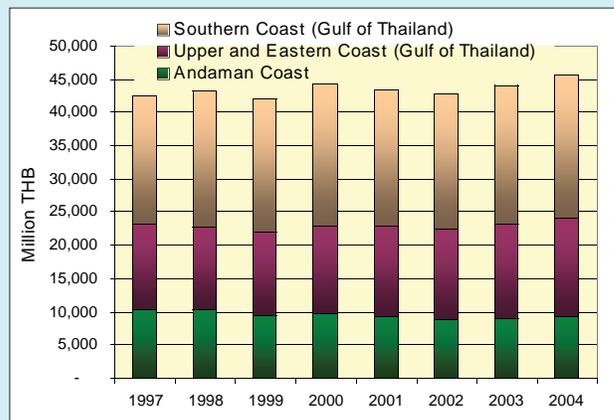
¹²DOF, 2002.

Table 2.2: Environmental Impacts from Tourism on Coastal Habitats

Tourism-related activities and events	Environmental impacts
Land clearing for construction.	Damage or loss of wetlands, mangroves, and other coastal habitats.
Changes in freshwater runoff and sedimentation from construction and development.	Increased salinity levels impact mangroves; increased sedimentation rates degrade mangroves, sea-grass beds and coral reefs.
Placement of buildings and other structures on the beach or in coastal waters.	Changes in sedimentation patterns increase erosion and elevate risks during natural disasters.
Increased waste generation, sewage, and wastewater disposal.	Pollution of near-shore waters.
Increased freshwater demand.	Water shortages and increased groundwater usage, possibly resulting in land subsidence and increased erosion.
Overfishing to supply restaurants.	Unsustainable fishing practices.
Walking and collection of souvenirs (e.g., on reefs).	Physical damage to reefs and removal of organisms beyond sustainable limits.
Harbor maintenance and boat anchoring.	Destruction of submerged and fringing vegetation; damage to coral reefs from anchors.
Sand mining for beaches and construction.	Increased erosion in other areas.

Source: Adapted from Philippines Environment Monitor 2005.

Fig. 2.4: Marine Fisheries Output



Source: NESDB and Task Team estimates, 2005.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

MARINE TRANSPORTATION

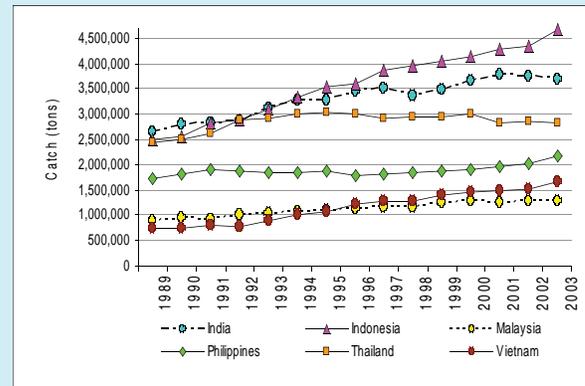
Port operations and marine transportation are sources of pollution. Large cargo ships and tankers produce large amounts of solid and liquid wastes, and accidents can have serious impacts on marine environments and animals. Data related to ocean dumping and discharges of solid wastes are not available.

Of the four major ports along the Thai coast, three are located in the Gulf. In 2004, the Gulf ports handled more than 100 million tons of cargo. The largest port alone, Laem Chabang on the Eastern Seaboard, handled 63 million tons. Figure 2.8 illustrates the growth in the number of vessels leaving and entering the major sea ports along the Gulf of Thailand. An increase in trade between 1997 and 2002 resulted in a 30 percent growth in the number of vessels.

Accidents and oil spills... According to the Pollution Control Department (PCD), from 1973 to 2004 about 150 2,100 tons of oil ended up in the ocean, in part as a result of a total of 162 accidents during this time. Most accidents occurred in the Inner Gulf and the Eastern Seaboard. While few records are maintained on the impacts of oil and chemical spills and their long-term environmental effects, immediate impacts include the killing of marine species and pollution of nearby coastal areas and beaches (Box 2.2).

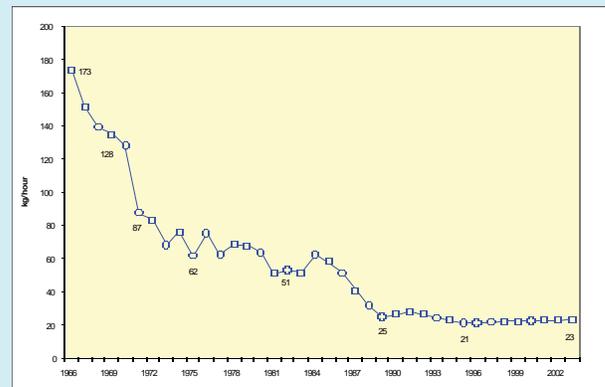
To prevent or mitigate potential impacts of an oil spill on the coastal area, the PCD has established a database for a Coastal Environmental Sensitivity Index Map. The

Fig. 2.5: Total Marine Catch, 1989–2003



Source: FAO, Yearbook of Fisheries Statistics, 2003.

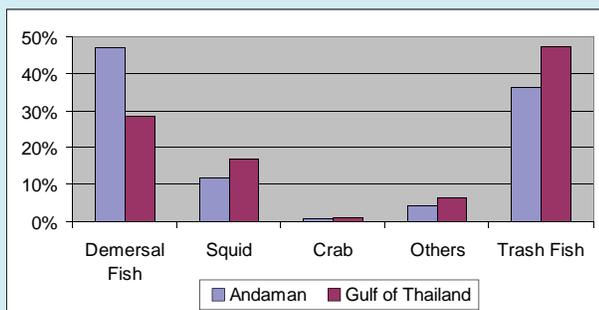
Fig. 2.6: Catch per Unit Effort (CPUE)



Source: DOF, 2003.

Box 2.1: What is Trash about Trash Fish?

Composition of Fish Catch, 2002

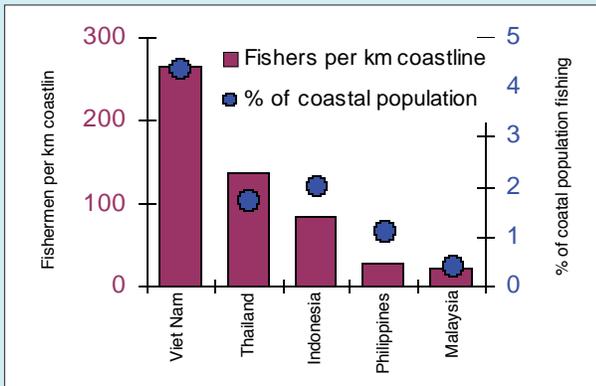


Source: DOF, 2002.

“Trash fish”, the fish that are either too small or too unpopular among consumers to have any value, currently form 48 percent of the total trawl catch from the Gulf of Thailand and 36 percent from the Andaman Sea. While the fish have little commercial value, they are used for a variety of purposes, including as fish food for aquaculture, to produce fish oil, and to feed domestic animals. More importantly, however, trash fish aren’t really trash: Between 18 and 32 percent of trash fish are juveniles of commercially important fish species. Given a chance to grow to a larger size, these species would provide many more benefits in terms of production and economic value. In addition, “trash fish” are part of the marine ecosystem and play a role in the marine food web.

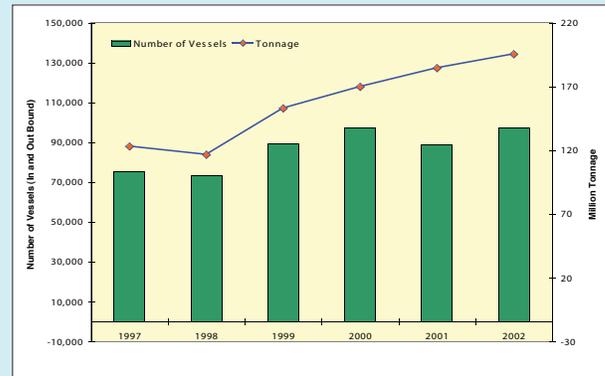
MARINE AND COASTAL RESOURCES UNDER PRESSURE

Fig. 2.7: Relative Number of Fishers



Source: FAO, Yearbook of Fisheries Statistics, 2003.

Fig. 2.8: Ocean Going Vessels, Gulf of Thailand



Source: MD, 2004.

database, based on information from GIS maps, remote sensing techniques, expert advice, and experiences from other countries, will be used to prepare an emergency action plan for oil spill clean ups.

Port operations and dredging... To keep ports open they need to be routinely dredged. Because port sediments in particular may be contaminated with toxic substances, proper disposal is important. The re-suspension of contaminated sediments can also increase toxicity levels in the water and sediment transport in the area.

Ballast water and invasive species... The ballast water used by oil tankers and other large vessels to remain balanced when they are not carrying a load has been identified as a major contributor to the global distribution of marine species. The vessels, taking in water in one port and releasing it in another, spread species beyond their native areas. Without natural predators, some become invasive species and affect or possibly even wipe out local species. Exchanging coastal ballast water with open-ocean water during a vessel voyage is a recommended voluntary measure by the International Maritime Organization (IMO) to reduce the risk of ballast-mediated invasion.

Vessel coating... Antifouling paints used on the hulls of ships to prevent barnacles and algae from growing are based on toxic and persistent chemicals. With a worldwide ban by the IMO on the use of tributyltin (TBT), vessels now use copper-based paints, which are less harmful but still toxic.

Box 2.2: Recorded Oil Spills, 1973-2005

Year	Number of oil spills
1973-1987 (15 years)	11
1988-1997 (10 years)	33
1998	5
1999	19
2000	10 (one large)
2001	8
2002	1 (large)
2003	N/A
2004	1 (large)
2005	1

Source: PCD, 2005.

From 2000 through 2005, several oils spills polluted the Thai coastal area. The following were among the largest:

- **September 2000:** Collision between the commercial tanker *Heron* and oil tanker *Play Boy* outside Chonburi: About 200-2,000 tons of diesel oil spilled.
- **January 2002:** Grounding of *Eastern Fortitude* near Jung Island, Chonburi: 250 tons of low speed diesel oil spilled.
- **December 2004:** Grounding of oil tanker *Dragon I* near Krok Island, Chonburi: 150 tons of oil spilled.



Oil spills, such as this one, kill marine species and pollute coastal areas and beaches.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

International regulations... Thailand has been a member of the IMO since 1973 and has ratified several conventions on commercial shipping and maritime safety. On pollution control, Thailand has ratified the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), but is still in the process of ratifying the International Convention for the Prevention of Pollution from Ships (MARPOL). It has, however, adopted some regulations as guided by this convention.

EXTRACTIVE INDUSTRIES AND SAND MINING

The mining of minerals and the production of oil and gas are also important forms of natural resource uses. Tin mining has been extensive over the past 50 years, and the mining of sands and stone has increased over the past 20. Oil and gas production from the Gulf yields about 85 percent of the national production of crude oil (petroleum), 95 percent of the national production of natural petroleum gases (NPG), and the entire production of total liquid petroleum gases (LPG). In July 2005, production was about 2,260 million cubic feet per day of NPG; 69,257 barrels per day of LPG, and 108,336 barrels per day of petroleum.

Sand mining from beaches and coastal areas that are sensitive to coastal erosion needs to be monitored and controlled. In addition, effective pollution control for all mining activities is necessary.

ILLEGAL ACTIVITIES

On top of regular activities in the coastal areas that already put the marine and coastal resources under pressure, illegal and unregulated activities pose an additional threat. While exact numbers for Thailand are not available, global estimates indicate that the costs are significant. Losses from illegal, unregulated, and unreported fishing impacts, for example, are in the range of \$9 billion annually¹³. Losses due to illegal trade in wildlife products amount to \$6 to 10 billion per year¹⁴.

Illegal activities undermine legitimate uses of the marine and coastal resources and planned efforts to manage resources sustainably.



Fisher folk at work at a port operation in Southern Thailand.
Source: World Bank, 2005.

TOWARDS A QUALITY OF GROWTH

The high rates of economic growth in Thailand have been accompanied by high environmental and social costs. The increasing pressures from industrial and urban development, tourism, fisheries, and marine transportation described in this chapter are the result of uncontrolled developments. Moreover, the rapid economic growth has not resulted in a reduction of poverty among poor coastal communities.

Pockets of poverty continue to exist... While across all coastal provinces the per capita real income is one-third higher than the national average, this is not the case for individual provinces.

The per capita real income of people living in the Andaman and Southern Gulf provinces is 20 and 30 percent lower than the national average. Nearly three-quarter of a million people in the coastal provinces live below the national poverty line, about half of which live in Pattani and Narathiwat provinces. Small fisher folks in particular are vulnerable to changes in coastal resources and are in conflict with commercial fishers.

Environmental impacts come at a cost... While the environmental impacts from unsustainable resource management are considerable, the losses and degradation of ecosystems and habitats also represent an economic loss. Losses of mangroves or sea grass beds, for example, decrease the shoreline's natural protection and increase impacts and costs associated with natural disasters.

¹³High Seas Task Force, 2006.

¹⁴16th Meeting of the Interpol Working Group on Wildlife Crime, October 2003.

MARINE AND COASTAL RESOURCES UNDER PRESSURE

Box 2.3: Quality of Growth

Economic activities can have environmental impacts, but the reverse is also true. Environmental degradation comes at an economic cost. The following table gives an overview.

Economic activities impacting the environment:

Urban and industrial development	⇒	Loss of wetlands and mangroves; increased wastewater and sewage production; coastal constructions; increased freshwater use.
Tourism	⇒	Loss of wetlands and mangroves; freshwater runoff; waste production and groundwater extraction; water pollution; habitat destruction.
Fisheries	⇒	Unsustainable harvesting of fish; fish stocks depleted.
Marine transportation	⇒	Oil spills; introduction of invasive species.
Agriculture	⇒	Pollution runoff; increased freshwater use.
Extractive industries and sand mining	⇒	Accidents causing pollution; increased erosion.
Aquaculture	⇒	Wetland and mangrove destruction.

Environmental degradation impacting the economy:

Mangroves and wetlands damaged or lost	⇒	Spawning and nursery habitats of commercially important species lost; decreased shoreline stabilization; increased costs associated with natural disasters and erosion; increased salt water intrusion; potential tourism revenue lost.
Poor water quality	⇒	Tourism affected; public health situations (e.g., childhood diarrheal disease).
Oil spills	⇒	Beaches and tourism affected.
Fish stocks depleted	⇒	Fisheries and livelihoods affected; loss of tourism potential.
Coral reefs damaged or lost	⇒	Decreased shoreline protection and increased coastal erosion; impacts on fisheries and biodiversity; potential tourism revenue lost.
Biodiversity lost	⇒	Impact on fisheries, ecological integrity and ecosystem services.
Erosion	⇒	Costs involved with relocations; engineering costs; loss of roads and infrastructure; human capital affected.

The losses also affect local livelihoods through reduced fisheries. Box 2.3 gives an overview of various linkages between environmental impacts and their costs.

Overall, the total environmental costs of unbalanced development (not including over-fishing) are estimated to be in the range of THB 20 billion or US\$ 500 million per year. This loss in potential benefits amounts to about 6 percent of the total economic benefits generated by the coastal fishing and tourism sectors¹⁵.

A new approach to management, including new regulations, economic instruments, and active enforcement is needed to lessen the current pressures on the marine and coastal resources. Moreover, the linkages between the various resources and pressures calls for an integrated, participatory approach that looks at the coastal area as a whole and effectively strengthens and integrates the efforts of local and national government agencies, institutions, and stakeholders.

¹⁵Task Team estimates

In Thailand, several government agencies and policies are involved with the management of the country's marine and coastal resources. This chapter highlights this institutional framework and the policies and regulations in place, and identifies the main challenges to their effectiveness. The role of protected areas and the involvement of local communities and other partners are also discussed.

NATIONAL AND SECTOR POLICIES

Thailand's national policies are set against the background of the Thai Constitution of 1997, which calls for good governance, people participation, and the rights of individuals and local communities to participate in decision-making processes and to have access to a sustainable use of natural resources.

Since 1997 several legal and institutional changes have been made that also affect the management of marine and coastal resources. In 2002, a major reform of the public sector was carried out. The reform included the establishment of a number of independent agencies, including the Ministry of Natural Resources and Environment (MONRE), responsible for the protection and conservation of protected areas, water resources, mineral resources, marine and coastal resources, and environmental quality (See also Figure 3.1). In recent years, a Decentralization Act and an Information Disclosure Act have also been promulgated, but their implementation has been slow. Reviews of other regulations are ongoing. Following the September 2006 *Coup de'tat*, the 1997 Constitution is under a review.

National policies... Several national and sector policies relate to Thailand's marine and coastal resources. Overall guidance for coastal resources management is provided by the National Policy on Natural Resources Preservation and Management (1997-2016), which was endorsed by the Government in 1996. In 2002, the Thai Cabinet approved the National Policy on Marine and Coastal Resources, which was submitted by the Office of Natural Resources and Environmental Policy and Planning (ONEP). An updated version of this policy, prepared by the MONRE Department of Marine and Coastal Resources (DMCR) is currently under review. The new draft policy sets forth a framework and calls for a master plan for the use of marine and coastal resources (Box 3.1).

Box 3.1: National Policy on Marine and Coastal Resources (2006 Draft)

The Department of Coastal and Marine Resources (DMCR) prepared the objectives and strategies for this draft policy. They include:

- **Setting a framework and standards for marine and coastal resources utilization** by developing and implementing safety and sanitary standards, ensuring control of land and marine-based pollution, and setting a national framework for integrated management.
- **Conserving and restoring marine and coastal resources** by developing a master plan for sustainable use and establishing credible technical knowledge.
- **Protecting and maintaining environmental quality** by setting effective monitoring systems to control pollution.
- **Ensuring the effective coordination of activities** by setting up a national board to promote integrated management and cooperation among public and private sectors.
- **Developing and maintaining a reliable database** and research and development capacity.
- **Improving national regulations** in line with international conventions.
- **Promoting cooperation** and setting up of a dispute-settlement mechanism.
- **Promoting public participation** at national and local levels, giving attention to engaging the private sector.
- **Improving Thailand's competitiveness** by providing infrastructure and services and by modernizing the Thai maritime industries.

Source: DMCR.

POLICIES, INSTITUTIONS AND MANAGEMENT

Sector policies... In addition to the overall natural resource policies, many sector policies apply. Relevant sector policies include those for fisheries, agriculture, industries, towns and cities, land transportation, and tourism development. At the same time, policies for land use zoning, coastal erosion, and marine based pollution control remain lacking. Continuity and consistency of the national policies and the sector policies is necessary for an effective management of marine and coastal resources.

Government Administrative Plan... The Government Administrative Plan (GAP) for 2005-2008 (2548-2551), which the cabinet approved in 2005, includes specific targets for natural resources and the environment, including those related to marine and coastal resources. Key targets include building a balance between development and conservation, protecting biodiversity, rehabilitating land resources, managing water resources, and including local communities and the private sector in resource management. Details in the GAP 2005-2008 form the basis for budget allocations.

INSTITUTIONS & REGULATIONS

As presented in Table 3.1, various laws and regulations relate to coastal and marine resources management. Key laws are those related to the use of resources (such as for fisheries, forests, and oil and gas); control of human activities (industries, buildings, transportation, and special area development); and other areas such as public health, natural areas and wildlife, culture, and local government administration. The various laws, developed at different times and for different purposes, involve multiple agencies and stakeholders. As a result, government agencies and departments at both national and local levels have overlapping responsibilities in the management of coastal and marine resources. Combined with ineffective cooperation, this overlap hinders an efficient implementation of environment-related plans and regulations. Limited government budgets and personnel further put restrictions on the monitoring and enforcement of regulations. Some laws, in particular the Fisheries Act, have not been updated in recent years (Box 3.2).

Box 3.2: Fisheries Act and Access to Fisheries

The Fisheries Act was enacted in 1947 and updated in 1994. The Act governs fishing and aquaculture development activities through the protection of fishing habitats and nursing grounds, control of fishing gears and fishing methods, registration of fishing boats, protection of marine species, and research and development. Changes in the sector, such as the growth of aquaculture, the increased competition between small-scale fisher folk and commercial operators, and fish stocks under pressure, however, make it necessary to review this Act. Currently, the Act does not limit access to fisheries, and two possible ways to address this issue are the use of Individual Transferable Quotas (ITQs) or Territorial Use Rights Fishing (TURF).

- **Individual Transferable Quotas (ITQs).** First implemented in Iceland in 1979, ITQs sometimes referred to as IFQs (Fisheries Quotas) – are typically combined with the use of a Total Allowable Catch (TAC), thus setting the percentage of the TAC that individual quota holders (fishermen, fishing vessels or others) can catch. Many versions of ITQ systems exist, and the approach is generally considered to be successful and has contributed to saving fish stocks. ITQs, well-suited to manage commercial fisheries, are now often replacing or supplementing earlier fishery regulations that were based on catch, exclusion, or technology.
- **Territorial Use Rights Fishing (TURF).** TURF refers to a traditional kind of fisheries management where local communities organize and enforce fishing rights. In Jamaica, one of a few documented cases of TURF in the Caribbean, TURF management performs better than open access, evidenced by higher fishing yields than the average Caribbean fishery.

Source: Sterner, 2003.

POLICIES, INSTITUTIONS AND MANAGEMENT

Table 3.1: Summary of Key Legislations and Agencies

Legislation	Key agencies
<p>National Environmental Quality Act (1992) Enhance and conserve natural resources and environmental quality through environmental policies and planning. The Act regulates and calls for the creation of Provincial Environmental Management Plans (PEMP), Environmental Impact Assessments (EIA), Environmental Protected Areas (EPAs) and Pollution Control Zones (PCZs), as well as standard setting and monitoring, public participation and environmental education, and an environmental fund for investment.</p>	ONEP, PCD, DEQP of MONRE, provincial and local governments of the Ministry of Interior (MOI) and other agencies.
<p>National Park Act (1961) Protects flora and fauna by prohibiting the trade or transport of species and human disturbances within park boundaries. The Act applies to all Marine National Parks.</p>	MONRE Department of National Park, Wildlife and Plant Protection (DNP).
<p>Wildlife Conservation and Protection Act (1992) Regulates the possession, trading, hunting, and propagation of wildlife species, including carcasses and carcass products.</p>	MONRE DNP, Department of Fisheries (DOF) of MOAC.
<p>Forest Act (1941) Controls logging concessions and the collection of non-timber forest products. Concession of mangroves was stopped in 1990s and all concession activities were ceased in 2003.</p>	MONRE Royal Forest Department (RFD).
<p>National Reserved Forest Act (1964) Controls the use and protection of forest areas and resources, including mangroves.</p>	MONRE RFD.
<p>Mineral Resource Act (1967) Regulates the concession of mineral resources.</p>	MONRE Dept. of Mineral Resources (DMR).
<p>Groundwater Act (1977, 1992, 2003) Controls the use of groundwater.</p>	MONRE Dept. of Ground Water Resources (DGR).
<p>Fisheries Act (1947, 1994) Governs fishing and aquaculture development through the protection of fishing habitats and nursery grounds, control of fishing gears and fishing methods, registration of fishing boats, protection of marine species, and research and development.</p>	DOF of the Ministry of Agriculture and Cooperatives (MOAC).
<p>Navigation Act (1913, 1992) Regulates navigation and water transportation, including the prohibition of waste disposal into waterways and the construction, registration, and operation of vessels.</p>	Marine Department (MD) of the Ministry of Transportation (MOT).
<p>Factory Act (1992) Controls factory operations by setting standards and regulating waste disposal.</p>	Department of Industry (DIW) of the Ministry of Industry (MOInd).
<p>Petroleum Act (1971) Controls oil and gas explorations.</p>	Dept. of Mineral Fuels (DMF) of the Min. of Energy.
<p>Public Health Act (1992) Controls activities that may cause health impacts.</p>	Ministry of Public Health (MOPH).
<p>Building Code (1979) and City and Town Planning (1975). Control the construction and operation of buildings and land use in city and towns.</p>	Dept. of Public Works and Town and Country Planning (DPT) of MOI.
<p>MONRE: Ministry of Natural Resources and Environment. ONEP: Office of Natural Resources and Environmental Policy and Planning. PCD: Pollution Control Dept. DEQP: Dept. of Environmental Quality Promotion. See also page iv.</p>	

POLICIES, INSTITUTIONS AND MANAGEMENT

Fig. 3.1: Government Organization

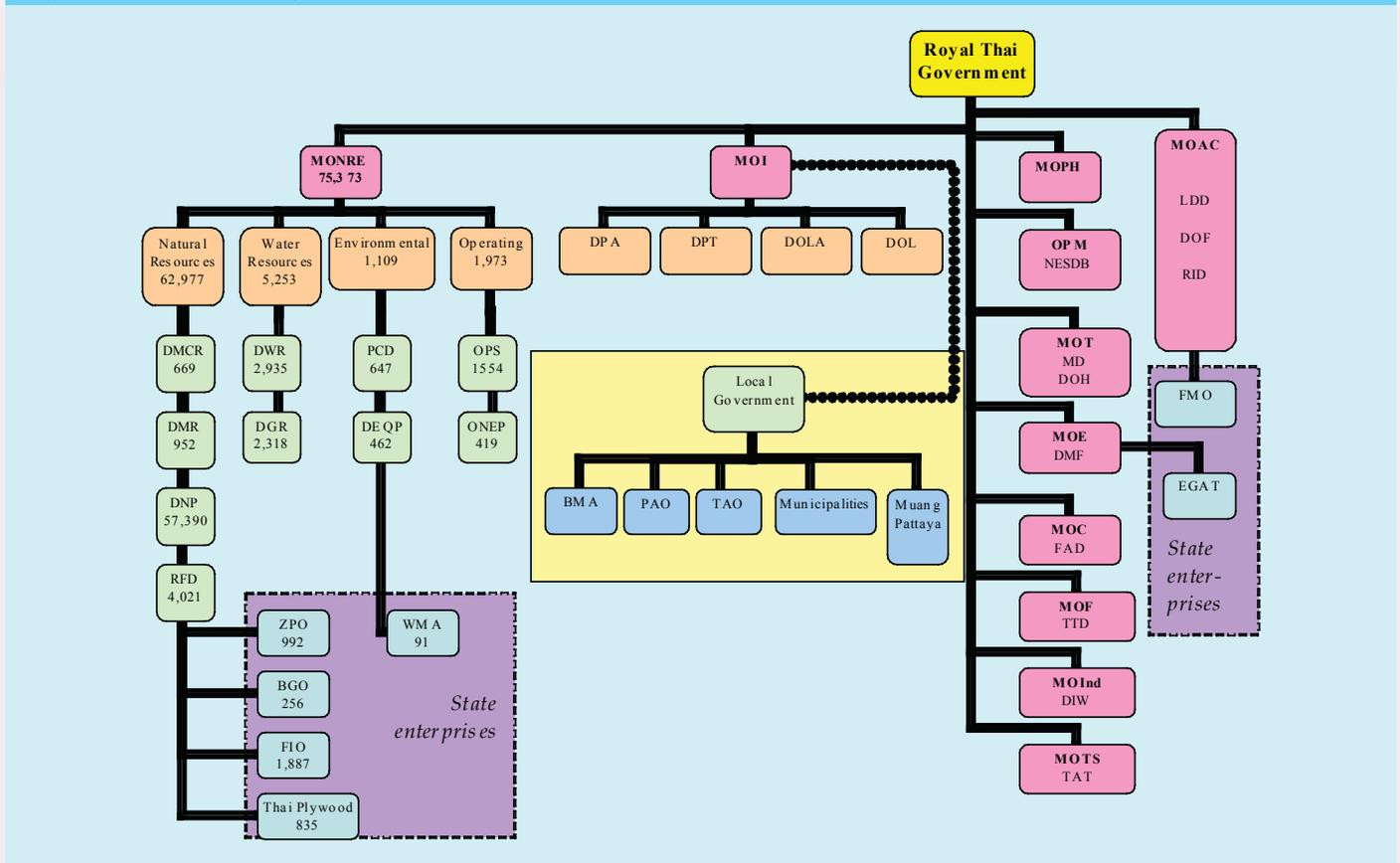


Figure 3.1 shows the various government agencies in an organizational chart¹⁶. Key agencies involved include the Ministry of Natural Resources and Environment (MONRE) and its Department of Marine and Coastal Resources (DMCR). MONRE was established in 2002 and comprises various agencies and departments that were transferred from other ministries.

Overlapping regulations has hindered the implementation of an integrated management approach... The overlap in agencies and regulations calls for a legal provision that could facilitate effective implementation of an integrated approach to coastal and marine resources management. The DMCR with assistance from the Asian Development Bank and The World Conservation Union (IUCN) has developed a legal framework to promote such an approach. The draft law, the Marine and Coastal Resources Management Act would provide the legal framework and institutional arrangements for an Area-Function Participation (AFP) approach, which

would identify the rights of communities to manage their own coastal and marine resources through a local organization or a co-management relationship with a local government. The framework would also create a fund for marine and coastal resources (Box 3.3). Implementing this integrated approach requires the strong coordination of policies, laws, regulations, management approaches, and stakeholders' interests, and would require DMCR to develop the needed institutional capacity to be the lead agency.

Integrated approach to sustainable tourism... An integrated approach to coastal and marine resources management is currently also being tested by the Designated Area for Sustainable Tourism Administration (DASTA) (See also Chapter 2). DASTA promotes tourism while focusing on conserving local cultures, increasing local benefits, and reducing negative impacts of tourism activities. A budget of about THB 11,000 million (US\$ 275 million) is estimated for implementing nearly 200 projects during 2006-2012. Capturing project experiences and lesson learned will be valuable.

¹⁶ See page iv for full agency names.

POLICIES, INSTITUTIONS AND MANAGEMENT

International treaties... Thailand is a member of many international agreements, including the Convention on Biological Diversity (CBD), the RAMSAR convention for wetlands of international importance, the CITES convention on international trade in endangered species, and the World Heritage Convention. As described in Chapter 2, Thailand's memberships in the International Convention for the Prevention of Pollution from Ships (MARPOL) and the United Nations Convention on the Law of the Sea (UNCLOS) have not yet been ratified due to a lack of national regulations and limited institutional capacity.

FINANCIAL RESOURCES

Sustainable management of coastal and marine resources requires the financial resources necessary for staffing, policy development, implementation, monitoring, and enforcement. National budget allocations, however, are complex and form a barrier to an integrated approach.

National budget allocations... In Thailand, budget allocations are made on a yearly basis, with priority given to agencies identified in the five-year national development plan or those otherwise considered a priority by the government. The yearly negotiation process among

agencies, however, makes it difficult to consistently implement national policies and does not further an integrated approach.

Overall, budget allocations have been complex and an appropriate mechanism for budget allocations in accordance with the Decentralization Act, the National Environmental Quality Act (NEQA), and other acts, is needed.

MONRE budget... Both the four-year budget for 2005-2008 and the yearly budget allocations of the Ministry of Natural Resources and the Environment (MONRE) are based on priorities in the GAP 2005-2008. Figure 3.2 illustrates the four-year budget plan, suggesting that over 90 percent of resources are allocated to water resources management, natural resources conservation, and participatory development, while less than 10 percent remains for other strategies. For 2006, the total MONRE budget was THB 16.3 billion (US\$ 407.7 million), allocated as shown in Figure 3.3. The largest department within the ministry is the Department of National Park, Wildlife and Plant Protection (DNP), with a staff of more than 35,000.

Box 3.3: Towards an Integrated Approach: The Marine and Coastal Resources Management Act

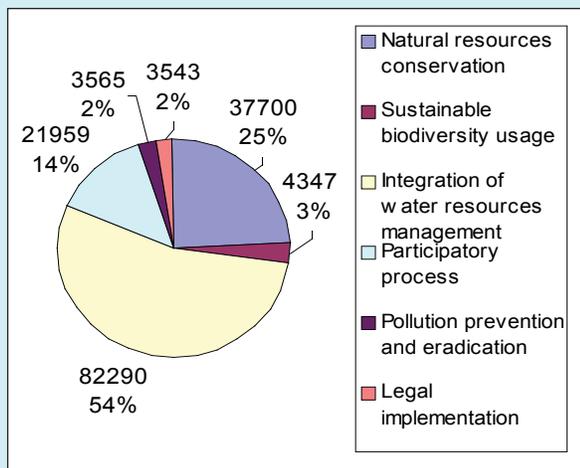
The Marine and Coastal Resources Management Act, drafted by DMCR, is designed to provide an integrated approach to coastal and marine resources management through an Area-Function Participation approach. It would establish coordination mechanisms to help integrate plans and activities and also establish Marine and Coastal Resources Funds (MCRF) at the national and provincial levels. The Act would further establish zoning for marine and coastal resources (preservation, conservation, restoration, and development), promote awareness and education, and ensure effective control of pollution and support for sustainable tourism. Integral to the plan are the establishment of a national committee, provincial and local committees, and "coastal communities."

- **National committee.** Chaired by the Prime Minister or a deputy, the National Committee on Marine and Coastal Resources (NCMCR) would consist of representatives of key agencies. The NCMCR would be responsible for a national plan and policy and oversee the operation of a Marine and Coastal Resources (MCR) Fund. The committee would further promote stakeholder cooperation and settle disputes. The secretariat would be at DMCR.
- **Provincial committees.** Provincial committees (PCMCR) would be chaired by the governor and consist of representative from agencies and ten experts. PCMCRs would prepare provincial MCR plans, approve local policies and plans, and oversee the operation of a provincial MCR fund.
- **Local committees.** Local committees (LCMCR) would consist of elected members from local communities and agency representatives. LCMCRs would prepare local plans, cooperate with agencies, manage community properties, and settle local conflicts.
- **Coastal Communities.** Coastal communities older than 20 years and with more than 30 members would have the rights to set up a recognized Coastal Community. A Coastal Community can manage and use coastal resources and participate in all related activities as provided in the Constitution. The objectives would be to protect the Coastal Community area, conserve environmental quality and biodiversity, and promote integrated management, local culture, and a sustainable use of resources.

Source: DMCR.

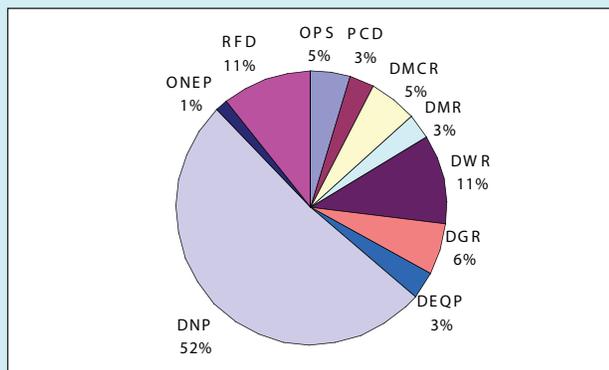
POLICIES, INSTITUTIONS AND MANAGEMENT

Fig. 3.2: MONRE Budget Allocation, 2005-2008
(in THB millions)



Source: MONRE, Four-year Implementation Plan, 2005-2008.

Fig. 3.3: MONRE Budget Allocation for Agencies, 2006



Note: Total budget is THB 16.3 billion.
For full agency names see page iv.

Source: Bureau of the Budget, 2006.

Economic instruments... Current policies and regulations in Thailand make little or no use of economic instruments, which have the potential to improve resources management while raising funds for conservation related activities. Figure 2.3, for example, illustrated that the income from tourism in Thailand is relatively low, considering the high number of tourists, when compared to other countries. Examples of economic instruments are presented in Box 3.4.

COASTAL AND MARINE AREA MANAGEMENT

Thailand has several types of protected areas, including Marine National Parks (MNP), RAMSAR sites to protect wetlands, and Environmental Protection Areas (EPA) and Pollution Control Zones (PCZ) for environmentally sensitive or heavily polluted areas. An overview is provided in Table 3.2. In particular MNPs and MPAs are crucial to the sustainable management of Thailand's marine and coastal resources. Other area management approaches used include an integrated watershed management and specific area development planning.

Marine National Parks... Thailand currently has 26 Marine National Parks (MNP), 17 of which are located in the Andaman Sea and 9 in the Gulf (2006 data). Most of these parks are located offshore, are rich in coral habitats, and contribute to tourism and fishery industries. MNPs are critical for management and conservation of coral reefs, fisheries, and mangroves. Major threats within marine parks include encroachment for resorts and shrimp farms, illegal fishing within prohibited zones, and infrastructural development incompatible with conservation practices. MNPs are established through the National Park Act and are the responsibility of MONRE's Department of National Park, Wildlife and Plant Protection (DNP).

Table 3.2: Protected Areas

Protected area	Legislation	Number (in coastal zone)	Comments
Marine National Park	National Park Act	26 (26)	17 in Andaman Sea; 9 in the Gulf of Thailand. 38 percent of reefs in an MPA
Environmental Protection Area (EPA)	NEQA	5 (5)*	Rehabilitation of a degraded habitat.
Pollution Control Zone (PCZ)	NEQA	11 (11)	Rehabilitation of polluted area.
RAMSAR sites	RAMSAR Convention	10 (8)	Protection of wetlands of international importance.

Note: * The Thai government is currently working to assign the Tsunami-affected area as another EPA; EPAs and PCZs can use other instruments such as Environmental Impact Assessments (EIA) or Initial Environmental Examinations (IEE).

POLICIES, INSTITUTIONS AND MANAGEMENT

Box 3.4: Economic Instruments

Economic instruments are tools that create and use markets to apply regulations. Well known examples include taxes, fees and charges. Various economic instruments have been applied in natural resources management, and in addition to enforcing regulations, they also have the potential to raise revenue that can be used for conservation. Examples include the use of park fees for tourists entering a national park, tradable quotas or rights (See also Box 3.2), a hotel “green tax” that is collected from visitors, fees for fishing or hunting licenses, fees on industrial pollution, performance bonds, and deposit-refund systems. What economic instrument is applicable depends on the situation. In the fisheries sector, for example, appropriate instruments would reduce catches to a sustainable level while preferably allowing for some flexibility in this level, as fish stock assessments vary. They would allow for the use of efficient fishing methods, leave the rents with the fishermen, and preferably generate funds to compensate the fishermen forced to leave the sector. Economic instruments require active monitoring to avoid unacceptable social outcomes, such as massive unemployment.

Source: Sterner, 2003.

About 38 percent of Thailand’s coral reefs and many mangrove forests are located within an MNP, and the enforcement of rules and regulations within an MNP contributes to Thailand performing relatively well in the protection of these resources (Table 3.3).

Thailand’s Marine National Parks overall are managed relatively well. Figure 3.4 illustrates the country’s MNP score card, which uses 34 parameters in six categories to assess MNP management. In three of six areas—status, input and output—MNP management is good. Planning, the management process, and achievement of outcomes on the ground, however, should be improved. Consolidating technical and management capacity of MNPs within the Department of Marine and Coastal Resources (DMCR) could increase management efficiency of MONRE.



Tourists can enjoy the beauty of Mu Koh Ang Thong Marine National Park, Surat Thani.

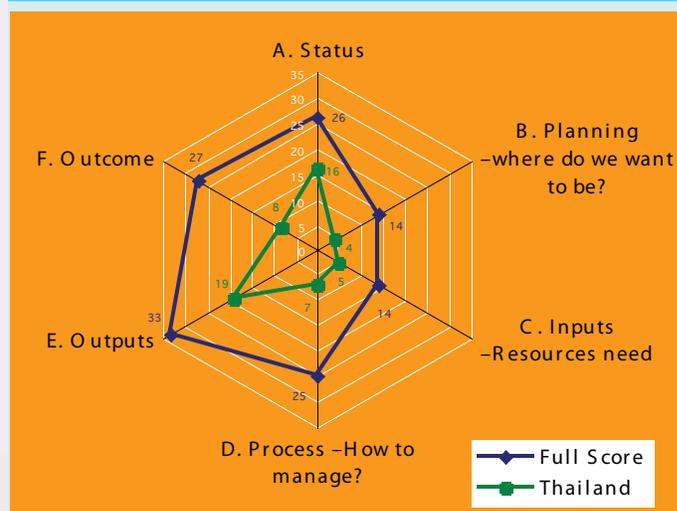
Source: DNP, 2004.

Table 3.3: Coral Reef and MNP Management

Country	MNPs	Percentage of reefs in MNP	Percentage of reefs under good MNP management
Domin. Rep.	15	43	N/A
Thailand	17	38	6.84
Belize	12	27	N/A
Jamaica	4	22	N/A
Vietnam	25	11	0.88
Indonesia	131	9	0.27
Philippines	110	7	0.7
Malaysia	136	7	1.26
India	97	3	N/A

Source: Reefbase, WRI.

Figure 3.4: Score Card for Marine National Parks



Note: The blue line indicates the full score possible in each category. Full scores are different for each category.

Source: Adapted from Staub and Hatziohos, 2004 and World Bank, 2006.

POLICIES, INSTITUTIONS AND MANAGEMENT

Integrated river basin management... Several communities, with assistance of NGOs and government agencies, have initiated watershed management activities. In the Songkhla Lake basin, for example, rapid developments in the watershed, which resulted in erosion, land use changes, flooding and droughts, prompted agencies such as the Office of Natural Resources and Environmental Policy and Planning (ONEP), Department of Water Resources (DWR), and DMCR to set up River Basin Organizations and develop watershed management plans. The protection of wetlands, watersheds, and cultural or historical sites can be a challenge because of the limited capacity of local governments. Assistance from central agencies may be needed (See also Box 4.3).

COMMUNITY AND OTHER PARTNERS

While the government provides a legal framework, sustainable management of coastal and marine resources increasingly relies on the knowledge and practices of local communities whose everyday lives are linked to those resources. The draft Marine and Coastal Resources Management Act specifically calls for public participation, and experience has shown community involvement is a key to the success of any natural resource management approach.

Throughout the coastal area, but mostly in the South, many community organizations, Civil Society Organizations (CSOs), and NGOs are actively involved in conservation activities such as protecting fish stock, rehabilitating mangroves, protecting watersheds, conducting waste management, and resolving land use conflicts. CSOs and NGO also play an important role in raising awareness, building local capacity, and developing community networks. More than 135 registered as well as many unregistered NGOs are involved in coastal resources management with community networks.

The establishment of the Community Organization Development Institute (CODI) has increased participation of local communities. In 2004, a budget of THB 8.6 million (US\$ 200 thousand) was used for natural resources and environment among about 255 local organizations in the South. Additional funding for community-based approaches comes from the government, international agencies, and the private sector.

Box 3.5 and 3.6 describe examples of the involvement of community groups with fisheries management and a Department of Fisheries (DOF) co-management approach.

Academic and international involvement... International organizations and agencies are also involved in the management of Thailand's coastal and marine resources. In 2004, sixteen academic institutions throughout Thailand, including Mahidol, Chulalongkorn, Kasetsart, Prince of Songkla, Burapha and Walailak Universities, set up the Association of Thai Academic Institutions on Environment. The association aims to improve the standard of environmental research and teaching, provide academic support and training, and promote environmental campaigns.

Box 3.5: Community-Based Fisheries Management

The Traditional Fishing Clubs (TFCs) and the Federation of Southern Fisher Folk (FSF), established in 1993, are two good examples of community-based fisheries management. Both groups focus on empowering and developing the livelihoods of poor fisher households in coastal provinces. Recognizing the links between long-term livelihood development and sustainable resource management, they also work to prevent the degradation of coastal resources.



A community gathering of the Federation of Southern Fisher Folk.
Source: World Bank, 2005.

POLICIES, INSTITUTIONS AND MANAGEMENT

Barriers to continued public participation... Despite documented successes, coastal and marine resources management in Thailand remains fairly centralized. The decentralization policy, designed to govern issues at a lower level, does not achieve its objectives in part because the genuine participation of local communities is hindered by a lack of recognition of their rights as users of the resources. Recognizing and respecting traditional community rules and regulations would be an important step towards increased participation. In addition, providing local governments, who can work closely with local stakeholders, with the authority to act as well as policy guidance and legislative support from central agencies will contribute greatly to local involvement and initiatives.



Box 3.6: A CHARMing Approach to Co-Management

The Coastal Habitats and Resources Management (CHARM) project, established by the Department of Fisheries (DOF) in 2002, promotes a co-management approach to coastal and marine resources management. In the five-year project, key stakeholders, including the government, local communities, NGOs, and other partners, are sharing the responsibility for protecting and managing natural habitats and fishing resources. The project is carried out in Phang Nga Bay of the Andaman Sea and Ban Don Bay in the Gulf and involves five provinces, 356 coastal and island villages, and 300,000 inhabitants. The project facilitates coordination and cooperation at central, provincial, and local levels and lets primary stakeholders lead the development process.

Source: CHARM, 2006.



CHALLENGES

CHAPTER 4: CHALLENGES

Thailand demonstrates good performance in the area of habitat protection, in particular for coral reefs and mangrove areas, but significant threats to its marine and coastal resources remain. Erosion is impacting the coastal areas, coral reefs are degrading, fish stocks are not managed sustainably, and tourism pressures and demands for water and other resources are high. With a rapidly growing population, those pressures and the need for additional infrastructure and urban and industrial development will continue to increase

in the coastal area, in particular along the Gulf of Thailand.

This section builds on the information in the previous chapters and experiences with local consultations (Box 4.1) to highlight the particular challenges on the path towards an effective and sustainable management of marine and coastal resources. The overarching challenge for Thailand will be to achieve an integrated approach and incorporate transparency and good governance into the management process.

Box 4.1: Lesson Learned from Local Consultation

As part of the process to develop this Thailand Environment Monitor, The World Bank in collaboration with local agencies conducted several consultation workshops. The regional consultations were conducted in Samuth Prakarn, Rayong, and Songkhla Lake river basin areas. The findings and lessons learned from these local consultations have been integrated into this report. The following specific lessons about local consultations can be used to strengthen community participation.

- **Informal meetings work.** Consultation is most effective through a series of informal meetings with key stakeholders. The scope and depth of these consultations can depend on the issue and the area.
- **Establishing a willingness to work together.** A minimum of 3 to 6 months is needed to establish a constructive group of people who are willing to move in the same direction. To maintain cooperation, differences in expectations will need to be identified and managed. In Samuth Prakarn, for example, the coastal communities wanted to see immediate actions to prevent erosion, while the technical experts and government representatives were focused on first understanding the erosion process and investment risks.
- **Strong leadership and technical knowledge are required.** Without a technical understanding of the situation and available options, consultations are less effective.
- **Engagement of local governments with support from central agencies is key.** Local agencies can work closely with local stakeholders. Their effectiveness can further be improved by the support and guidance from central government agencies.
- **Considering everyone's ability to participate is needed.** A lack of time and limited financial resources may hinder people's active participation. Timing in terms of season (such as the farming season) and other factors is important. The availability of continuous funding also appears critical for the active participation of local communities in coastal and marine resources management.
- **Conversations and coordination must continue.** After key stakeholders agree to work together to resolve an issue, they must continue their dialogues to ensure all parties agree on the actions and implementation responsibilities.

CHALLENGE 1: COASTAL EROSION

Challenge 1: Reducing coastal erosion and adverse impacts of natural hazards

Thailand's coasts are experiencing severe erosion. While preventing erosion and mitigating impacts will require substantial investments, the costs of inaction are even greater. Engineering solutions will play a role, but a strategic approach must include non-engineering measures such as preserving mangroves and wetlands and establishing cost-sharing mechanisms among stakeholders. Past experiences have shown that efforts to mitigate coastal erosion will likely fail, unless all key parties – including central and local agencies, communities, and land owners – work together

towards the same goal. Local consultation experiences in the Upper Gulf also suggest that active leadership by a central agency is essential (Box 4.2).

To move forward, the following actions may be considered:

- *Developing a strategic plan and allocating an appropriate budget.* DMCR and DMR should plan and implement strategic measures to reduce coastal erosion in the 30 defined priority areas. The draft policy framework on coastal erosion and various investment studies should be reviewed. To ensure implementation, involved agencies need to be provided with the necessary budget.

CHALLENGES

Box 4.2: Lessons Learned from Local Consultation: Coastal Erosion at Ban Khun Samuthchin

As described in Chapter 1, coastal erosion is causing hardship for communities along the coast, including Ban Khun Samuthchin in Sumuth Prakarn Province (See also Box 1.3). Consultation with the local community at this village in early 2006 confirmed that cooperation among key stakeholders is feasible when a common understanding of the situation can be reached and actions are taken, even while the discussion continues.

Other lessons learned from this consultation include that a central agency, like the Department of Marine and Coastal resources (DMCR) or Department of Mineral Resources (DMR), can play a key role in bridging the gaps among key stakeholders, and that cost sharing is as important as the technical issues. A pilot study, funded by the province and the Thailand Research Fund, on the cost-effectiveness of a plan to mitigate coastal erosion along the Upper Gulf is being conducted at Ban Khun Sumuthchin. More pilot studies along the Upper Gulf are needed to better understand coastal processes and determine the cost-effectiveness of various measures to reduce erosion.

- *Consulting with local governments and communities in priority areas.* Local consultations should be used to explore issues, concerns, and feasible options for moving forward. The cooperation of local governments and communities is critical for implementation. Previous knowledge and experiences, including the pilot study at Ban Khun Sumuthchin described in Box 4.2, can serve as a model. Efforts of the various agencies and communities will have to be integrated to ensure effective investments and prevent unfavorable impacts.
- *Strengthening the understanding of coastal erosion processes along the Thai coast.* Technical knowledge can be strengthened through a comprehensive program for data collection and analysis and through technical studies in close cooperation with local stakeholders. Attention should also be paid to naturally occurring erosion that is not enhanced by human activity and of which the resulting sediment transport may play a role in local habitat development. For improved technical information Thailand must support and build new connections and capacity at universities and institutions in the country, as well as explore technical collaborations with specialized agencies abroad.
- *Reviewing the adequacy of the Environmental Impact Assessment (EIA) process in controlling coastal erosion.*

The EIA process and implementation, in particular in terms of the responsibilities for actual environmental impacts on coastal ecosystems, should be carefully reviewed. Results should be made available to the public.

- *Improving the warning of and responses to natural disasters in the coastal area.* Following the 2004 Tsunami event, a natural hazards warning system and associated measures are being implemented along the Andaman Coast. To reduce the damage from natural hazards along the entire coast, similar efforts will have to be made for the Gulf of Thailand, giving high priority to the West Coast. A system and database for collecting and sharing information related to the causes and effects of coastal natural disasters, including a hazard map, need to be developed.
- *Developing strategies for preventing and mitigating impacts of a global sea level rise.* The Upper Gulf, including Bangkok and the middle part of the West Coast are identified as hot spot areas for a rise in global sea level. Studies are needed that explore opportunities and policy options for mitigating and adapting to the impacts of climate change in these areas.

CHALLENGE 2: FISHERIES

Challenge 2: Establishing sustainable fisheries

Current marine fisheries practices are not sustainable. While a sector policy exists and interesting community-based approaches are tested and applied, a stepped-up management approach is required if Thailand is to meet increasing demands for fish products for export and local consumption. In particular, the conflict between small-scale fishermen and large commercial operators must be addressed. Stepping up enforcement of regulations, however, appears difficult in light of limited government staff, poverty, and other social issues.

To move forward, the following specific actions should be considered:

- *Use of economic instruments as a management tool for sustainable fisheries.* This exploration must be carried out in close collaboration with key stakeholders. Regulating access to fisheries can be effective in preserving fish stocks. This can be done in various ways, such as by reducing open-access, restricting the number of licenses issued, limiting total allowable

CHALLENGES

catch, limiting entries into the sector, and developing an exist strategy for current fishermen. Also, interventions such as closed fishing seasons need to be created during key spawning periods for commercial species. Marine Protected Areas as breeding and nurturing habitats need to be further developed, and area-based fishing gear restrictions need to be created and enforced. Economic instruments can also be used to enforce regulations, encourage inefficient actors to leave, and increase financial resources to improve management. Lessons learned from previous experiences can be used to guide new strategies.

- *Rehabilitating fish stocks and fish habitats* by increasing nursery habitats and seed bed areas for fish breeding, and by protecting mangroves and sea-grass beds as natural nursery, breeding, and feeding grounds.
- *Stepping up conflict management between small scale and commercial fishers.* Co-management can be used as a strategy for conflict management, increased compliance, and community enforcement.
- *Updating the Fisheries Act to reflect necessary policy changes to achieve critical reforms.* Further effort should be made to strengthen monitoring and control systems to enforce regulations and apprehend violators.

CHALLENGE 3: AREA DEVELOPMENT

Challenge 3: Stepping up oversight and monitoring of development activities.

Tourism development, aquaculture, and industrial and port activities are among the major threats to the marine and coastal resources along the Thai coast.

Sector policies, regulations, and responsible agencies exist, but ensuring effective control of pollution and other negative impacts from these land and marine-based sources has been a challenge.

Priority actions include:

- *Stepping up the oversight and management of area development,* in particular for the Eastern Seaboard, Upper Gulf, Pak Panang Nakorn Srithammarat, Songkhla Lake, and the Pollution Control Zones (PCZs). Activities should include monitoring pollution loads from ports, industries, hotels, and other commercial and domestic sources. Collecting and improving the reliability of water quality data and information about

wastewater production, treatment and prevention should be part of this effort. Findings must periodically be made available to the public.

- *Stepping up control of shrimp farming* through third party audits of the GAP and CoC system and disclosing the implementation and monitoring results.



Monitoring aquaculture, such as here in Phang Nga Province, is important to prevent adverse impacts of this productive industry.

Source: World Bank, 2007.

- *Stepping up capacity of local governments and regulatory agencies* to implement Environmental Impact Assessments and monitoring of water quality and ecosystems in target areas and beaches. DMCR and PCD must coordinate this effort and make monitoring data available to the public. Findings must be disclosed to the public.
- *Monitoring ongoing efforts with integrated management for sustainable tourism development.* Experiences from the tourism development project in the Trad-Ko Chang area, implemented by DASTA, should be carefully captured, analyzed and used to guide future development activities.
- *Increasing coordination among DMCR and local water agencies* to manage freshwater resources. Water resources management is an important coastal resource issue and requires an integrated river basin management approach that ensures effective coordination among agencies and involves all stakeholders. The promotion of such an approach requires a series of formal and informal meetings as part of a consultation process (Box 4.3).

CHALLENGES

Box 4.3: Lessons Learned from Local Consultation: Integrated River Basin Management

Local consultation workshops for the Tha Chiad river basin (part of the Songkla Lake basin) suggested that the use of water resources is an important issue in the coastal area. In terms of challenges, the workshops found that local conflicts can hinder government efforts to facilitate constructive discussion and that technical information has to be consolidated and simplified to deliver messages that lead parties to agree on immediate actions to be carried out on the ground. Sharing available technical information and small group discussions proved to be useful tools for solving conflicts and building cooperation. The workshops also highlighted the needs for follow-up actions and investments, including capacity building and sharing of experiences, to make this integrated approach to river basin management effective in the long run.

CHALLENGE 4: PUBLIC PARTICIPATION

Challenge 4: Increasing local capacity and public participation.

While community participation is crucial to the successful management of marine and coastal resources, effective and meaningful participation is often hindered by a lack of local capacity, conflicts of interest, communication gaps, and a lack of financial resources. Funding for community initiatives comes from a variety of resources and improved coordination among projects is required.

Enacting the draft Marine and Coastal Resources Management (MCRM) Act will establish the right for coastal communities to manage its resources and access information and sustainable funding mechanisms (See also Challenge 5). Other actions to be considered include:

- *Increasing local capacity through strengthening existing environmental education efforts* to build awareness and enthusiasm for conservation. Technical and management training and information sharing through meetings, seminars, workshops, and study tours, have proven to be effective.
- *Examining and strengthening the role of local governments in coastal management.* Local governments work closely with local stakeholders. Policy guidance and legislative support by central government agencies should be used to strengthen local efforts.
- *Recognizing and respecting traditional community rules and regulations.* DMCR should study local community activities that may have potential in other areas.

Recognizing traditional community rules would be an opportunity for DMCR to test and improve the concepts and implementation procedures for the Coastal Community approach of the MCRM Act.

- *Exploring financial options to support active participation of local communities.* The concept of raising funds from the private sector through community funds should be further explored, as well as other sustainable funding mechanism that could support local communities.

CHALLENGE 5: INTEGRATED MANAGEMENT

Challenge 5: Strengthening the institutional framework and updating legislation to establish integrated management

In Thailand, integrated coastal resources management has been identified in the national policies. Its implementation, however, remains a challenge due to overlapping and outdated regulations, limited government resources, and a lack of reliable data. In addition, responsibilities for marine and coastal resources management remain scattered among various agencies, including the Office of Natural Resources and Environmental Policy and Planning (ONEP), the Department of National Parks, Wildlife and Plant Conservation (DNP), the Pollution Control Department (PCD), the Department of Water Resources (DWR), the Royal Forestry Department (RFD), and the Department of Marine and Coastal Resources (DMCR). To provide a clear policy direction and reduce the number of involved agencies, key functions should be consolidated. Moreover, greater authority needs to be extended to local governments, combined with policy guidance and law and regulation support from central government agencies.

Possible next steps include:

- *Strengthening DMCR capacity and enabling the agency to lead* the implementation of an integrated approach to marine and coastal resources management and the protection of natural habitats. At the national level, DMCR should be the lead agency and ensure effective management through the integration of policy and budget planning with other ministries—including the Ministries of Agriculture, Transport, Industry and Interior and monitoring overall performance. At sector levels, and in close cooperation with local communities and stakeholders, DMCR should be the key agency responsible for protection and rehabilitation of coastal

CHALLENGES

habitats, including management of the National Marine Parks. DMCR will need to develop the required institutional capacity and have sufficient budget to implement its plans.

- *Enacting the Marine and Coastal Resources Management Act (MCRM)* to provide a legal framework for the implementation of an integrated management approach that involves the active cooperation of local communities and local governments and the sustainability of financial resources. Connecting with local communities and stakeholders should be a key objective of DMCR regional offices. Local knowledge and experiences on community-based coastal resource management should be established and shared through networking.
- *Establishing monitoring and evaluation (M&E) mechanisms* and upgrading existing databases and information system to support M&E for marine parks, coral reefs, natural habitats, marine animals, land-based pollution control, and fisheries. Many studies have been carried out by various agencies, but results are hard to access and data is not always reliable. To improve the cost effectiveness of resource management, reliable data must be collected and disseminated among target audiences.

THE WAY FORWARD

Thailand's coastal and marine resources require a stepped-up approach to preserve these resources and the economic values they represent. The five challenges describe specific measures that would contribute towards this goal. Among all suggested measures, two specific actions are a priority, as they are key to all other improvements:

- (1) Enabling strong leadership by MONRE's Department of Marine and Coastal Resources (DMCR), and;
- (2) Enacting the draft Marine and Coastal Resource Management Act.

The legal framework, combined with a leadership role for DMCR, appropriate authorities for local governments, and genuine public participation, would form the basis for an integrated and participatory approach to coastal and marine resources management.

At the basis of any change, however, is also an increased awareness of the seriousness of the situation. Thailand's rich and abundant coastal and marine resources are under tremendous pressure. The expected growth of both the economy and the population in the coastal provinces demands an improved management of resources to prevent more serious environmental damage and preserve the resources for current and future generations.



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GLOSSARY OF TERMS

- EEZ** The EEZ or Exclusive Economic Zone refers to the zone in which a country has special rights over the exploration and use of marine resources. Generally an EEZ extends to a distance of 200 nautical miles (370 kilometers) out from the coast, except where resulting points would be closer to another country.
- Wetland** Wetlands are considered to be between a truly terrestrial ecosystem and a truly aquatic one. Wetlands are indeed “wet,” and the water table is usually at or near the surface of the land, or the land is even covered by shallow water. Wetlands are defined based on their vegetation, soil, and the fact that the land is saturated with water at least some time during the growing season.
- Climate change** Climate change refers to the variation in the Earth’s global climate or in regional climates over time. It describes changes in the variability or average state of the atmosphere – or average weather – over time scales ranging from decades to millions of years. These changes may come from processes internal to the Earth, be driven by external forces (e.g. variations in sunlight intensity) or, most recently, be caused by human activities.
- Fish stock** Fish stocks are subpopulations of a particular species of fish, for which intrinsic parameters (growth, recruitment, mortality and fishing mortality) are the only significant factors in determining population dynamics, while extrinsic factors (immigration and emigration) are considered to be insignificant.
- Trash fish** Fish, usually marine, with little or no market value as a food for humans. Trash fish is sometimes used to produce fish meal. (See also Box 2.1.)

ONLINE RESOURCES

Andaman Pilot Project, www.cusri.chula.ac.th/andaman/th.

Information on the environment and local cultures of sea people in coastal regions and small islands.

Coastal Habitats and Resources Management Project (CHARM), www.charm-th.com.

Information on CHARM's co-management approach.

Coastal Resources Institute (CORIN), www.corin.psu.ac.th/.

Publications related to sustainable management of coastal and marine resources.

Coastal Wetlands Policy and Conservation Awareness Project, www.wildlifefund.or.th/wetlands.html.

Information about wetland pilot projects and other natural resource management topics.

Community Organizations Development Institute (Public Organization) (CODI), <http://www.codi.or.th>.

Reports about local organizations and community networks, policies, projects and strategies.

Department of Disaster Prevention and Mitigation, Ministry of Interior of Thailand, www.disaster.go.th.

Statistical data and other information related to natural disasters.

DOF Fishery Information Technology Center, www.fisheries.go.th.

Fisheries statistics.

EnvironNET, www.environnet.in.th/evdb/law/national.

Overview of environmental laws, policies, and strategies in Thailand.

Forestry Statistics of Thailand, www.forest.go.th.

Forestry information including statistics on mangrove areas and reforestation.

International Center for the Environmental Management of Enclosed Coastal Seas, www.emecs.or.jp.

Resources related to the International EMECS Center's role as a cooperation of scholars, government officials, industry representatives and private organizations that work to solve problems in enclosed coastal seas such as the Gulf of Thailand.

MONRE Department of Marine and Coastal Resources (DMCR), www.dmcr.go.th.

Information on the Department's conservation and rehabilitation efforts.

National Park, Wildlife and Plant Conservation Department, www.dnp.go.th.

Information about marine parks in Thailand.

Network of Aquaculture Centre in Asia-Pacific, www.enaca.org.

Publications and case studies on sustainable aquaculture and aquatic resource management practices in different countries. Includes reports on Tsunami damage assessments and restorations.

Phuket Marine Biological Center (PMBC), www.pmbc.go.th.

The main objective of the PMBC is to carry out research on the marine and coastal flora and fauna in the Andaman Sea and the Gulf of Thailand.

Ramsar Sites Information Service, www.wetlands.org/RSDB.

Information on RAMSAR-designated wetlands.

Save Andaman Network (SAN), www.saveandaman.com.

Information on coastal aquaculture and Tsunami responses.

United Nations Food and Agriculture Organization (FAO), www.fao.org.

Statistical databases, country profiles, and publications on sustainable fisheries and agriculture.

Wildlife Fund Thailand, www.wildlifefund.or.th.

Links to the Coastal Wetlands Policy and Conservation Awareness Project in Thailand.

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Department of Mineral Resources

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Pollution Control Department

Dr. Pornsook Chongprasith
Ms. Wanpen Tuanwechayan

Department of Fisheries

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Department of National Parks, Wildlife and Plant Conservation

Mr. Kitiphat Taraphibarl

Department of Groundwater Resources

Ms. Somkid Buapeng
Ms. Oranuj Lorpensri

Designated Area for Sustainable Tourism Administration

Dr. Sarawoot Chayovan
Mr. Achawin Suksawang

Marine Department

Mr. Suppaporn Pukasemwarangkul

Department of Local Administration

Mr. Chaipat Chaisawat

Department of Environmental Quality Promotion

Mrs. Rachanee Emaruchai

International organizations, NGOs, and academic institutions:

United Nations Environment Program/ Coordinating Bodies of the Seas of East Asia (COBSEA)

Dr. Srisuda Jarayabhand
Ms. Tunnie Srisakulchairak

World Health Organization

Ms. Kanpirom Wiboonpanich

Chulalongkorn University

Dr. Thanawat Jarupongsakul
Mrs. Sumalee Sukdanon
Dr. Nittharattana Paphavasit

Kasetsart University

Dr. Shettapong Meksumpun

Community Organizations Development Institute

Ms. Panthip Petchmark

Local Development Institute

Ms. Benjamas Siripatra

Chumchonchai Foundation

Ms. Monta Agchariyakul

Thailand Environment Institute

Dr. Sanit Aksornkoae

Population and Community Development Association

Mr. Mechai Viravaidya

Coastal Habitats and Resources Management (CHARM)

Dr. Yves Henocque
Ms. Soithip Weerasoonthon

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THAILAND-AT-A-GLANCE

GEOGRAPHY	ECONOMY/SOCIETY
<p>Land area: 517,770 sq km (2006)</p> <p>Land boundaries: <i>total:</i> 4,863 km <i>border countries:</i> Myanmar 1,800 km, Cambodia 803 km, Laos 1,754 km, Malaysia 506 km</p> <p>Coastline: 2,880 km (2004 est.)</p> <p>Maritime claims: <i>continental shelf:</i> 200 m or to depth of exploitation <i>exclusive economic zone:</i> 200 nautical miles <i>territorial sea:</i> 12 nautical miles</p> <p>Climate: tropical; rainy, warm, cloudy southwest monsoon (mid-May to September); dry, cool northeast monsoon (November to mid-March); southern isthmus always hot and humid</p> <p>Terrain: central plain; Khorat Plateau in the east; mountains elsewhere</p> <p>Elevation extremes: <i>lowest point:</i> Gulf of Thailand 0 m <i>highest point:</i> Doi Inthanon 2,576 m</p> <p>Mineral resources: tin, natural gas, tungsten, tantalum, timber, lead, fish, gypsum, lignite, fluorite</p> <p>Land use: <i>Urban area:</i> 3.6 percent <i>Agriculture:</i> 56 percent <i>Forest and woodland:</i> 35.8 percent <i>Water:</i> 1.6 percent <i>Others:</i> 3 percent (2002)</p> <p>Irrigated land: 49,860 sq. km (2003)</p> <p>Environment - international agreements: <i>party to:</i> Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Marine Life Conservation, Ozone Layer Protection, Tropical Timber 83, Tropical Timber 94, Wetlands, Nuclear Test Ban <i>signed, but not ratified:</i> Law of the Sea</p>	<p>GDP: THB 7,813 billion (2006)</p> <p>GDP per capita: THB 120,000 (2006)</p> <p>GDP growth rate: 5.0 percent (2006)</p> <p>GDP - composition by sector: <i>agriculture:</i> 8.9 percent <i>industry:</i> 47.4 percent <i>wholesale and retail trade:</i> 13.7 percent <i>services:</i> 30.1 percent (2006)</p> <p>Inflation rate: 4.7 percent (2006)</p> <p>Exchange rate: US\$ 1 = THB 37.88 (2006 average)</p> <p>Unemployment rate: 1.5 percent (2006)</p> <p>Gross capital formation/GDP: 22.4 (2006)</p> <p>Exports of good and services/GDP: 68.6 (2006)</p> <p>Gross domestic savings/GDP: 31.0 (2005 preliminary)</p> <p>Gross national savings/GDP: 30.3 (2005 preliminary)</p> <p>Industrial production growth rate: 5.9 percent (2006)</p> <p>Agricultural production growth rate: 4.4 percent (2006)</p> <p>Agriculture - products: rice, cassava (tapioca), rubber, corn, sugarcane, coconuts, and soybeans.</p> <p>Exports: <i>total value:</i> THB 4,849 billion (2006)</p> <p>Imports: <i>total value:</i> THB 4,769 billion (2006)</p>
	<p>Population, 17 October 2005: 62.3 million</p> <p>Population growth rate: 0.7 (average annual growth, 1998-2004)</p> <p>Urban population (percent of total population): 32</p> <p>Birth rate: 13 births/1,000 population (2005)</p> <p>Death rate: 6.8 deaths/1,000 population (2005)</p> <p>Infant mortality: 7.6 deaths/1,000 live births (2005)</p> <p>Access to safe water (percent of population): 97.9 (urban); 98.5 (rural) (2000 est.)</p> <p>Access to sanitation (percent of population): 98.17 (2000 est.)</p> <p>Life expectancy at birth: 68 (male), 75 (female)</p> <p>Literacy (at age 15) (percent of population): 96 (2005)</p> <p>Gross primary enrollment (percent of school-age population): 98.5 (2005)</p> <p>National capital: Bangkok</p> <p>Administrative divisions: 76 provinces (<i>changwat</i>)</p> <p>Independence: 1238 (traditional founding date; never colonized)</p>
<p><i>Sources: Bank of Thailand, Land Development Department (LDD), National Statistical Office, National Economic and Social Development Board (NESDB), Ministry of Commerce, Ministry of Public Health, World Health Organization (WHO Thailand), Office of Education Council, Ministry of Education, and Thailand Economic Monitor (www.worldbank.or.th)</i></p>	



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