Chapter 5 Environmental Conditions in Study Area

5. Environmental Conditions in Study Area

5.1 National Policy for Conservation of Environments

The Office of Environmental Policy and Planning, Ministry of Science, Technology and Environment has formulated the 1997–2016 conservation goals as follows: To aim for integration of natural resources management and enhancement, and conservation of national environmental quality, with sustainable economic and social development, and to ensure the quality of life, the Policy and Prospective Plan for Enhancement and Conservation of National Environmental Quality.

This policy and plan consist of six main policy areas: natural resources, pollution prevention and eradication, natural and cultural environments, community environment, environmental education and promotion, and environmental technology.

Although the demand for use of natural resources is increasing at an accelerating rate, current management and protection are neither effective nor sustainable. Thus, once abundant natural resources have been seriously exploited, those that remain are degraded and have limited long-term development capacity of the nation.

The policy and implementation guidelines for soils and land use, forest resources, water resources, mineral resources, energy resources and coastal resources are clearly described.

Unsuitable utilization of coastal areas and marine resources for aquaculture, industry, tourism and services have resulted in numerous management problems. Natural resources such as mangrove forests, beaches, coral reefs and other marine resources have been degraded and depleted. For example, mangrove forest decreased by 57 % between the years 1961 and 1993 all over the country, by being converted for different purposes, but mainly for aquaculture. Currently, there are only about 1.05 million rai (170,000 ha) remaining.

As the coastal area is the object of this study, the following policy objectives on coastal resources shall be considered.

Goals : 1. Preserve at least one million rai (0.16 million ha) of mangrove forests.

2. Conserve and rehabilitate all types of coastal resources for protection of the balance of coastal ecosystems.

Policy :

1. Develop coastal areas and utilize coastal resources

   Policy 1 : Minimize environmental impacts of coastal development.

   Policy 2 : Utilization of coastal resources must be based on conservation principles and productivity of those resources.

   Policy 3 : Establish zones for coastal land-use and seabed, while at the same time formulating guidelines and criteria for controlling utilization, protecting the environment, and solving land-use conflicts.

2. Preserve and rehabilitate coastal ecosystem.

   Policy 1 : Reserve and maintain coastal ecosystems as suitable for sustainable development.

   Policy 2 : Increase capacity to administer and manage mangrove forests on a systematic and continuing basis.

   Policy 3 : Accelerate the rehabilitation and restoration of degraded mangrove forests.

   Policy 4 : Conserve coastal and island environments for sustainable tourism development.

Implementation Guidelines on Conservation of Mangrove Forests and Beaches

1. Designate environmental protection areas in zones for mangrove conservation, and formulate action plans for rehabilitation, protection, and control of coastal ecosystems.

2. Conserve and rehabilitate beaches to serve as natural buffers between terrestrial and marine areas, including preventing the degrading of sand beaches, rock shores, and mud flats, in order to preserve the ecosystem and the scenic attraction of the area.

5.2 Environmental Conservation Area in Study Area

5.2.1 Environmental Aspects

The Office of Environmental Policy and Planning has designated the places shown in Table 5.2.1-1 and Figure 5.2.1-1 in the study area as an environmental conservation area. These conservation areas are put into following three categories.

A) Natural resources
B) Historic place
C) Cultural resources

Most of the designated conservation area is sandy beaches for tourist attraction and recreation for local people. Only four areas of Pak Phanang, Thale Noi, Thale Luang and Yaring (Pattani) are mentioned as typical mangrove forests.

Special attention should be paid to two marine bird parks of Thale Noi in Phatthalung province and Khu Khud at Thale Luang in Songkhla province.

5.2.2 Archaeological Aspects

A significant archaeological site around the Songkhla port area is Hua Khao Daeng historic city, which is located at the foothill of Khao Daeng mountain in Singha Nakhon district opposite to Songkhla port (see Figure 5.2.2-1).

Ancient monuments are building basement, pagoda, city wall and fortress. At present, Hua Khao Daeng is declared a part of Songkhla historic city. City wall, forts and moat are under excavation and restoration by the Department of Fine Arts. However, ancient evidences in Hua Khao Daeng site have already been destroyed and altered by the current community of Ban Bon Muang.

According to the research documents, Khao Daeng historic city is located in Moo 7 Ban Bon Muang and a part of Moo 1 Ban Khao Daeng, Hua Khao sub-district, Singha Nakhon district of Songkhla with total area of 2,460 rais. It has been proclaimed archaeological sites in the Royal Decree (Volume 102, Section 180 of November 29, 1985: special edition) and zoning proclamation in the Royal Decree (Volume 109, Section 119 of September 17, 1992).

Table 5.2.1-1 List of Designated Conservation Area

No.	Province	Name of Conservation Area	Category
1	Nakhon Si Thammarat	Nai Phlao Beach	Natural resources
2		Hin Ngam Beach	Natural resources
3		Srabua Beach	Natural resources
4		Pak Phanang Mangrove Forests	Natural resources
5		Laem Talumphuk	Natural resources
6	Phatthalung	Thale Noi Marine Bird Park	Natural resources
7		Sansuk Lampum Beach	Natural resources
8	Songkhla	Thale Noi Mangrove Forests	Natural resources
9		Sathing Phra Beach	Natural resources
10		Khu Khud Marine Bird Park	Natural resources
11		Thale Luang Mangrove Forests	Natural resources
12		Muan Ngam Beach	Natural resources
13		Cockfighting	Cultural resources
14		Laem Son On	Natural resources
15		Ko Naew & Ko Noo	Natural resources
16		Samila Beach	Natural resources
17		Kao Seng Beach	Natural resources
18		Cloth Products (Ko Yo)	Cultural resources
19		Nathap Beach	Natural resources
20		Sakom Beach	Natural resources
21	Pattani	Yaring (Pattani) Mangrove Forests	Natural resources
22		Laem Ta Chi	Natural resources
23		Ta Lo Ka Po Beach	Natural resources
24		Chala Beach	Natural resources
25		Ratcharak Beach	Natural resources
26		Khae Khae Beach	Natural resources
27		Souvenir (Ko Lae : Fishing Boat)	Cultural resources
28		Wasukri Beach	Natural resources
29	Narathiwat	Banthon Beach	Natural resources
30		Narathiwat Beach	Natural resources
31		Royal Palace	Historic place
32		Ao Manao Beach	Natural resources
33		Ban Kubu Beach	Natural resources
34		Ko Yao Beach	Natural resources
35		Tak Bai Custom House	Cultural resources

Source: Office of Environmental Policy and Planning

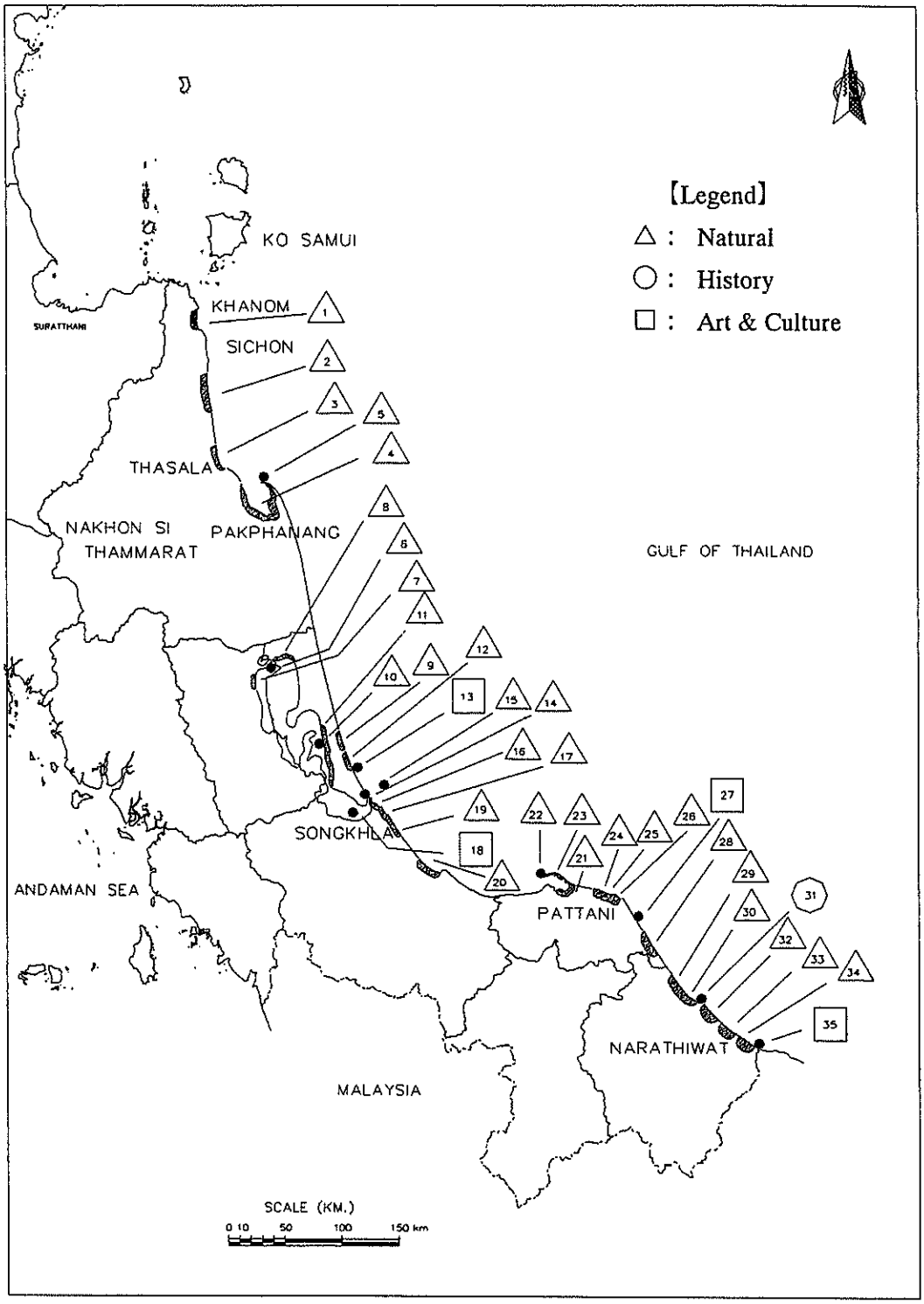


Figure 5.2.1-1 Location Map of Designated Conservation Area

At present, a number of forts can be found within the compound from the foot of the hill to the top. Important monuments in the city include the followings:

(1) Fortress

There are thirteen forts on land and one at seafront (Fort No.14) according to the preservation and development report on historic city of Songkhla by the department of Fine Arts (1992). All those forts were made of stone and plaster.
Later, another fort (Fort No.15) was found at the foot of Kaay Muang hill and following the latest survey, one fort at seafront (Fort No.14) was confirmed at latitude 100 ° 34 ′ 23 ″ E, longitude 7 ° 13 ′ 24 ″ S.

(2) City Wall

Only the northern wall is visible with the length of 150 meters. It was made of stone and plaster like the forts.

(3) City Moat

The moat lines only on the north and east sides of the city with total length of 2,000 m. The eastern moat is not in good condition, but the northern moat is still in good shape with the widest part of 30 m.

(4) Religious Monuments (Monastery)

Two religious monuments are found, one chedi (jeti) at the top of Khao Daeng mountain and one at the top of Khao Noi hill.

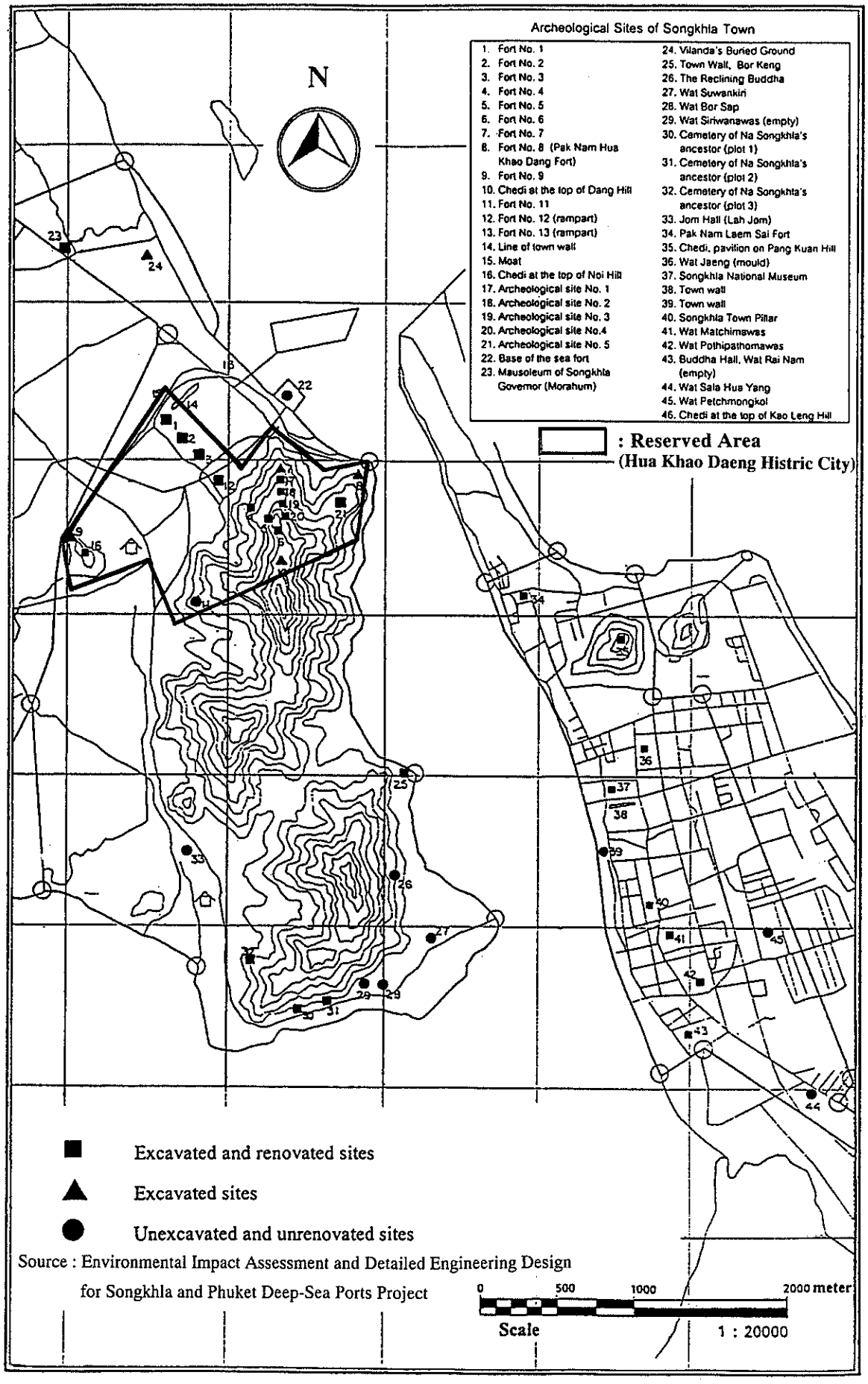


Figure 5.2.2-1 Archeological Sites of Songkhla City

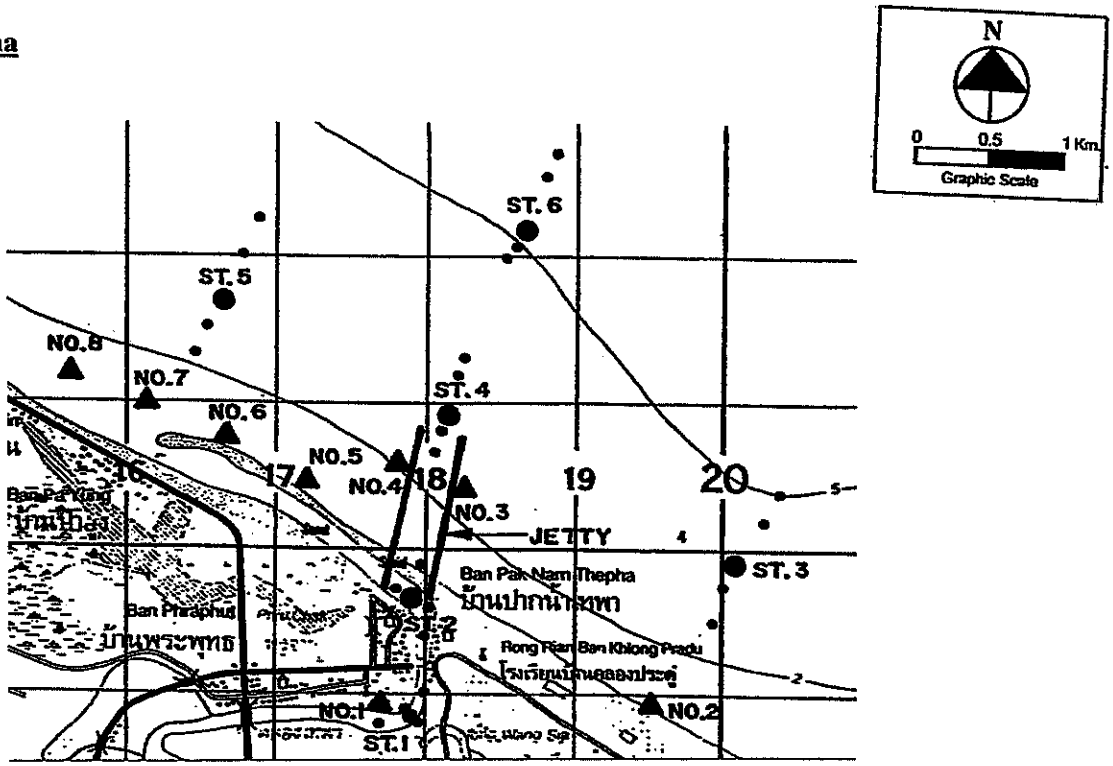
5.3 Results of Environmental Conditions Survey

In order to analyze the present situation of environmental conditions in relation to the master plan study, environmental conditions survey was carried out. Contents of the survey are shown in Table 5.3-1 and sampling locations of benthos and algae are in Figure 5.3-1.

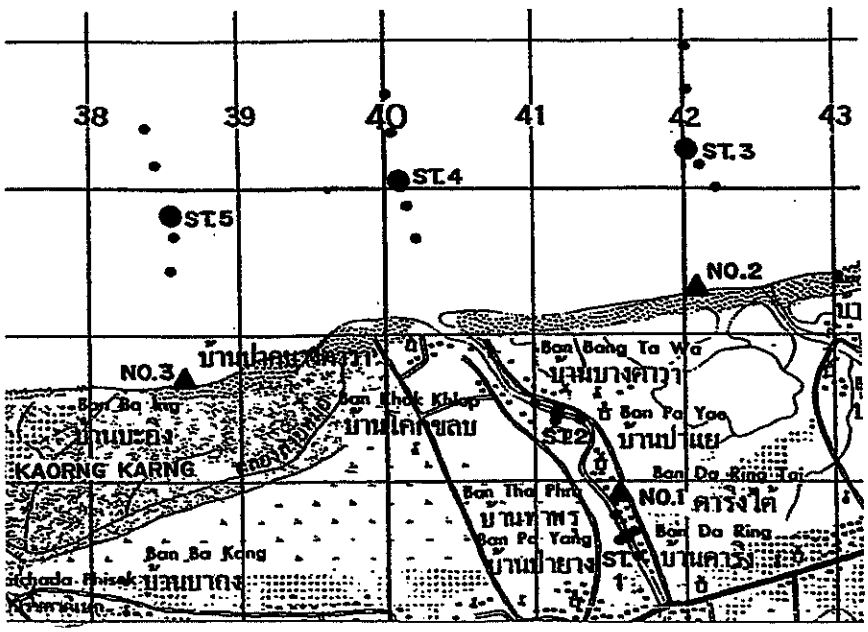
Table 5.3-1 Contents of Environmental Conditions Survey
(Fishery, Benthos and Algae Survey)

Items	Contents of Survey	Survey Period	Remarks
1. Fishery Survey			
	Method : Interview Survey Area : Thepha : Village Moo 7 Bang Ta Wa : Village Moo 1 & 2	Mar. 30 - Apr. 1, 2001	No. of informants 17 15
2. Benthos Survey			
	Method : Sampling & Identification Survey Area : Thepha : 6 sites (30 points) 4 sites at offshore 2 sites at river-mouth Bang Ta Wa : 5 sites (25 points) 3 sites at offshore 2 sites at river-mouth	Sampling : Mar. 30 - Mar. 31	
3. Algae Survey			
	Method : Sampling & Identification Survey Area : Thepha : 8 sites (40 points) 2 sites at training jetty 4 sites at groins 1 site at river-mouth 1 site at shoreline Bang Ta Wa : 3 sites (15 points) 1 site at river-mouth 2 sites at shoreline	Sampling : Mar. 31 - Apr. 1	

Thepha



Bang Ta Wa



LEGEND

● BENTHOS

▲ ALGAE

Figure 5.3-1 Location Map of Environmental Conditions Survey

Furthermore, environmental conditions survey for mangrove ecology and wildlife inventory was carried out on the feasibility study stage in Songkhla, Sichon and Bang Ra Pha areas.

Contents of the study is shown in Table 5.3-2 and study areas are shown in Figure 5.3.4-1 for the entrance of Songkhla Lake and Figure 5.3.4-2 for Sichon and Bang Ra Pha river-mouths.

Table 5.3-2 Contents of Environmental Conditions Survey
（Mangrove Ecology and Wildlife Inventory）

Items	Contents of Survey	Survey Period	Remarks
1. Mangrove Ecology Survey			
	Method : Field Survey Subject of Study : Dominant Tree Species Average Densities of Trees, Saplings & Seedlings Average Volume of Fuel Wood Sampling Plot Size : 10 x 10 m^2 : trees over ϕ4 cm 5 x 5 m^2 : sapling (small trees) 2 x 2 m^2 : seedling (very small trees) Survey Area : Songkhla Lake Entrance Sichon River-mouth Bang Ra Pha River-mouth	Aug. 28 - Sep. 3, 2001	
2. Wildlife Inventory Survey			
	Method : Data Collection & Field Survey Subject of Study : Four Main Terrestrial Vertebrate Animals (Mammal, Bird, Reptile, Amphibian) Survey Area : Songkhla Lake Entrance Sichon River-mouth Bang Ra Pha River-mouth	Aug. 28 - Sep. 3, 2001	

5.3.1 Fishery Survey

During fishery survey by interviewing with fishermen at villages in Thepha and Bang Ta Wa, the following information was collected:

1. Number of active fishermen
2. Types of boats and gear in use
3. Quantities and species distribution of fish catches
4. Incomes generated by fish catches
5. Habitat and spawning ground of fish and fishery activities within 3 km from the shore

The information obtained through the interview were compiled and tabulated in Tables 5.3.1-1 and 5.3.1-2 for Thepha and Bang Ta Wa, respectively.

The commercially dominant catches at river-mouth and within 50 km from the shore can be divided into two groups such as fishes and crabs in Thepha, and four groups such as fishes, crabs, shrimps and shells in Bang Ta Wa as shown in Table 5.3.1-3.

5.3.2 Benthos Survey

Analysis results of bethic organisms collected at six and five sampling stations in Thepha and Bang Ta Wa are summarized in Tables 5.3.2-1 and 5.3.2-2, respectively.

The abundance of benthic organisms in Thepha was 528 at river-mouth and ranging 748–2,992 individuals/m^2 in offshore area.

On the other hand, the abundance of benthic organisms in Bang Ta Wa was in the range of 7,656 –19,712 and 1,276–2,596 individuals/m^2 in river-mouth and offshore area, respectively.

5.3.3 Algae Survey

Results of algae identification in Thepha and Bang Ta Wa are as shown in Table 5.3.3-1. The most frequent Genus type was Genus Polysiphonia as the representative of Division Rhodophyta (Red algae).

Concerning the relative abundance percentage, most of results indicated that only one type was found at each station except No. 5 (medium level) at Thepha. And percentage of algae coverage was low at every stations.

Table 5.3.1-1 Information of Fishery Activities in Thepha

No.		No. of Boat	Fishing Boat Size (m.)	Fishing Boat No. of Crew	Fishing Period Duration	Fishing Period Period / Trip	Fishing Period Season	Fishing Gear	Main Fishing Ground Location	Main Fishing Ground Distance (km.)/ Depth (m.)	Main Fishing Ground Direction	Main Fishing Ground Main Species Caught	Main Fishing Ground Price (baht/kg)	Catch / Trip (kg.) Max.	Catch / Trip (kg.) Avg.	Catch / Trip (kg.) Min.	Economic Income (baht/trip)	Economic Cost (baht/trip)	Fishery Activity within 3 km. from the Shore Type	Fishery Activity within 3 km. from the Shore No. of Fishermen	Fishery Activity within 3 km. from the Shore Main Species Found	Spawning Species Species	Spawning Species Period	Remark
	FISHERMEN AT BAN PAK BANG																							
1	BPB 1*	2 8	16-17 14	9-10 5-6	Day	14 hrs. (03.00 a.m. - 05.00 p.m.)	January - October	- Crab gill net - Indo-Pacific mackerel gill net	- Thepha river mouth and near shore	30-40/-	- No definite direction	- Blue swimming crab - Indo-Pacific mackerel - Threadfin bream	- Blue swimming crab • Large = 110 • Medium = 80 • Small = 60 - Indo-Pacific mackerel = 12-17 - Threadfin bream • Large = 70 • Medium = 50 • Small = 35	700-800	100-200	0-10	13,000 - 14,000	800 - 3,000	- Hand push net - Push net with engine - Crab gill net	40	- Indo-Pacific mackerel - Threadfin bream	- Indo-Pacific mackerel - Threadfin bream	- February - March - February - March	- Low crab catch
2	BPB 2*	2	5-7	2	Day	8 hrs. (04.00 a.m. - 12.00 a.m.)	Whole year	- Indian mackerel gill net - Crab gill net	- Thepha river mouth and near shore	2-3/-	- No definite direction	- Indian mackerel - Purple-spotted bigeye	- Indian mackerel = 7 - Purple-spotted bigeye = 3-5	200	20	3	1,200	300-400	- Hand push net - Push net with engine - Crab gill net	60	- Indian mackerel	- Indian mackerel	- December-February	- Low fishery productivity
3	BPB 3*	1	10-15	6-7	Night	15 hrs. (05.00 p.m. - 08.00 a.m.)	April - October	- Crab gill net - Anchovy falling net	- Thepha river mouth and near shore	14-15/-	- No definite direction	- Anchovy - Blue swimming crab	- Anchovy = 7 - Blue swimming crab = 95	5,000	1,500	300 - 400	10,000	2,000	- Crab gill net - Indian mackerel gill net - Otter board trawl - Sand whiting gill net - Mullet gill net	100	- Indian mackerel - Mullet	- Mullet	- May	-
4	BPB 4**	1	4-5	5-6	Day	14 hrs. (04.00 a.m. - 06.00 a.m.)	December - May	- Indo-Pacific mackerel encircling gill net - Sand whiting gill net - Crab gill net	- Thepha river mouth and near shore	- 10-15/-	- No definite direction	- Indo-Pacific mackerel - Sand whiting - Blue swimming crab	- Indo-Pacific mackerel = 8-15 - Sand whiting = 40-50 - Blue swimming crab = 90-100	2,000	500	100	10,000	3,000	- Push net with engine - Hand push net - Otter board trawl	50-60	- Indian mackerel - Black pomfret - Silver pomfret	- Pomfret - Croaker	- December - January - December - January	- Decline of fishery productivity because of trawl net and push net
5	BPB 5*	1 1	12 16	9-10 9-10	Night	17 hrs. (03.00 p.m. - 8.00 a.m.)	March - October	- Achovy falling net	- Thepha river mouth and near shore	- 30-40/10-15	- No definite direction	- Anchovy	- Fresh anchovy = 8 - Dried anchovy = 40-50	3,000	1,000	20-30	25,000	2,000	- Indian mackerel gill net - Shrimp trammel net - Squid trammel net - Pomfret gill net	45	- Indian mackerel - Black pomfret - Silver pomfret	- Indian mackerel	- December - March	
6	BPB 6*	1 1	16 12	10 7-8	Night	15 hrs. (04.00 p.m. - 7.00 a.m.)	March - October	- Achovy falling net - Crab gill net	- Thepha river mouth and near shore	- 25-30/-	- No definite direction	- Anchovy - Blue swimming crab	- White anchovy = 10 - Black anchovy = 6 - Blue swimming crab • Large = 90 • Medium = 60	3,000	1,000 - 1,500	300 - 500	30,000	5,000	- Crab gill net - Push net with engine - Hand push net - Trawl net	60	- Indian mackerel - Blue swimming crab	- Anchovy	- December - January	- Oil for boat is expensive
7	BPB 7*	1	5-6	2-3	Day	8 hrs. (04.00 a.m. - 12.00 a.m.)	Whole year	- Indo-Pacific mackerel gill net - Crab gill net	- Thepha river mouth and near shore	- 15-20/-	- No definite direction	- Indo-Pacific mackerel - King mackerel - Blue swimming crab - Sardine	- Indo-Pacific mackerel = 8-15 - King mackerel = 30-40 - Blue swimming crab = 80-100 - Sardine = 8-10	300 - 400	20-30	0-10	6,000 - 10,000	200 - 1,000	- Indian mackerel gill net	60-90	- Indian mackerel - King mackerel - Sardine	- Indian mackerel	- December - February	- Decline of fishery productivity because of trawl net and push net
8	BPB 8*	1	9	2	Day	10 hrs. (05.00 a.m. - 03.00 p.m.)	Whole year	- Mullet gill net - Indo-Pacific mackerel gill net - Crab gill net	- Thepha river mouth and near shore	- 10-15/-	- No definite direction	- Indo-Pacific mackerel - Sand whiting - Mullet - Blue swimming crab	- Indo-Pacific mackerel = 8-15 - Sand whiting = 70 - Mullet = 25 - Blue swimming crab • Large = 30 • Medium = 25	200	25-30	4-5	1,500	250	- Pomfret gill net - Indian mackerel gill net - Sand whiting gill net	100	- Pomfret - Indian mackerel - Sand whiting	- Sand whiting - Pomfret - Indian mackerel	- January - February - January - March - December February	-
9	BPB 9*	1	3	2	Day	6 hrs. (04.00 a.m. - 10.00 a.m.)	Whole year	- Crab gill net - Indian mackerel gill net	- Thepha river mouth and near shore	- 3-4/-	- No definite direction	- Indian mackerel - Blue swimming crab	- Indian mackerel = 30 - Blue swimming crab • Medium = 40	50	10-20	1-5	200-400	120	- Trawl net - Crab gill net - Indian mackerel gill net - Squid trammel net	80	- Indian mackerel - Sand whiting	- Indian mackerel - Croaker	- December - September	- Decline of fishery productivity because of trawl net and push net
10	BPB 10*	1	6	2	Day	6 hrs. (04.00 a.m. - 10.00 a.m.)	Whole year (Except in April)	- Indo-Pacific mackerel gill net	- Thepha river mouth and near shore	- 4/-	- No definite direction	- Indo-Pacific mackerel	- Indo-Pacific mackerel = 10-15	100	10-15	2-3	200	140	- Indian mackerel gill net - Sand whiting gill net - Hand push net	60	- Indian mackerel - Sand whiting - Pomfret	-	-	- Decline of fishery productivity because of trawl net and push net
11	BPB 11*	1	3-4	2	Day	4 hrs. (05.00 a.m. - 09.00 a.m.)	Whole year (Except in January)	- Indo-Pacific mackerel gill net	- Thepha river mouth and near shore	- 3/-	- No definite direction	- Indo-Pacific mackerel - King macherel - Sardine	- Indo-Pacific mackerel = 10-15 - King macherel = 25-30 - Sardine = 7-8	100	15-20	0-3	2,500	300	- Push net with engine - Hand push net - Indian mackerel gill net	20-30	- Indian mackerel - Sardine	-	-	- Decline of fishery productivity because of trawl net and push net

Table 5.3.1-1 Information of Fishery Activities in Thepha (Cont'd)

No.		No. of Boat	Fishing Boat		Fishing Period			Fishing Gear	Main Fishing Ground					Catch / Trip (kg.)			Economic		Fishery Activity within 3 km. from the Shore			Spawning Species		Remark
			Size (m.)	No. of Crew	Duration	Period / Trip	Season		Location	Distance (km.)/ Depth (m.)	Direction	Main Species Caught	Price (baht/kg)	Max.	Avg.	Min.	Income (baht/trip)	Cost (baht/trip)	Type	No. of Fishermen	Main Species Found	Species	Period	
12	BPB 12*	1	14	6	Night	15 hrs. (05.00 p.m. - 08.00 a.m.)	Whole year	- Crab gill net - Anchovy falling net	- Thepha river mouth and near shore	- 30/-	- No definite direction	- Blue swimming crab - Anchovy	- Blue swimming crab • Large = 90 • Medium = 50 • Small = 30 - Anchovy = 5	500 - 1,000	200 - 300	50 - 100	15,000	2,000 - 4,000	- Crab gill net - Push net with engine - Hand push net	100	- Indian mackerel	-	-	- Small size of fish
13	BPB 13**	1 1	15 14	7-13	Night	15 hrs. (04.00 p.m. - 07.00 a.m.)	Whole year	- Crab gill net - Anchovy falling net	- Thepha river mouth and near shore	- 25-30/-	- No definite direction	- Blue swimming crab - Anchovy	- Blue swimming crab • Large = 95 • Medium = 70 • Small = 40 - Anchovy = 6	600 - 2,000	200 - 400	0-50	3,500 - 4,000	2,000	- Crab gill net - Squid trammel net - Push net with engine	120 - 150	- Indian mackerel	-	-	- Distance of fishing is farther than last year
14	BPB 14*	1	6	2	Day	9 hrs. (04.00 a.m. - 01.00 p.m.)	Whole year	- Indian mackerel gill net	- Thepha river mouth and near shore	- 10/-	- No definite direction	- Indian mackerel - Threadfin bream - Purple-spotted bigeye	- Indian mackerel = 13-15 - Threadfin bream = 30 - Purple-spotted bigeye = 3	50	30	0-10	500	200	- Indian mackerel gill net - Sand whiting gill net - Hand push net - Push net with engine	40	- Indian mackerel - Sand whiting - Sardine	-	-	- Small size of fish
15	BPB 15*	1	12	4-6	Day and Night	2 days	Whole year	- Crab gill net	- Thepha river mouth and near shore	- 50-70/-	- No definite direction	- Blue swimming crab - Mush crab	- Blue swimming crab • Large = 90-100 • Small = 50-60 - Musk crab 20-30	200-300	100	50	10,000	4,000	- Push net with engine - Hand push net - Indian mackerel gill net	90	- Indian mackerel	- Indian mackerel	- December - February	- Decline of fishery productivity because of trawl net and push net
16	BPB 16**	1	16-17	4-6	Day and Night	2-3 days	January - October	- Crab gill net	- Thepha river mouth and near shore	- 40-50/-	- No definite direction	- Blue swimming crab	- Blue swimming crab = 90	500-600	200 - 300	40-50	10,000	4,000 - 5,000	- Push net with engine - Hand push net - Indian mackerel gill net - Crab gill net	130	- Blue swimming crab - Indian mackerel	- Indian mackerel	- December - January	-
17	BPB 17*	1	12	2	Day	7 hrs. (04.00 a.m. - 11.00 a.m.)	February - November	- Indian mackerel gill net	- Thepha river mouth and near shore	- 5-6/6	- No definite direction	- Indian mackerel - King mackerel - Sardine	- Indian mackerel = 12 - King mackerel = 30 - Sardine = 7	30	20	2-3	500	70	- Indian mackerel gill net	40	- Indian mackerel - Sardine	-	-	- Low fishery productivity

Remark:
- * = Own fishing
- ** = Fishing labour
- BPB = Fishermen at Ban Pak Bang (Ban Pak Nam Thepha)
- Size of boat : Large boat > 18 m, Medium boat = 10-17 m and Small boat < 10 m.

Table 5.3.1-2 Information of Fishery Activities in Bang Ta Wa

No.		No. of Boat	Fishing Boat		Fishing Period			Fishing Gear	Main Fishing Ground					Catch / Trip (kg.)			Economic		Fishery Activity within 3 km. from the Shore			Spawning Species		Remark
			Size (m.)	No. of Crew	Duration	Period / Trip	Season		Location	Distance (km.)/ Depth (m.)	Direction	Main Species Caught	Price (baht/kg)	Max.	Avg.	Min.	Income (baht/trip)	Cost (baht/trip)	Type	No. of Fishermen	Main Species Found	Species	Period	
	FISHERMEN AT BAN BANG TA WA																							
1	BTW 1*	1	14	2	Day	7 hrs. (04.00 a.m. - 11.00 a.m.)	Whole year (except Friday)	- Indian mackerel gill net	- Bang Ta Wa river mouth and near shore	10/-	- No definite direction	- Indian mackerel - King mackerel - Threadfin bream - Banana prawn	- Indian mackerel = 15 - King mackerel = 70 - Threadfin bream = 15 - Banana prawn = 200 (Medium size)	300	10	5	1,000	300	- Indian mackerel gill net - Crab gill net - Shrimp trammel net	40	- Indian mackerel	- Indian mackerel	- February - March	- Small size of fish
2	BTW 2*	1	10	2	Day	4 hrs. (05.00 a.m. - 09.00 a.m.)	Whole year (except Friday)	- Indian mackerel gill net - Crab gill net - Mullet gill net	- Bang Ta Wa river mouth and near shore	-/10	- No definite direction	- Indian mackerel - Mullet - Blue swimming crab	- Indian mackerel = 6-7 - Mullet = 8-10 - Blue swimming crab • Large = 70-80 • Medium = 30 • Small = 25	100	30-50	15-20	2,000	500	- Crab gill net - Shrimp trammel net	200	- Indian mackerel - Mullet	- Croaker	- December	- Decline of fishery productivity because of trawl net and push net
3	BTW 3*	1	14	1-2	Day	3 hrs. (03.00 a.m. - 06.00 a.m.)	Whole year (except Friday)	- Crab gill net - Indo-Pacific mackerel gill net	- Bang Ta Wa river mouth and near shore	-/20-30	- No definite direction	- Indo-Pacific mackerel - Blue swimming crab	- Indo-Pacific mackerel = 5-15 - Blue swimming crab • Large = 100 • Medium = 75 • Small = 45	300-400	100	0	15,000	1,000	- Crab gill net - Shrimp trammel net - Otter board trawl - Push net with engine - Hand push net	400-600	- Croaker - Indian mackerel	- Croaker - Indian mackere	- December - December	- Decline of fishery productivity because of trawl net and push net
4	BTW 4*	1	7.5	3	Day	4 hrs. (05.00 a.m. - 09.00 a.m.)	Whole year (except Friday)	- Croaker gill net	- Bang Ta Wa river mouth and near shore	30/-	- No definite direction	- Croaker	- Croaker = 30-35	500	100	50	400-500	300	- Crab gill net - Shrimp trammel net - Otter board trawl	200-300	- Croaker - Indian mackerel	- Croaker - Indian mackere	- November - December - December - January	- Decline of fishery productivity because of trawl net and push net
5	BTW 5*	1	9	1	Day	6 hrs. (06.00 a.m. - 12.00 a.m.)	Whole year (except Friday)	- Crab gill net - Croaker gill net - Ivory shell trap	- Bang Ta Wa river mouth and near shore	1.5/5	- No definite direction	- Croaker - Blue swimming crab - Ivory shell	- Croaker • Large = 35-40 • Small = 15 - Blue swimming crab • Large = 105 • Medium = 80 • Small = 40-45 - Ivory shell = 70	100	30	5-10	1,500	250	- Shrimp trammel net - Indian Mackerel gill net	200	- Banana prawn - Croaker	-	-	-
6	BTW 6*	1	10	2	Day	5 hrs. (05.00 a.m. - 10.00 a.m.)	Whole year (except Friday)	- Indo-Pacific mackerel gill net - Shrimp trammel net	- Bang Ta Wa river mouth and near shore	10/-	- No definite direction	- Indo-Pacific mackerel - Banana prawn - Croaker	- Indo-Pacific mackerel • Large = 25 • Medium = 15 - Banana prawn = 400-500 - Croaker = 25-30	300	20-30	5-10	500	150	- Shrimp trammel net	100	- Banana prawn	- Indian mackere	- March	- Oil for boat is expensive
7	BTW 7*	1	10	2	Day and Night	1 day (10.00 a.m. - 09.00 a.m.)	Whole year (except Friday)	- Indian mackerel gill net - Crab gill net - Shrimp trammel net	- Bang Ta Wa river mouth and near shore	-/10	- No definite direction	- Indo-Pacific mackerel - Croaker - Blue swimming crab	- Indian mackerel = 8 - Croaker = 10 - Blue swimming crab • Large = 30 • Small = 25	100	30	10	800	200	- Crab gill net - Shrimp trammel net - Push net	100	- Indian mackerel	-	-	- Distance of fishing is farther last year
8	BTW 8*	1	10	3	Day	9 hrs. (03.00 a.m. - 12.00 a.m.)	Whole year (except Friday)	- Sand whiting gill net - Indo-Pacific mackerel gill net	- Bang Ta Wa river mouth and near shore	20/10	- No definite direction	- Threadfin bream - Indo-Pacific mackerel - Blue swimming crab	- Threadfin bream • Large = 70 • Small = 50-60 - Indo-Pacific mackerel = 30 - Blue swimming crab • Large = 100 • Small = 50-60	200	30-40	10	10,000	500-1,000	- Crab gill net - Shrimp trammel net - Indian mackerel gill net	100	- Indian mackerel - Banana prawn - Blue swimming crab	-	-	- Distance of fishing is farther last year
9	BTW 9*	1	6.5	3	Day	11 hrs. (02.00 a.m. - 01.00 p.m.)	Whole year (except Friday)	- Indian mackerel gill net - Crab gill net	- Bang Ta Wa river mouth and near shore	50/-	- No definite direction	- Indian mackerel - King mackerel - Threadfin bream - Blue swimming crab	- Indian mackerel = 20 - King mackerel • Large = 100 - Threadfin bream = 60-80 - Blue swimming crab • Large = 120 • Small = 50	300	70-80	50	12,000	2,000	- Crab gill net - Shrimp trammel net - Ivory shell trap	60-90	- Banana prawn	- Indian mackere	- March	- Distance of fishing is farther last year
10	BTW 10*	1	7-8	3	Day	9 hrs. (03.00 a.m. - 12.00 a.m.)	Whole year (except Friday)	- Crab gill net - Indian mackerel gill net	- Bang Ta Wa river mouth and near shore	30/-	- No definite direction	- Indian mackerel - Blue swimming crab	- Indian mackerel • Large = 15-20 • Small = 7-10 - Blue swimming crab • Large = 120 • Small = 70	500	50-60	5-10	10,000	350	- Crab gill net - Shrimp trammel net - Indian mackerel gill net	100	- Indian mackerel - Blue swimming crab - Banana prawn	- Indian mackere	- December	-
11	BTW 11*	1	8	3	Day	7 hrs. (05.00 a.m. - 12.00 a.m.)	Whole year (except Friday)	- Crab gill net - Indian mackerel gill net	- Bang Ta Wa river mouth and near shore	20/-	- No definite direction	- Indian mackerel - Blue swimming crab	- Indian mackerel = 13 - Blue swimming crab • Large = 100 • Small = 50	1,000	70-80	20-30	8,000	4,000	- Crab gill net - Indian mackerel gill net	60	- Indian mackerel - Blue swimming crab	-	-	- Small size of fish

Table 5.3.1-2 Information of Fishery Activities in Bang Ta Wa (Cont'd)

No.		No. of Boat	Fishing Boat		Fishing Period			Fishing Gear	Main Fishing Ground					Catch / Trip (kg.)			Economic		Fishery Activity within 3 km. from the Shore			Spawning Species		Remark
			Size (m.)	No. of Crew	Duration	Period / Trip	Season		Location	Distance (km.)/ Depth (m.)	Direction	Main Species Caught	Price (baht/kg)	Max.	Avg.	Min.	Income (baht/trip)	Cost (baht/trip)	Type	No. of Fishermen	Main Species Found	Species	Period	
12	BTW 12*	1	10	2	Day	8 hrs. (04.00 a.m. - 12.00 a.m.)	Whole year (except Friday)	- Crab gill net - Indian mackerel gill net	- Bang Ta Wa river mouth and near shore	20/-	- No definite direction	- Indian mackerel - Blue swimming crab	- Indian mackerel = 15 - Blue swimming crab • Large = 100 • Small = 50-70	500	100	10	5,000	1,000	- Crab gill net - Indian mackerel gill net	100	- Blue swimming crab - Indian mackerel	-	-	- Low fishery productivity
13	BTW 13*	1	6	3	Day	8 hrs. (04.00 a.m. - 12.00 a.m.)	February - October	- Crab gill net - Indian mackerel gill net	- Bang Ta Wa river mouth and near shore	-/20	- No definite direction	- Indian mackerel - King mackerel - Croaker - Blue swimming crab	- Indian mackerel • Medium = 10 • Large = 20 - King mackerel = 60 - Croaker = 40 - Blue swimming crab = 100	150	40-50	0-5	2,500 - 3,000	500	- Crab gill net - Shrimp trammel net - Indian mackerel gill net	200	- Banana pram - Blue swimming crab	-	-	- Oil for boat is expensive
14	BTW 14**	1	10	3	Day	11 hrs. (03.00 a.m. - 02.00 p.m.)	Whole year	- Indian mackerel - Crab gill net	- Bang Ta Wa river mouth and near shore	20/-	- No definite direction	- Indian mackerel - Blue swimming crab	- Indian mackerel = 20 - Blue swimming crab • Large = 80 • Medium = 60 • Small = 40	50-70	5-10	2-5	1,000	500	- Crab gill net - Shrimp trammel net - Indian mackerel gill net	150	- Indian mackerel - Banana prawn	-	-	- Decline of fishery productivity because of trawl net and push net
15	BTW 15*	1	12	3-4	Day	10 hrs. (03.00 a.m. - 01.00 p.m.)	Whole year (except Friday)	- Indo-Pacific mackerel gill net - Indo-Pacific mackerel encircling gill net	- Bang Ta Wa river mouth and near shore	20/20-25	- No definite direction	- Indian mackerel - Threadfin bream	- Indian mackerel = 15-20 - Threadfin bream = 50-65	150	40-50	0-3	500-1,000	300	- Crab gill net - Shrimp trammel net - Otter board trawl - Push net with and engine - Hand push net	50-100	- Indian mackerel - Croaker	- Croaker	- December	- Decline of fishery productivity because of trawl net and push net

Remark:
- * = Own fishing
- ** = Fishing labour
- BPE = Fishermen at Ban Pak Bang (Ban Pak Nam Thepha)
- Size of boat : Large boat > 18 m., Medium boat = 10-17 m., Small boat < 10 m.

Table 5.3.1-3 Species of Aquatic Life Caught by Fishermen in Thepha and Bang Ta Wa

Scientific Name	Common Name	Ban Pak Bang			Ban Bang Ta Wa			Type of Habitat
		Thepha River Mouth	Within 3 km from the Shore	Within 50 km from the Shore	Bang Ta Wa River Mouth	Within 3 km from the Shore	Within 50 km from the Shore	
1. FISH								
1.1 *Rasterlliger brachysoma*	Indo-Pacific mackerel	-	X	X	-	-	X	- Pelagic coastal water
1.2 *Rasterlliger kanagurta*	Indian mackerel	-	X	X	-	X	X	- Pelagic coastal water
1.3 *Stolephorus* spp.	Anchovy	-	-	X	-	-	-	- Pelagic coastal water
1.4 *Scomberomorus* spp.	King mackerel	-	-	X	-	-	X	- Pelagic coastal water
1.5 *Namipterus* spp.	Threadfin bream	-	X	X	-	-	X	- Bethic coastal water and sandy bottom
1.6 *Sillago* spp.	Sand whiting	X	X	X	-	-	-	- Bethic coastal water and sandy bottom
1.7 *Priacanthus tayenus*	Purple-spotted bigeye	X	X	X	-	-	-	- Inshore and off-shore reef
1.8 *Otolithes ruber*	Croaker	X	X	X	X	X	X	- Shallow coastal water over mud banks
1.9 *Andodontosoma chacunda*	Sardine	-	X	X	-	-	-	- Pelagic coastal water
1.10 *Moolgarda* spp.	Mullet	X	X	X	X	X	X	- Coastal water enter river estuary
1.11 *Parastromateus niger*	Black pomfret	-	X	X	-	-	-	- Pelagic coastal water
1.12 *Pampus argenteus*	Silver pomfret	-	X	X	-	-	-	- Pelagic coastal water
2. CRAB								
2.1 *Portunus pelagicus*	Blue swimming crab	X	X	X	X	X	X	- River mouth, coastal water
2.2 *Charybdis cruciata*	Musk crab	-	-	X	-	-	-	- Benthic coastal water and sandy bottom
3. SHELL								
3.1 *Babylonia areolata*	Ivory shell	-	-	-	X	X	X	- Benthic shallow coastal water
4. SHRIMP								
4.1 *Penaeus merguiensis*	Banana prawn	-	-	-	X	X	X	- Coastal water, enter river, estuary

Remark : X = Caught by fishermen
Species of aquatic life were classified by Mansor et. al.(1997) and Supap et. al. (1997).

Table 5.3.2-1 Species Composition and Abundances of Benthic Organisms in Thepha

Phylum / Family	Abundance (Individuals / sq.m.)					
	ST.1 (River Mouth)	ST.2 (River Mouth)	ST.3 (Off-shore)	ST.4 (Off-shore)	ST.5 (Off-shore)	ST.6 (Off-shore)
PHYLUM ANNELIDA						
Family Nereidae	44	44	220	176	88	1,760
Family Glyceridae	-	-	-	-	-	176
Family Cossuridae	176	88	440	-	308	176
Family Capitellidae	-	-	396	44	308	-
Family Magelonidae	-	-	352	88	748	-
Family Maldanidae	-	-	-	-	220	-
Sub-total	220	132	1,408	308	1,672	2,112
PHYLUM ARTHROPODA						
Order Copepoda	-	-	-	132	-	-
Order Isopoda	-	-	-	-	132	-
Family Diogenidae (Hermit crab)	-	44	-	44	-	-
Family Talitridae	-	-	44	220	44	352
Family Sergestidae (Sergested shrimp)	220	-	-	-	44	-
Family Apseudidae	-	-	-	44	-	-
Family Penaeidae (Shrimp larvae)	-	-	-	-	-	352
Sub-total	220	44	44	440	220	704
PHYLUM SIPUNCULIDA						
Peanut worms*	-	-	-	-	44	132
Sub-total	-	-	-	-	44	132
PHYLUM MOLLUSCA						
Class Bivalvia						
Family Mactridae (*Mactra* sp.)	44	-	132	-	484	44
Family Tellinidae (*Tellina* sp.)	-	132	44	-	-	-
Family Donacidae (*Donas* sp.)	44	176	220	-	132	-
Class Gastropoda						
Family Planaxidae (*Planaxis* sp.)	-	44	-	-	-	-
Sub-total	88	352	396	-	616	44
Grand Total	528	528	1,848	748	2,552	2,992

Remark : * Unidentified

In each sampling station comprised 5 composit grab samples.

- Abundance of benthos at station 1 (ST.1 - ST.1.4) was ranging from 44-176 individuals/sq.m.
- Abundance of benthos at station 2 (ST.2 - ST.2.4) was equal to 132 individuals/sq.m.
- Abundance of benthos at station 3 (ST.3 - ST.3.4) was ranging from 88-748 individuals/sq.m.
- Abundance of benthos at station 4 (ST.4 - ST.4.4) was ranging from 88-264 individuals/sq.m.
- Abundance of benthos at station 5 (ST.5 - ST.5.4) was ranging from 264-792 individuals/sq.m.
- Abundance of benthos at station 6 (ST.6 - ST.6.4) was ranging from 220-968 individuals/sq.m.

Source : Field Survey by TEAM Consulting Engineering and Management Co., Ltd., 30 March 2001

TABLE 5.3.2-2 Species Composition and Abundance of Benthic Organisms in Bang Ta Wa

Phylum / Family	Abundance (Individuals / sq.m.)				
	ST.1 (River Mouth)	ST.2 (River Mouth)	ST.3 (Off-shore)	ST.4 (Off-shore)	ST.5 (Off-shore)
PHYLUM ANNELIDA					
Family Nereidae	396	440	176	308	-
Family Glyceridae	-	-	44	-	-
Family Cossuridae	-	-	880	-	-
Family Capitellidae	88	44	44	1,276	352
Sub-total	484	484	1,144	1,584	352
PHYLUM ARTHROPODA					
Family Apseudidae	264	44	-	-	-
Family Diogenidae (Hermit crab)	44	-	-	-	-
Family Talitridae	6,204	616	88	264	88
Family Penaeidae (Shrimp larvae)	264	132	-	-	-
Sub-total	6,776	792	88	264	88
PHYLUM MOLLUSCA					
Class Bivalvia					
Family Mactridae (*Mactra* sp.)	-	-	352	-	132
Family Tellinidae (*Tellina* sp.)	-	-	264	44	88
Family Donacidae (*Donax* sp.)	-	-	132	88	44
Family Arcidae (*Anadara* sp.)	-	-	-	572	264
Class Gastropoda					
Family Thiaridae (*Sermyla* sp.)	12,320	6,380	-	-	-
Family Potamididae (*Faunus* sp.)	88	-	-	-	-
Family Neritidae (*Neritina* sp.)	44	-	-	-	-
Family Planaxidae (*Planaxis* sp.)	-	-	-	44	308
Sub-total	12,452	6,380	748	748	836
Grand Total	19,712	7,656	1,980	2,596	1,276

Remark : In each sampling station comprised 5 composit grab samples.

- Abundance of benthos at station 1 (ST.1 - ST.1.4) was ranging from 1,320-8,844 individuals/sq.m.
- Abundance of benthos at station 2 (ST.2 - ST.2.4) was ranging from 88-5,720 individuals/sq.m.
- Abundance of benthos at station 3 (ST.3 - ST.3.4) was ranging from 88-836 individuals/sq.m.
- Abundance of benthos at station 4 (ST.4 - ST.4.4) was ranging from 220-968 individuals/sq.m.
- Abundance of benthos at station 5 (ST.5 - ST.5.4) was ranging from 176-352 individuals/sq.m.

Source : Field Survey by TEAM Consulting Engineering and Management Co., Ltd., 31 March 2001

Table 5.3.3-1 Identification and Relative Abundance Percentages of Algae In Thepha and Bang Ta Wa

Station No.	Taxonomic Details	% Relative Abundance	% Coverage	Remark
THEPHA AREA				
No. 1 : General	- D = Cyanophata, O = Nostocales, F = Oscillatoriaceae, G = Lyngbya - D = Chlorophyta, O = Ulotrichales, F = Microsporaceae, G = Microspora	-	-	• Only found on the root of Nipa palm
Low	-	-	-	Nothing found
Medium	-	-	-	
High	-	-	-	
No.2 : General	- D = Chlorophyta, O = Ulvalves, F = Ulvaceae, G = Enteromorpha - D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	-	-	• Only found on the old log installed at the shoreline
Low	-	-	-	Nothing found
Medium	-	-	-	
High	-	-	-	
No.3 : Low	-	-	-	Nothing found
Medium	-	-	-	
High	- D = Cyanophyta, O = Nostocales, F = Oscillatoriaceae, G = Oscillatoria	100	5	• Attached to the barnacle
No.4 : Low	-	-	-	Only found the byssal thrend of green-mussel
Medium	-	-	-	
High	-	-	-	• Only shell was found
No.5 : Low	-	-	-	
Medium	- D = Chlorophata, O = Cladophorales, F = Cladophoraceae, G = Cladophora	50	40	• Attached to the green mussel
	- D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	50	40	
High	- D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	100	20	• Found on the shell
No. 6 : Low	-	-	-	• Nothing found
Medium	- D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	100	55	Found on the rock
High	- D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	100	50	
No. 7 : Low	-	-	-	• Nothing found
Medium	- D = Chlorophyta, O = Ulvalves, F = Monostromataceae, G = Monostroma	100	66	Found on the rock
High	- D = Chlorophyta, O = Ulvalves, F = Monostromataceae, G = Monostroma	100	1	
No.8 : Low	-	-	-	• Nothing found
Medium	- D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	100	73	Found on the rock
High	- D = Rhodophyta, O = Ceramiales, F = Rhodomelaceae, G = Polysiphonia	100	20	
BANG TA WA AREA				
No.1 : Low	-	-	-	• Nothing found
Medium	- D = Chlorophyta, O = Cladophorales, F = Cladophoraceae, G = Chaetomorpha	100	7.3	• Found on the bank
High	-	-	-	• Nothing found
No.2 : General	-	-	-	Nothing found and bad condition due to effluent from village and shrimp farm are presented
Low	-	-	-	
Medium	-	-	-	
High	-	-	-	
No.3 : General	- D = Chlorophyta, O = Ulvales, F = Ulvaceae, G = Enteromorpha	-	-	• Only found on the rock
Low	-	-	-	Nothing found
Medium	-	-	-	
High	-	-	-	

Remark : D = Division, O = Order , F = Family, G = Genus