

TOURISM AUTHORITY OF THAILAND



A STUDY ON CARRYING CAPACITY FOR TOURISM DEVELOPMENT OF KO PHI PHI

EXECUTIVE SUMMARY



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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

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**A STUDY ON CARRYING CAPACITY
FOR TOURISM DEVELOPMENT
OF KO PHI PHI**

BY

**THAILAND INSTITUTE OF SCIENTIFIC AND
TECHNOLOGICAL RESEARCH**

15 DECEMBER 1992



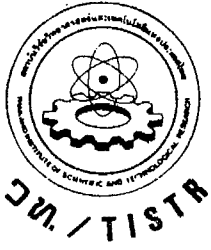
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สถาบันวิจัยวิทยาศาสตร์และเทคโนโลยีแห่งประเทศไทย

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การพัฒนาการท่องเที่ยวของแหล่งท่องเที่ยว เกาะพีพี

เรียน ผู้ว่าการการท่องเที่ยวแห่งประเทศไทย

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การท่องเที่ยวแห่งประเทศไทย กับ สถาบันวิจัยวิทยาศาสตร์และเทคโนโลยีแห่งประเทศไทย

สิ่งที่ส่งมาด้วย รายงานขั้นสุดท้ายการศึกษาขีดความสามารถในการรองรับการพัฒนา

การท่องเที่ยวของแหล่งท่องเที่ยว เกาะพีพี จำนวน 200 ชุด

ตามที่สถาบันวิจัยวิทยาศาสตร์และเทคโนโลยีแห่งประเทศไทย (วท.) ได้รับ

มอบหมายจากการท่องเที่ยวแห่งประเทศไทย (ททท.) ให้ศึกษาขีดความสามารถในการรองรับ

การพัฒนาการท่องเที่ยว เกาะพีพี ดังรายละเอียดในสัญญาที่อ้างถึง นั้น

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PREFACE

"A Study on Carrying Capacity for Tourism Development of Ko Phi Phi" has been conducted by Thailand Institute of Scientific and Technological Research (TISTR) since September 27, 1991, under the contract sponsored by Tourism Authority of Thailand (TAT).

The study has focused its attention on analysis of tourism situation on Mu Ko Phi Phi one of the most famous natural marine tourist destinations of Thailand's Andaman Sea. Tourism magnitude of Mu Ko Phi Phi, so far, has rapidly expanded, with a tendency of following serious impacts on the islands' environment, and with a greater pace than the governmental agencies concerned can chase up to provide the basic public needs and facilities. As a result, Ko Phi Phi now is facing the problems of untidiness (from high density and dirty environment due to polluting matters), and deteriorating scenic beauty because of unplanned and haphazardous development. Appropriate measures to cope with those undesirable development, therefore, are badly in need of. And the carrying capacity level of the tourist destination is envisaged to be a determinant capable to indicate the should-be suitable development level -- the underlying rationale that motivates TAT to initiate this study project.

In the study, TISTR has reviewed and analyzed data from various sources before finding out the suitable level of carrying capacity. Besides, numerous recommendations also have been made on pattern, direction, and projects of development that should be carried out in the course of Ko Phi Phi's tourism development.

In this executive summary, the concise contents of the study have been presented, including the introduction, study's basic concept, Ko Phi Phi's tourism situation, estimation of carrying capacity level, and management guidelines, together with table on operation plan of Mu Ko Phi Phi's tourism development.

The attempt to integrate a research and planning together into this study has been made in a considerate extent within the available time-frame. Emphasis also is given to data sources and opinion of the local people. Especially, the study has been revised and added in some aspects gathered from the proceedings of the seminar organize in the locality of November 26, 1992. Therefore, the study team believes that the end product from this study will be correct and clear, and able to be used as a tourism development guidelines for the days to come. In addition, the TISTR study team fully hopes that the agencies, organizations and individuals concerned may widely take the results of this study to use or adapt in their interests in the near future, which eventually leads to a positive outcomes of environmental conservation and sustainable tourism of Ko Phi Phi.

ACKNOWLEDGEMENT

In carrying out "A Study on Carrying Capacity for Tourism Development of Ko Phi Phi", the team from Thailand Institute of Scientific and Technological Research (TISTR) has received the best cooperation from individuals, groups and organizations concerned, especially those on Ko Phi Phi and in Krabi Province, who gave a full support on informations, opinions, facilities, as well as useful recommendations to the study mission.

The TISTR study team would like to extend our sincere gratitudes to the organizations which render to us various informations and opinions, including Krabi Provincial Office, Krabi Provincial Tourism Business Club, Muang Krabi District, Lands Office of Muang Krabi District, Hat Nobpharat Thara-Mu Ko Phi Phi National Park, Public Works Office of Krabi Province, Ko Phi Phi's Tourism Business Club, Tourism Authority of Thailand's Phuket Office, Ko Phi Phi's Management Committee, Ko Phi Phi Protection Group, and Phuket Marine Biological Center.

For individuals and groups, the TISTR team felt impressed and would like to heartfully thank for cooperations in giving informations and facilitating the team, to the operators of hotels, bungalows, guesthouses, passenger boats, restaurants, shops on Ko Phi Phi, and the tourists, both Thai and foreigners. The team deeply appreciates the assistances of Mr. Upparit Srichan, former Chief of Krabi Provincial Office; Mr. Udon Noitabtim, former Planning Section Chief of Krabi Provincial Office; Mr. Phairoj Sootthakorn, Chief of Lands Office in Muang Krabi District; Mr. Manop Kongkaewriep, Village 7 headman of Ao Nang Sub-district; Mr. Loh Boonsom, Vice Chairman of Ko Phi Phi's Management Committee; Mr. Wan Meng-iad, Ko Phi Phi's Management Committee member, and several others who we cannot name names, as well as those who attended the public hearing seminar on November 26, 1992.

Lastly, the TISTR would like to express our utmost thanks to the Tourism Authority of Thailand in bestowing reliances upon us to conduct this study, as well as the project committees, the counterparts and TAT officials who gave useful advices and recommendations since the start till the complete success of the study.

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GLOSSARY

Ao	=	Bay
baht	=	Basic unit of Thai currency apx. 25.15 baht = 1 US.\$ (1992)
Hat	=	Beach
Ko	=	Island
Laem	=	Cape
Mu Ko	=	Archipelago Group of islands.
Rai	=	unit of area (1 rai = 1,600 sq. m.) or = 0.395 acre)
Tham	=	Cave

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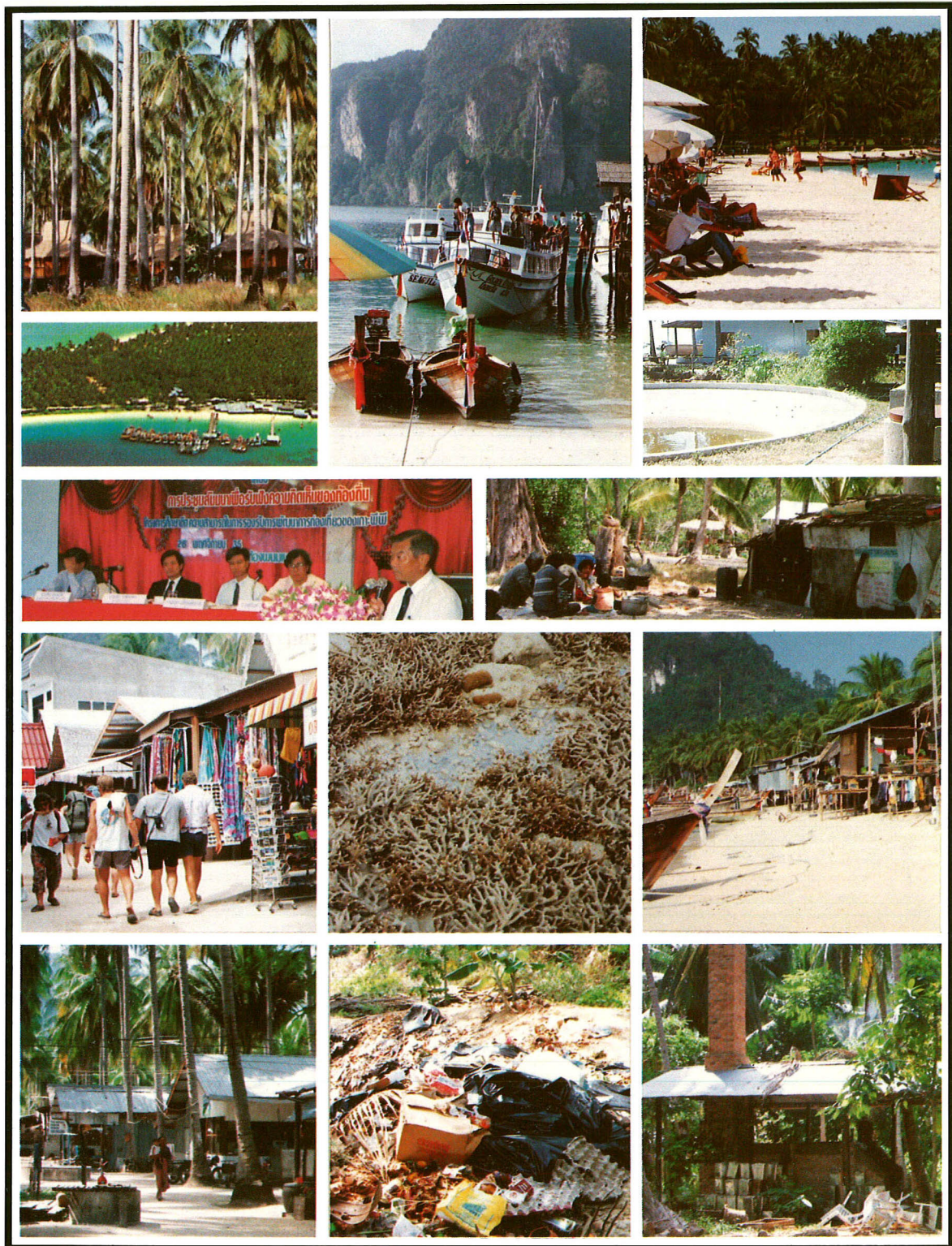
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A STUDY ON CARRYING CAPACITY FOR TOURISM DEVELOPMENT OF KO PHI PHI

1. INTRODUCTION

The Tourism Authority of Thailand (TAT) had assigned Thailand Institute of Scientific and Technological Research (TISTR) to conduct the project "A Study on Carrying Capacity for Tourism Development of Ko Phi Phi" in order to find out the appropriate level for tourism development of Phi Phi archipelago (Mu Ko Phi Phi). The underlying objectives of this study include :

1) To study and to give recommendation of a suitable tourism development carrying capacity level of the major tourism attractions on Mu Ko Phi Phi considering from physical, environmental, economic as well as social aspects.

2) To determine the equilibrium of infrastructure and tourism services quantities in accordance with the recommended carrying capacity level.

3) To formulate guidelines and measures aiming to curb the visiting tourist volume to the level which will not jeopardize the tourist attractions' values.

4) To recommend some guidelines on how to apply the study's results in follow-up planning and measures setting to cope with the existing problems or to prevent the problems from occurring.

5) To draft a practical operation plan consisting of projects to be undertaken by TAT and the core agencies concerned, compatible with the islands' carrying capacity level, beneficial to the economic and social condition, and in harmony with environment.

The project area covers Mu Ko Phi Phi in Muang Krabi District, Krabi Province, which consists of 6 islands; namely Phi Phi Don, Phi Phi Le, Bida Nok, Bida Nai, Phai and Yung, totaling about 11.2 sq.km. of area. However, the emphasizes are given to the major attractions receiving a large number of tourists which are, for instance, Ao Ton Sai - Ao Lo Da Lam, others Ao and beaches on Ko Phi Phi Don, Tham Viking and Ao Maya on Ko Phi Phi Le, and the scattering coral reefs diving sites.

2. BASIC CONCEPT

2.1 Carrying Capacity for Tourism Development

Carrying capacity for tourism development means the optimum area utilization which that particular area can shoulder before its degradation takes place. The carrying capacity level can be measured by the maximum number of tourists being allowed to stay full-time on one specific place (for Ko Phi Phi in this case), affecting the surrounding environment to the least and still being able to preserve the quality of attractions to the most. Under this context, the tourists still should be suitably served and satisfied while the development of infrastructures, public utilities, and services must not disturb the local people's basic necessary services and attitudes.

The concept of carrying capacity is therefore believed to be used as an effective tool to enhance the tourism standard and extent which eventually will lead to the destruction of environment as less as possible.

The carrying capacity level may relatively vary and differ according to types of attractions, activities, time and place. Still, the carrying capacity level also will change due to criteria and factors to be taken for consideration for instance, land area, water consumption demand, wastes discharge, scenic beauty preservation, as well as the tourists' satisfaction. In addition, chances and capability for management (like policy, administration, technology, budget), for control and prevention of impacts from the increasing number of tourists (on the existing environment and tourist attraction's image) also have influences on the carrying capacity level.

Carrying capacity may be classified into 4 types or aspects, including physical carrying capacity, environmental carrying capacity, social carrying capacity, and economic carrying capacity.

2.2 Principle in Determining Carrying Capacity for Tourism Development Level

The factors which determine the carrying capacity level may include everything ranging from tourist attractions and environment which will be affected by tourism and subsequently be a constraint or hindrance of tourism development or other kinds of development related both directly and indirectly with human beings. Therefore, in each or many considerations, various levels of carrying capacity may be found due to numerous factors taken for granted. The critical level pertaining insoluble or hardest to solve problem will eventually be chosen. However, in the final step, each carrying capacity level will have its respective condition attached. When any individual factor which is related to other factors changes, the carrying capacity level may also change accordingly. In this sense, the management will play

a significant role. Therefore, the best, most suitable and practical management must also be taken as a determining factor.

Usually, the carrying capacity level which should be chosen will be the lowest one or the level which has lowest utilization endurance. But in practical or empirical sense of development, it is thought that there is no any single investment without lost. The matter concerned is only whether the returns from that investment is worthwhile or not. Therefore, the criterion or factor which is chosen to be determinant of suitable carrying capacity level must be the one which is the most significant or leading factor. If it is a sensitive or fragile factor, it should also have potentiality or possibility of increasing significance.

Measurement criteria of carrying capacity level has variation according to types of tourist attractions, local condition, tourist market and many measuring components. Measurement criteria may be roughly classified into 2 groups - statistically measurable and unmeasurable groups. Unit of measurement may be related to time, open space, ratio of tourist uses and etc.

In summary, it may conclude that number of tourists with service area or service capability of facilities are mostly used criteria, by considering from the tourists' basic needs which eventually will help to determine tourism carrying capacity (interpreted into tourist number)

2.3 Study Focus for the Case of Ko Phi Phi

Due to tourism boom since 1985 onward, Ko Phi Phi has faced numerous problems ranging from tourism concentration, pollution, and environmental degradation. The major agencies concerned like Krabi Province, Hat Nopharat Thara-Mu Ko Phi Phi National Park, and TAT all try to solve the problems and act within the existing development frameworks, namely Tourism Development Master Plan of Krabi Province, the National Park Development Plan (Second Phase), and policy framework of TAT. This study on tourism development carrying capacity of Ko Phi Phi is instructed to gear towards the main target of decelerating the island's tourism growth. The major factors taken for accounts in the study's analysis therefore will relate and reflect the problems concerning tourist volume, either directly or indirectly, which consist of :

- Scenery and aesthetic values, meaning natural condition, structures and building appearances, community condition, as well as tourist behaviors which may affect Ko Phi Phi's image;
- Water supply, meaning water shortage which may hamper tourist services;
- Water pollution caused by waste water discharge which affects marine lives and tourism system;
- Garbage and sanitary factor;
- Ecological disturbance especially coral reefs which are prime tourist magnets;

- Attitudes towards and conflicts between local residents, tourists and entrepreneurs;
- Service quality which is still not up to standard;
- Increasing service prices which will affect the tourists; satisfaction.

After comparison, the factor which has most significance will be chosen as standard determinant of the island's carrying capacity level.

2.4 Study's Methodology

The process of this study is started by reviewing all the related literatures and analyzing the existing service capacities as well as potential tourism resources of the island. Results of the analysis will be used for demarcation of Ko Phi Phi's tourist territorial thresholds in conjunction with quantitative thresholds of various considered factors. End products from this stage will go through threshold tests by adjusting standards and determinants of carrying capacity of various factors in compatible with tourism resources condition of Ko Phi Phi. Then testing of variation of carrying capacities in numerous new management systems is done in order to find out various new thresholds according to various levels of management condition. Finally, all the acquired carrying capacity levels will go through selection process in order to choose the most suitable level under the most practical or feasible management system. The desirable carrying capacity level then will be determined, while recommendations on how to manage and control the tourism development within the desired level will be done. Action plan also is drafted subsequently.

3. TOURISM SITUATION OF KO PHI PHI

Mu Ko Phi Phi consists of 6 isles including Phi Phi Don, Phi Phi Le, Bida Nok, Bida Nai, Phai and Yung isles, covering a total area of 6,950 rai (11.2 sq.km.). Ko Phi Phi Don is the center of Mu Ko Phi Phi, having 5,880 rai (9.408 sq. km.) or about 84.6% of total archipelago land area. Mu Ko Phi Phi has been enclosed to be a part of Hat Nobpharat Thara - Mu Ko Phi Phi National Park since 1983, because of its natural beauty, archaeological and natural resource endowment which need to be conserved. However, some parts of Ko Phi Phi Don have already been excluded from the national park for local people's residential areas. (Figure 1)

Land feature of Ko Phi Phi is mostly mountainous area, especially steep lime-stone mountains. Some parts of the island are plain land and beautiful beaches. Ko Phi Phi Don has the highest peak of 314 metres above means sea level while Phi Phi Le has 374 metres peak. For maritime features, the average sea depth of the islands are 20 metres, having 34 metres as the deepest bottom. Along the shore lines, abundance of coral reefs can be found surrounding all the isles.

3.1 Tourism Resources and Attractions

Major attractions receiving a large number of tourists comprise of beautiful beaches for sun-bathing and swimming, scenic bays for cruising and sight-seeing, coral reefs for diving and snorkeling. There are picturesque sceneries and view point which the tourists can cruise and climb up to appreciate the beauty. Besides, ancient rock mural painting and swallow nest collecting also are the main interest of the tourists. Distributions of those attractions can be grouped by each island as follow :

Ko Phi Phi Don : Hat Ton Sai, Hat Bo Hin, Hat Yao
Hat Lo Da Lam, Hat Lo Ba Kao,
Hat Lo La Na, Hat Laem Tong, Ao Nui
Ao Wang Long, Tham Wang Long, view point;
coral reefs at Laem Hua Raket, Hin Pao,
Ao Nui, Lo La Na, Laem Tong and Lo Ba Kao

Ko Phi Phi Le : Ao Maya, Ao Pi Le, coral reefs at Ao Maya
and Tham Viking

Ko Phai : beach and coral reefs

Ko Yung, Ko Bida Nok and Ko Bida Nai : coral reefs

Among all the attractions, the ones which receive high popularity from the tourists are Ao Ton Sai, Ao Lo Da Lam, Tham Viking and view point; followed by the group of Hat Bo Hin, Hat Yao, Hat Laem Tong, Hat Maya, Ko Phai's beach and Ao Pi Le.

Land utilization on Mu Ko Phi Phi can be found only on Ko Phi Phi Don which can be classified into residential zone for houses, bungalows and coconut plantation about 831 rai (14.13%), and agricultural zone about 1,014 rai (17.24%); although there are about 1,000 rai area only which possess official land title deeds or land holding documents. The rest are unused forestry areas and irrigation reservoir as shown in Figure 2. The community areas can be found around Ao Ton Sai - Ao Lo Da Lam covering about 243 rai, at Ao Bo Hin and Ao Hat Yao about 88 rai and 83 rai respectively, and at Ao Lo La Na - Ao Lo Ba Kao and Laem Tong area around 179 rai and 111 rai respectively.

From the survey, it is found out that land use for tourism purpose and related services of Ko Phi Phi Don which is the center of archipelago is utilized for tourist accommodations and other services mingled with the community's residences and coconut plantations, accounted for 337 rai of area (about 40.6%) of which 241 rai are hotels and accommodations, 16 rai for shops and market place and 80 rai for living community. This type of land use has a tendency to grow in the future. According to the analysis of land use potentiality, the total areas of 977 rai are classified as suitable zone for tourism development purpose, of which 297 rai are suitable and the other 680 rai are viable areas. Another part of 868 rai is demarcated as a possible reserves for the future development while the rest are rated as unsuitable for uses or for tourism, except for trailing path or view points.

However, this study suggests that the total area that should be used for tourism purpose in the present stage should expand to only 527 rai.

3.2 Tourism Volume

As there was no any statistical data or survey concerning the tourist number visiting Mu Ko Phi Phi in the past, the study therefore has to consider the figures of Phuket and Krabi Provinces' visitor number, in comparison with results of the island's field survey which is done by counting tourist number at the island's pier, beaches and major attractions, as well as interviewing the entrepreneurs and tourists in Phuket and Krabi Provinces.

In summary, the survey and available data indicate that the volume of visitors to Phuket and Krabi Provinces in 1990 altogether accounted for 1.77 million (TAT, 1991). 71% were Phuket visitors and 29% were Krabi visitors. All these visitors can be classified tourists 98% and the rest 2% as excursionists. Share of international tourists to Phuket was bigger than the domestic, but vice versa for Krabi. During 1987-1990, tourism market of Phuket had grown with an average 21.95% annually, with higher growth rate of 30.94% annually for international market and only 12.85% yearly for domestic market. In case of Krabi during the same period, as average of 32.09% annual growth rate was recorded, but no figure available for each market segment.

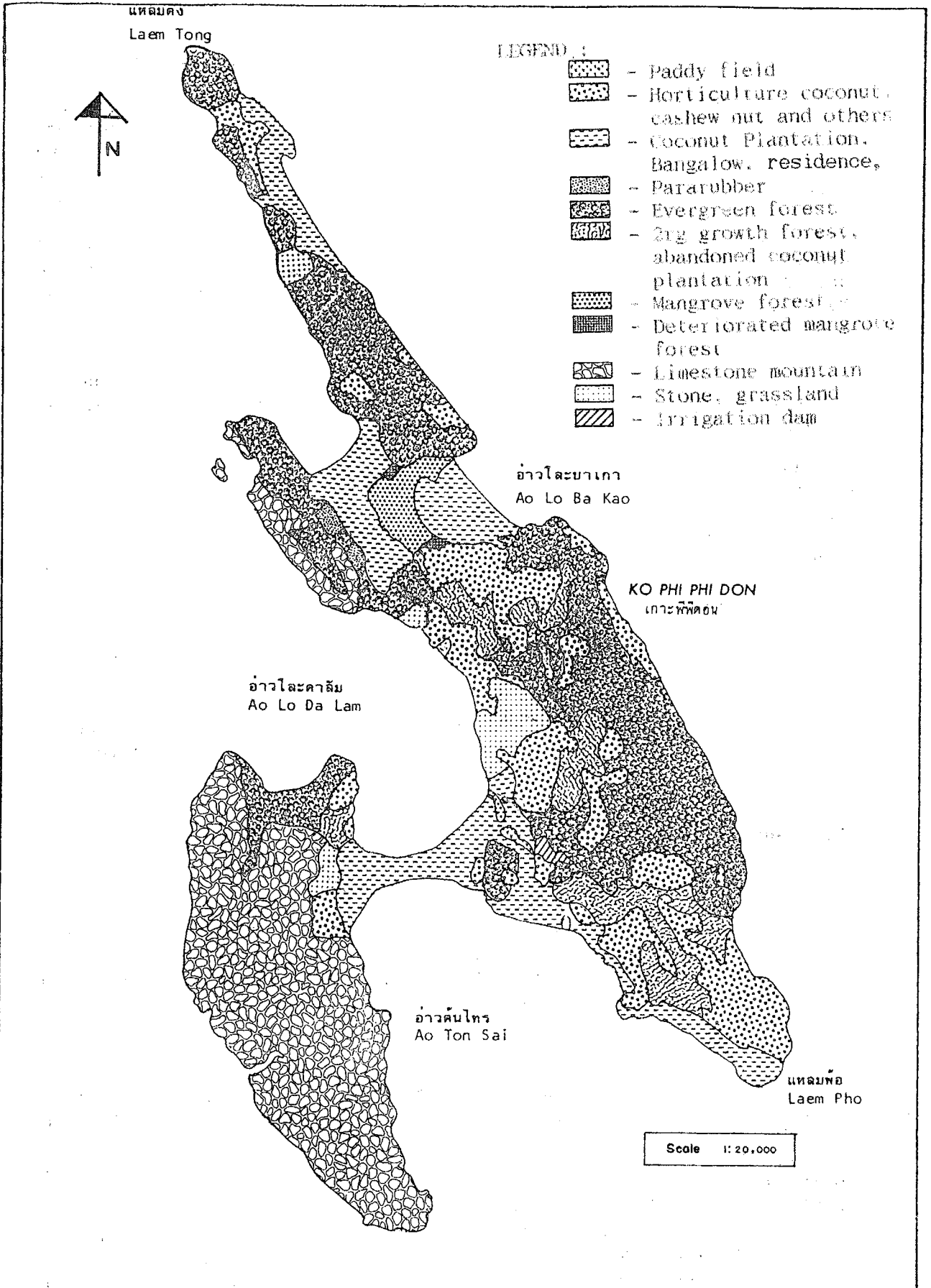


Figure 2 Land Use of Ko Phi Phi Don in 1992

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The tourists visiting Ko Phi Phi mostly came from Phuket and Krabi Provinces. They regarded the island as a sight-seeing or satellite attraction. Therefore, percentage of the island's daily excursionists are quite high. According to the survey in 1991-1992, a total number of 333,181 visitors were estimated for the island, of which 259,996 or 78.03% came from Phuket and 73,185 or 21.97% from Krabi, 167,523 or 49.7% of the total visitors were Thai visitors while the rest 165,658 or 48.7% were foreigners. Most of the visitors from Phuket, about 85.4%, were daily excursionists. But on the contrary, 90.0% of those who came from Krabi were over-night tourists. In overall picture, most of Ko Phi Phi's visitors, about 229,447 or 68.87% were daily excursionists, and the rest of 103,734 or 31.13% over-night tourists (see Figure 3).

Season-wise, Ko Phi Phi has a peak tourist period during December - January, receiving average 1,452 persons daily. During medium season in February - May, and October - November an average 1,043 people visit the island daily while during low season of June - September, average 815 daily visitors are recorded. (Figure 4)

But when accumulated number of tourists staying on the island is taken for granted, counted person-day, it was estimated that the island has received a total of 696,250 person-day annually, or 1,908 person-day daily, meaning there were 1,908 persons being present on the island in each day. However, variations during the tourist seasons can be detected, that is average 3,092 person-day daily in high season, 2,339 person-day daily in medium season, and only 1,042 person-day daily in low season. Area-wise, distribution of tourists to each major popular attraction can be observed that average 919 person-day have visited Hat Ton Sai daily, 231 person-day daily for Hat Yao, and 758 person-day daily for Hat Laem Tong (including Hat Lo Ba Kao) as shown in Table 1.

Ko Phi Phi's visitor volume at Hat Ton Sai can be classified into 276,439 person-day of over-night tourists and 58,991 persons of daily excursionists. The second biggest volume of 106,056 over-night tourists and 170,456 excursionists have visited Laem Tong area. At Hat Yao, only a few excursionists were found, but 84,303 person-day over-night tourists were estimated. The excursionists usually will visit Hat Ton Sai area, Hat Lo Da Lam and Hat Laem Tong for swimming, lunch and strolling in market place according to the tour programme. Besides, they also paid a visit to Tham Viking Ao Pi Le, Ao Maya and popular coral reefs according to the tour programme.

From the available survey figures and Phuket and Krabi Provinces' tourists projection, a forecast on number of Ko Phi Phi's visitors has been made by using the existing 78% and 22% share of tourist origin from Phuket and Krabi Provinces respectively and the same percentage of both Thai and international tourists for both provinces. A projection of total 765,944 and 1,198,412 tourists have been made for the year 2001 and 2011 respectively, (see Table 2). However, share of domestic tourists are expected to a little bit change from 50.28% in 1991 to 46.85% and 45.90% in 2001 and 2011 respectively. Should the island's tourism structure be intact, there will be 4,375 person-day daily tourists and 6,846 person-day daily

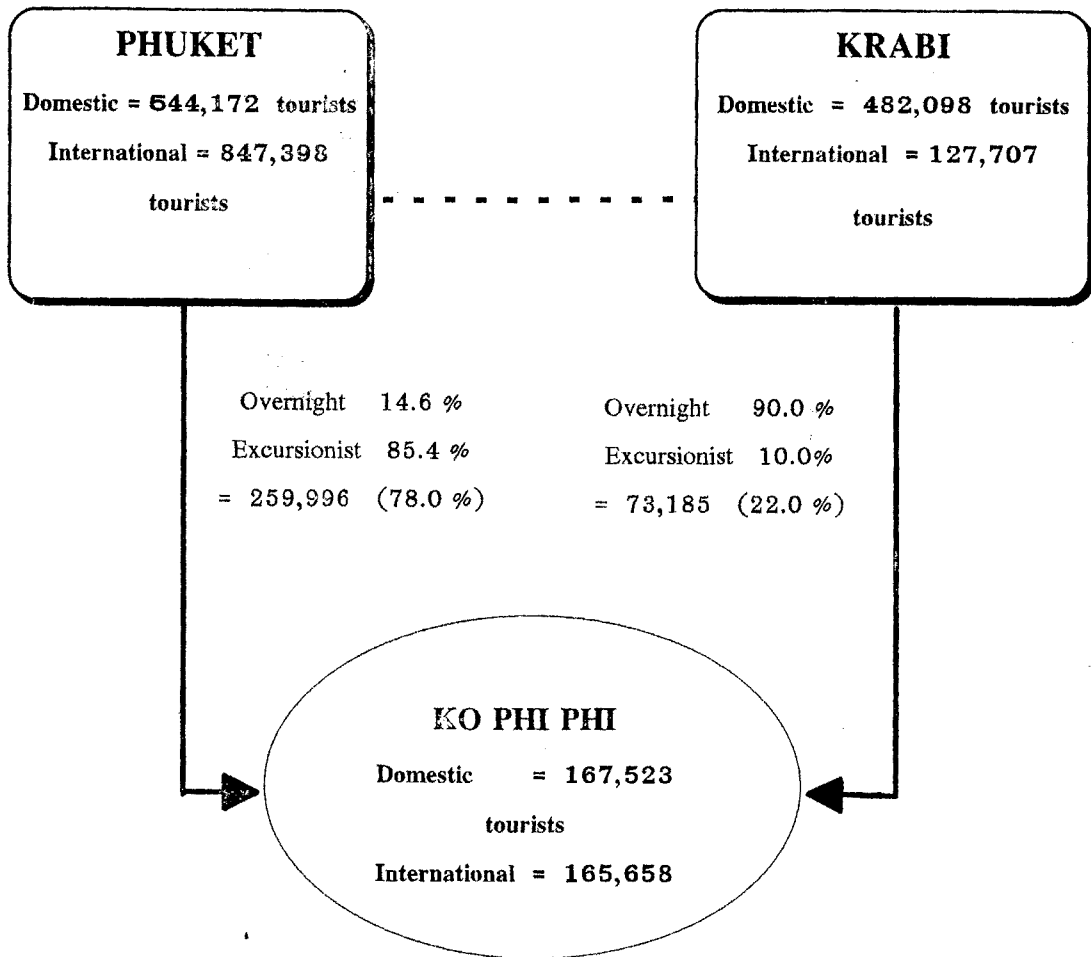


Figure 3 Number of Tourists visitors in Ko Phi Phi : from Phuket and Krabi Provinces

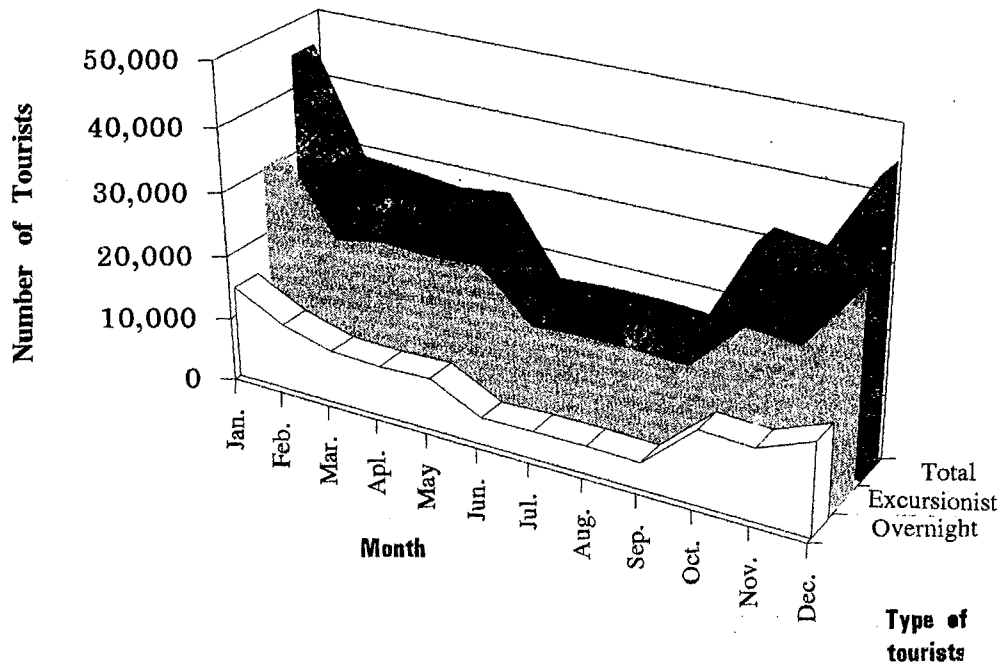


Figure 4 Tourist Season of Ko Phi Phi by month in 1991

Table 1 Distribution of tourists by month in 1991

Month	Ao Ton Sai			Hat Yao			Laem Tong			Total		
	Tourists Excur- sionist night	Person -day /day	Person -day /day	Tourists Excur- sionist night	Person -day /day	Person -day /day	Tourists Excur- sionist night	Person -day /day	Person -day /day	Tourists Excur- sionist night	Person -day /day	Person -day /day
January	7838	8603	46550	1502	11806	381	22648	3300	37500	1210	30485	14527
February	4742	6190	32596	1164	8495	303	13702	2375	24388	871	18444	10452
March	5154	4870	27071	873	6684	216	14893	1869	23302	752	20048	8224
April	4988	4713	26198	873	6468	216	14413	1808	22550	752	19401	7959
May	5154	4870	27071	873	6684	216	14893	1869	23302	752	20048	8224
June	3184	2483	14356	479	3407	114	9199	953	13485	450	12383	4193
July	3290	2566	14835	479	3521	114	9506	984	13935	450	12795	4332
August	3290	2566	14835	479	3521	114	9506	984	13935	450	12795	4332
September	3184	2483	14356	479	3407	114	9199	953	13485	450	12383	4193
October	5250	6853	36089	1164	9405	303	15170	2629	27001	871	20420	11572
November	5081	6632	34925	1164	9101	303	14680	2544	26130	871	19761	11199
December	7838	8603	46550	1502	11806	381	22648	3300	37500	1210	30485	14527
Total	58991	61431	335432	919	84305	231	170456	23568	276514	758	229447	103734
												696250
												1908

Table 2 Forecast number of tourist visiting Ko Phi Phi
in 1992-2011

Year	Domestic		International		Total	
	Number	Rate	Number	Rate	Number	Rate
2534	167,523	-	165,658	-	333,181	-
2535	186,655	11.42	189,794	14.57	376,448	12.99
2536	205,787	10.25	213,936	12.72	419,722	11.50
2537	224,925	9.30	238,068	11.28	462,992	10.31
2538	244,066	8.51	262,208	10.14	506,274	9.35
2539	263,201	7.84	286,357	9.21	549,558	8.55
2540	282,335	7.27	310,497	8.43	592,832	7.87
2541	301,478	6.78	334,654	7.78	636,131	7.30
2542	320,622	6.35	358,782	7.21	679,404	6.80
2543	339,763	5.97	382,928	6.73	722,691	6.37
2544	358,891	5.63	407,053	6.30	765,944	5.99
2545	378,020	5.33	431,191	5.93	809,211	5.65
2546	397,148	5.06	455,338	5.60	852,486	5.35
2547	416,291	4.82	479,470	5.30	895,761	5.08
2548	435,440	4.60	503,588	5.03	939,028	4.83
2549	454,425	4.36	527,710	4.79	982,135	4.59
2550	437,556	4.21	551,826	4.57	1,025,382	4.40
2551	492,688	4.04	575,941	4.37	1,068,629	4.22
2552	511,804	3.88	600,073	4.19	1,111,877	4.05
2553	530,946	3.74	624,196	4.02	1,155,141	3.89
2554	550,060	3.60	648,352	3.87	1,198,412	3.75

Remark : Forecasted by Regression Model

tourists in 2001 and 2011 respectively.

3.3 Accommodation and Services

As the tourist number visiting Ko Phi Phi increases, tourist accommodations and related services on the island also have expanded accordingly. In 1991, there were tourist accommodations ranging from hotel, bungalow and guest-houses altogether 32 establishments, about 1,094 guest-rooms (and another 150 rooms under-construction). Most of the accommodations are situated around Hat Ton Sai-Hat Lo Da Lam, Hat Yao and Hat Laem Tong - Hat Lo Ba Kao, 23, 5 and 4 in number of establishments and 656, 194 and 244 in number of guest-rooms respectively. Room rate is sold in wide range from 80-3,000 baht per day. However, the room rate will be quoted in peak season 2-3 times higher than in low season, during which only 70% of the total establishments are still rendering services.

Other tourist services available include shops and service places totaling 139 places. The major groups consists of 51 food-drink shops or eating places, 16 travel service shops, 14 boutique shops, and 14 diving and angling rental shops. Besides, there are groceries shops, souvenir shops, drug stores, department stores, laundry, gasoline shops, ancient massages, beer bars, snooker club, and show place available, 1-3 places each type.

It is remarkable that 56.25% of all the shops and service places on the island will operate all year round while the rest of 43.75% will do their business during the peak tourist season only. Concerning the ownership aspect, 65.63% of the entrepreneurs are immigrants from other localities, while only 12.5% are the island residents and 21.87% came from Krabi Province. In average, the shops utilize 184.4 sq. m. each for their business. The smallest place occupy only 4 sq. wa while the biggest uses 400 sq. m. Tenancywise, it is found out that as high as 78.13% of all the entrepreneurs are land render. Average rent is 37,179 baht annually per piece of land. Those entrepreneurs who own their lands are made up of 21.87%, all of which 87.5% are island residents, 6.25 living in Krabi Province and another 6.25% living in other provinces.

3.4 Transportation

Travelling to Ko Phi Phi is quite convenient. During the tourist season, there are tourist boat and scheduled passenger boats commuting between Phuket Province and Krabi Province (Ko Lanta District and Ao Nang Sub-district) to Ko Phi Phi in average 2-6 times daily. The landing pier of the island is at Ao Ton Sai (now under renovation). Altogether there are more than 30 boats - both tourist and scheduled passenger boats - serving Ko Phi Phi, 21 of which comes from Phuket and 9 from Krabi. Total loading capacities are 7,066 seats (4,674 seats from Phuket and 2,392 seats from Krabi). In addition, there are 260 long-tailed boats more available for travelling within the Mu Ko Phi Phi.

3.5 Public Utilities and Services

Telecommunications: Ko Phi Phi can get in touch with outside by postal and telephone services, both long distant and inter-continental calls. The services are operated by private investors by using mobile radio and telephones.

Potable water: Most of the drinking water are clean, bottling water which is prevalent and shipped from Phuket and Krabi. On the island there is also one factory bottling clean water for sale. Water for other uses can be acquired from shallow wells which are widely dug. Though water from 3-4 metres deep wells are available all year round, water during dry season usually is salty which is assumed that it is a result of penetrating underground sea water due to more underground water extraction amount than the natural replenishment (from rain) can cope with. Some of the tourist service places therefore resort to buy raw water from Phuket to solve the problem at a price of 120-130 baht per cubic meter. Rain water reserves are another source of water for some entrepreneurs. However, most tourist business enterprises still rely on shallow well water, though its quality is not quite suitable. The government tries to alleviate the problem by Krabi Irrigation Office is constructing 25,000 cubic metres reservoir and 8 circular-shaped dikes capable of storing 30 cubic metres water each scattering on suitable sites all over the island. The project is scheduled to start holding water since the end of 1992.

Electricity : All the business enterprises have to generate electricity for their own uses. But around Ton Sai market, there is a private investor generating electricity for sale by using 2 electricity generators, with 80 and 50 KW capacity, supplying 18 hours electricity during 8.00-2.00 AM to about 50 customers. Other entrepreneurs have to rely on their own generators. It is estimated that all the power supply used within the island is about 2,000 KW per day. But Provincial Electricity Authority still does not have a clear policy on developing or serving power supply to the island yet.

Garbage disposal : Garbage quantity from the area around Ao Ton Sai community which are generated from shops, eating and service places, and residents amounts to 2.2 tons or 15 cubic meter per day. The disposal is carried out by Ko Phi Phi Management Committee. Everyday, garbages will be gathered and collected around 11.0 P.M., then loaded onboard and shipped to be disposed at Muang Krabi Municipality disposal site. For bungalows, each of which will generate garbages around 1.02 kg. or 2.29 liters per guest per day totaling 2.9 cubic meter per day, the entrepreneurs will take care of his own disposal by gathering and burning the garbages from time to time. Some operate for land-fill while others use incinerator. Only a few use the island committee's service. However, left-over wastes and littering still can be found around the island. Krabi Province therefore, is constructing community incinerator capable of burning 3 tons of garbages per day which hopefully will help disposing all the community's garbages in the near future.

3.6 Ecological System

Ko Phi Phi is a part of national park. Most of its terrestrial and maritime territory is proclaimed to be enclosed in the national park which enable to keep the island's ecological system intact. Forest still covers 31% of Ko Phi Phi Don's area, in which more than 67 species of fauna can be found. Forestry condition on other islands also can be preserved to a certain extent. Some of prominent wild lives which can be found include boars, bats, monkeys, frogs, toads, swallows, and mynas. Coral reefs can be found all around the islands, with conditions ranging from perfect to degraded. There are more than 200 species of corals prevalent on both continental shelf level and deep sea (8 - 15 metres). Fish population also are abundant, consisting of karang fish, snakehead mullet, butterfly fish and etc.

Coral is one of the most significant ecological systems tourist attractions and related to tourism mostly. Therefore, diving activities (both scuba diving and snorkeling) are prevailing at Ko Yung, Ko Hin Pae, Ao Maya, Ao Nui and Laem Hua Raket where about 30 official buoys have been installed for tourist boats' uses and marks. Coral reefs coverage area of Ko Phi Phi Don are estimated to be around 405.4 rai, 121 rai for Ko Phi Phi Lay, 40 rai for Ko Yung, and 10.8 rai for Ko Phai. Most of the reefs still are in good quality condition, except around Ko Phi Phi Lay of which 33.6% are damaged and in degraded condition.

All the number of tourists coming to appreciate Ko Phi Phi's corals are estimated to be as much as 333,182 persons or 47.85% of the total visitors. They enjoy the under water beauty using tourist boats, and glass-bottomed boat mostly. About 16-18% use snorkeling and only 1-3% can enjoy scuba diving.

3.7 Administration and Management of Ko Phi Phi's Tourism

Ko Phi Phi is located in Ao Nang Sub-district, Muang District of Krabi Province. And most of its areas are proclaimed to be a part of Hat Nopharat Thara - Mu Ko Phi Phi National Park. The island therefore is under various organization's supervision, like district, sub-district or village administrations, as well as provincial administration and national park. The administration and supervision of the island are facing the problems of insufficient budget, conflicts on land tenant and conflict between national park management and local people living on the island.

In 1991, Krabi Province has set up Ko Phi Phi Development Council comprising of 16 members of representatives and delegates from various provincial offices and private sector. The council is chaired by deputy governor and being in charge of pushing for development and solving problems of the island within the guidelines of Krabi Province's Tourism Development Master Plan. Later, the council has set up Ko Phi Phi Management Committee comprising of 7 members (Most are local residents) and taking care of the island's cleanliness, sanitation, environmental conservation, facilities

provision and safety and security. In practice, the committee has collected money from the entrepreneurs in exchange for the garbage collection services. Besides, the committee also collects maintenance fees from passenger boats (calculated from number of passengers) and long-tailed boats, as well as issues some rules and directives for the community to live together in harmony. However, all the actions of the committee still are in lack of legal backup and facing recognition problem from many people.

Concerning the national park, the entity has full authority according to the legal aspect. But in actual practice, the national park is encountered with land tenancy conflict against the local people. In addition, most of the tourist attractions are out of the national park boundary. So the management cannot be done in due course.

The problems of management aspect can be summed up as follow :

(1) Ko Phi Phi currently is an international famous destination. Utilization of the island's tourism resources is mostly done by the tourists from Phuket, under the business network of Phuket entrepreneurs. But the management is under the supervision and authority of Krabi Province. It is the responsibility which the local authority regards as a great burden, while many feel that the locally cannot reap a handful benefits from the tourism.

(2) The management committee which is now run by the private sector is a good way out. But the organization is still in lack of legal basis to back up and recognition from entrepreneurs, especially those in Phuket.

(3) It is lacking good coordination in practice between agencies concerned, of Phuket and Krabi provinces, and private sectors.

(4) There is no suitable all round organization in charge of Ko Phi Phi Don to a sanitary district status, the issue which is now under consideration and discussion between Local Administration Department and Royal Forestry Department. However, from a thorough analysis, the study has an opinion that the organization which is capable to manage Ko Phi Phi should be the one which can be responsive to the national tourism development policy, able to coordinate with the locally in utilizing its resources, swift and feasible in terms of legal aspect. Besides, the organization must not be a hindrance from outside participation, and accelerating the urbanization on the island.

Currently, the National Environmental Board and the Science, Technology and Environment Ministry has issued a ministerial decree proclaiming Mu Ko Phi Phi to be pollution control and environmental protection area. As a result, some kinds of activities cannot be operated or operated within a certain prerequisites, which will effectively help Ko Phi Phi to halt or decelerate its growth if a proper practice is carried out.

3.8 Environmental Impact Assessment

Up till now, the past development of the island is a kind of haphazard growth, without plan or direction which eventually leads to a large number of undesirable consequences. Some of those negative impacts include unplanned land uses, public area trespassing, nature destruction, densely constructed buildings degrading the aesthetic values, high frequency of land ownership changing hands leading to sky-rocketing land price increases, higher conflicts between local people and national park on land tenancy and land uses, damaged coral reefs, water shortage, waste water discharge and treatment problems and garbages disposal problem. Concerning social consequences, higher immigration rates; local people changing their occupations, attitudes, and way of living; higher incomes as well as cost of living for populace; changing society to be more commercialized; changing relationships between relatives; and higher conflicts between investors of different levels; all can be easily observed.

If those negative impacts are not checked, the severity of the problems will have tendency to increase. Many undue phenomenon will grow, including tourist areas expansion trespassing into sensitive and public areas, which may lead to other ecological disturbances; more buildings built in vertical direction with higher density, crowding, but less tidy and beautiful; more trees cut down; uncontrolled land uses; inadequate potable water; higher land prices; bigger pollution problems; improved tourism standards; higher service charges; higher incomes for both locality and populace; and also higher cost of living. The local people will have to adapt themselves to suit new social system. Immigration from outside is also expected to increase. Meanwhile, the agencies concerned also have to find out and speed up more problem-solving measures.

4. CARRYING CAPACITY LEVEL ESTIMATION

4.1 Tourism Area Demarcation

In order to estimate the carrying capacity level, the study has tried to demarcate the areas which are considered suitable to be utilized for tourism development purpose by employing Potential Surface Analysis Technique. Consequently, 4 areas can be classified (as shown in Figure 5) as follow :

1) Area suitable for tourism development, covering 297 rai, most of which are existing community and tourism service zone area.

2) Area to be used for tourism development, covering 680 rai including the area which are partly developed but having land tenancy problem, and the undeveloped area.

3) Reserved areas for tourism development in the future, covering 868 rai, most of which are still having controversial problem of land ownership. Uses of the lands have to be carefully considered.

4) Unsuitable area for tourism development, all of which are the area under the jurisdiction of national park and environmentally sensitive area if being developed. However, a temporary use of the area, for instance, for trailing path or view point, may be possible.

4.2 Physical Carrying Capacity Level

Physical carrying capacity means quality and quantity of physical environment and man-made facilities which will determine carrying capacity in physical aspect, including consumption water, buildings and landuses, electricity and telecommunications, and beach area usage.

1) Consumption water. The present and future consumption water resources of the island consist of :

- 40 shallow wells, from which 84,000 cubic metres of water per year (7 months) during high tourist season can be expectedly extracted

- water from Phuket, currently being purchased about 58,000 cubic metres annually (7 months)

- water from reservoir capable to hold 21,000 -25,000 cubic metres which are reserved stock of water to be used after rainy season.

Altogether, there is 142,000 cubic metres/year or 676 cubic meter/day in average or expected 167,000 cubic metres/year of about 800 cubic meter/day of water to serve visiting tourists, populace and entrepreneurs about 4,000 persons/day.

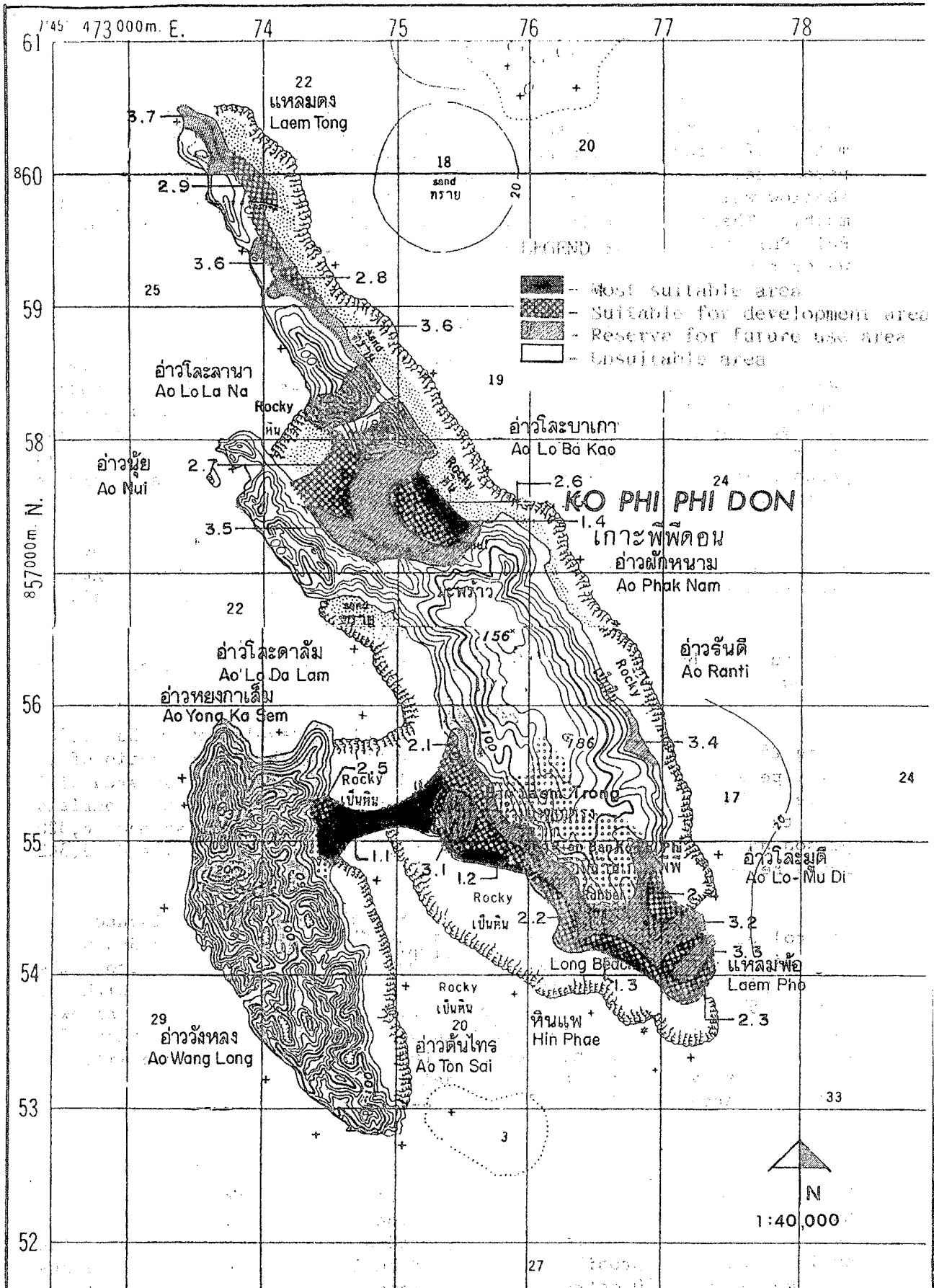


Figure 5. Area Suitable for Tourism

A STUDY ON CARRYING CAPACITY
OF TOURISM DEVELOPMENT
OF KO PHI PHI

But when taking only quality water into account, by excluding salty and brackish water in dry season, there is only 21,000 cubic metres of water from the reservoir available which can serve 14,000 person/day (2,200 person-day daily) for only 26 days. Water from shallow wells is salty and brackish while water from Phuket costs too much. Therefore, it is obvious that tourism development level of Ko Phi Phi has already grown beyond the carrying capacity of natural water resources.

2) Buildings and landuses

- The existing area utilized for tourism purpose covers 337 rai of land (241 rai for hotels and bungalows, 16 rai for tourism services, 80 rai for community) serving a total number of tourists and populace around 3,848 - 5,032 person-day, 800 populace, and 1,140 entrepreneurs, employees and workers). Average density is 11.4 - 15 person/rai. Highest density is concentrated around tourism service areas, in which more than 70% of the buildings are constructed.

- The area which may be utilized for tourism development (expanded area) with an effort to control the negative impacts within present situation, is expected to be around 527 rai.

Therefore, 4 alternatives under different assumptions of the future buildings and landuses expansions can be perceived as follow :

(1) To keep the present level of development, that is by using 25% of service zone for tourism purpose with average ratio of 25 sq.m./person. Consequently, the existing 337 rai of tourism area will serve a highest number of 3,856 person-day daily over-night tourists and the expanded area to become 557 rai will serve maximum 6,320 person-day daily, meaning the maximum guest-rooms of 2,051 and 3,362 rooms respectively.

(2) To apply Interior Ministerial Decree issued to control buildings construction along the coastal area of the South on Ko Phi Phi (now exempted), then 50 metres stripe of land from the coast will be allowed only to construct one-storey buildings with at least 75% of open space, and 150 stripe of land further away allowed to construct not higher than 12 high buildings with not less than 50% of open space. Under this context, the existing tourist area will be able to serve 10,366 person-day daily over-night tourists and the expanded area serving 23,329 person-day daily or meaning 5,498 and 12,443 guest-rooms in each area respectively.

(3) To apply ministerial order and ministerial decree No. 3 of Science, Technology and Environment Ministry issued under Environmental Promotion and Conservation Act. B.E. 1992 upon Ko Phi Phi. Both the ministerial order and decree do not control the building size but prohibit factory and buildings higher than 6 metres on the island. 20 metres stripe of land from the coast will not be allowed to construct any building. Development on another 50 metres stripe further of land is allowed with not less than 75% of open space condition. For the rest, open space must be kept for not less than

50%. Under this context, the existing tourist area will be able to serve 6,448 person-day daily over-night tourists, and expanded area serving 12,978 person-day daily over-night tourists, which are equivalent to maximum 3,430 and 6,902 guest-rooms in each respective area.

(4) To apply more stringent conditions on the island's landuses. Ratio of building area per head of tourist should be increased to 30 sq.m./person. All the buildings within 50 metres stripe of land from the beach have to set back 20 metres, leaving open space for 80% of the total area and constructing not more than 6 metres high buildings. The area deep further than 50 metres from the sea must leave 60% of land for open space. Under these conditions, the existing tourist area will be able to serve maximum 4,299 person-day daily over-night tourists and expanded area serving 8,651 person-day daily over-night tourists, or being equivalent to 2,284 and 4,601 guest-rooms in each respective area.

After a thorough comparison, the alternative 1 is being chosen as the best scenario, in which 3,856 person-day daily over-night tourists are served in existing tourist area and 6,320 person-day daily over-night tourists in expanded area or being equivalent to 2,051 and 3,362 guest-rooms in each respective area. When the number of 1,740 person-day daily excursionists in existing tourist area and 2,851 person-day excursionists in expanded area, as well as 1,940 person-day daily populace in existing tourist area and 3,034 person-day daily populace in expanded area are included, the total number of both tourists and populace Ko Phi Phi can shoulder will be 7,536 person-day daily for existing tourist area and 12,206 person-day daily for expanded area, which can be transformed into 2,051 and 3,362 guest-rooms in each respective area.

3) Electricity and Tele-communications

At present, the private sector has generated electricity for their own uses, about 2,000 KW/day, or in average 0.52 KW/person. Should the customers increase to 7,536 and 12,206 person-day daily in the existing tourist area and expanded area, the electricity demands will soar up to 3,918 KW/day and 6,347 KW/day respectively. Therefore, it is necessary to have an electricity generating plant for Ko Phi Phi. Tele-communications also are necessary for the island. At present though mobile telephones are already utilized by some groups of investors, 200 more of telephone lines are still estimated to be in need of.

4) Public transport

The existing passenger boats with a full capacity of 7,066 seats being capable to serve the tourists up to 1,193 person/day in average, or 1,452 person/day during the peak period, is considered a sufficient boat transport at present.

5) Beach usages

At present, beach area is estimated to be around 40 rai. About 15 -20% of the accumulated tourists will use the beach area. So provided that the tourist density on the beach is 20 person/rai, the tourist volume using the beach area is estimated to be 4,896 person-day daily in average (4,000 - 5,333 person-day daily).

4.3 Environmental Carrying Capacity Level

Environmental carrying capacity level means durability of the environmental and ecological systems against the impacts from population and tourist number. The environmental and ecological systems include :

1) Sea water quality

In general, sea water around the island is still in good quality. The sea is not contaminated or polluted by the wastes discharged because pollutants are prior trapped and filtered by the sandy soils.

2) Sewage water

Sewage water discharged from the residents and service places are treated in septic tanks system from which pollutants will be naturally trapped by sandy soil filter. At present, there is no evidence of impacts, but only some fat stains from the kitchens which hamper the soil's permeability and absorbability, resulting floods in some areas.

3) Solid wastes and garbages

The garbage generated from Hat Ton Sai area (in tourist season) come from market place around 2.2 ton/day and from tourist accommodations around 1.368 ton/day. Hat Yao area produces 0.317 ton/day of garbages while Lo Ba Kao-Laem Tong area produces 0.281 ton/day. The disposal is now carried out by the private sector and Ko Phi Phi Management Committee. The garbages are collected and shipped to dump on shore of Krabi Province. However, when the province's incinerator construction is finished, the operation will be able to serve the tourists up to 620 person-day daily more, or 2,528 person-day daily in total. So it means that the island's garbages disposal system is not sufficient to meet the demands during peak season.

4) Coral reefs

The coral reefs which must be preserved and not allowed to be damaged any more cover 528 rai of area. And in order to preserve corals in such quantity, the number of tourists allowed to enjoy the underwater beauty must be limited to the present level, that is 1,908 person-day daily in average or 3,092 person-day daily during peak season between December - January. The tourism growth therefore should be halted at present stage.

4.4 Social Carrying Capacity Level

1) Most of the populace have gained benefits from tourism. There is only a few conflicts in the society. The difference between the old generation who are rather religious stringent and the new generation who are business entrepreneurs can be observed in a small extent. The conflicts between entrepreneurs or interest groups will initiate more development of tourist services.

2) The tourists are impressed by the natural beauty of tourist attractions and the hospitality of local people. Most of the visiting tourists still feel that the tourist volume is not very high and the increase is acceptable. If it is estimated by the assumptions that density of tourists on the beach in one period of time is not allowed to exceed 20 person/rai, then the accumulated tourist number should not be more than 5,333 person-day daily, or in guest-room figure not exceeding 1,905 rooms.

4.5 Economic Carrying Capacity Level

The island's economic structure is based on tourism sector. The economic expansion then are mostly related to tourism. The role of economic sector is diminishing. The populace have incomes related to tourism in 3 aspects -- being owners of land for rent, being tourist accommodations and service entrepreneurs (some land owners also have their own businesses), and being labourers. Through these public participations, the tourist then is widely accepted by the populace, leading to rapid socio-economic changes towards the new economic sector. As a result, there are some problems on inadequate knowledges of the populace, unsuitable labour force quality to the jobs, and shortage of readiness for land development. However, these short-comings are not major constraints for investment. Some minor conflicts between entrepreneurs from the local investors and outside investors may be taking place.

In terms of investment, most of the investors still use their own capital. They are small-scaled entrepreneurs using local capital funds. The large enterprises usually resort to outside capital sources. But the major constraint of investment by the entrepreneurs is the difference in facilities provision instead.

The island's tourism revenues are estimated to be around 701 million baht, 67.6% of which come from the over-night tourists. In terms of source of origin, the tourists coming from Krabi generate 308. million baht revenues, while those from Phuket contribute 392.6 million baht.

4.6 Summary

Many components supporting tourism are in critical stage, including consumption water, coral reefs, garbage disposal, and scenic beauty. Some components like sewage wastewater are having problems.

On the other hand, the factors on service areas, beach areas, and the acceptability of general population and tourists, show a higher carrying capacity, to a certain extent. The carrying capacity level of Ko Phi Phi therefore depends on the stage of tourism development management and the level of each major factor's constraints. In order to choose the appropriate level of carrying capacity, 3 alternative scenarios as shown in Figure 6 are perceived as follow :

Scenario 1 To keep the tourism at present stage without any expansion, which means there will be 1,908 person-day daily tourist volume in year-round average or maximum 3,092 person-day daily tourists in January, with 1,100 guest-rooms available. In this scenario, tourism must be controlled, without expansion allowed. Various measures also have to be sought in order to seriously and continuously preserve coral reefs, to solve the problems of consumption water, visual aesthetics (site plan and building forms), and garbages disposal. Sewage wastewater directly discharged into the sea must be prohibited. The expansion of tourism services must be stopped but concentrating on improving the service quality instead.

Scenario 2 The tourist volume is allowed to grow to 4,000-5,333 person-day daily or 4,896 person-day daily in average, with 1,795 guest-rooms capacity-- the level which the tourists are still satisfied to go to the beach and service areas. Should this option be chosen, numerous preventive and problem-solving measures must be increased, including more coral reefs preservation measures, increasing consumption water provision, improving scenic beauty, issuing buildings and landuse control measures, more garbages disposal provision, providing water treatment system, improving community site plan, and decelerating growth of tourist service places.

Scenario 3 Number of tourists is still allowed to grow in short-term to reach 6,236 person-day daily in average during tourist season. Accommodations also can increase to 2,287 guest-rooms. In order to meet this scenario, infrastructures, public utilities, and tourist accommodations must be developed more in the vacant lands. Lands will be more intensively used and eventually leading to more stringent measures on coral reefs conservation. Consumption water provision must be carried out in a large-scaled project, similar to many other infra-structure provisions. Landuse plan must be urgently formulated. Landuse and buildings controls must be strictly enforced by the laws. Solid wastes and garbages disposal and sewage treatment must be systematically provided. Compensation from the investment to nature and society must be increased. However, investment still must be systematically and properly encouraged, by caring for the environment.

From a careful comparison by considering the impacts of the 3 scenarios, it comes to a conclusion that for the sake of appropriateness, the expansion of tourism services must come to a stand still. Concentration should be shifted instead to improving and solving the existing untidiness problem, as well as mitigating and preventing the impacts from tourism from taking place. After those implementation schemes bearing a satisfactory fruits, the tourism expansion then probably will be allowed to grow for another period of time. The scenario 2 should be the maximum, allowed to 4,896 person-day daily, with 1,795 guest-rooms.

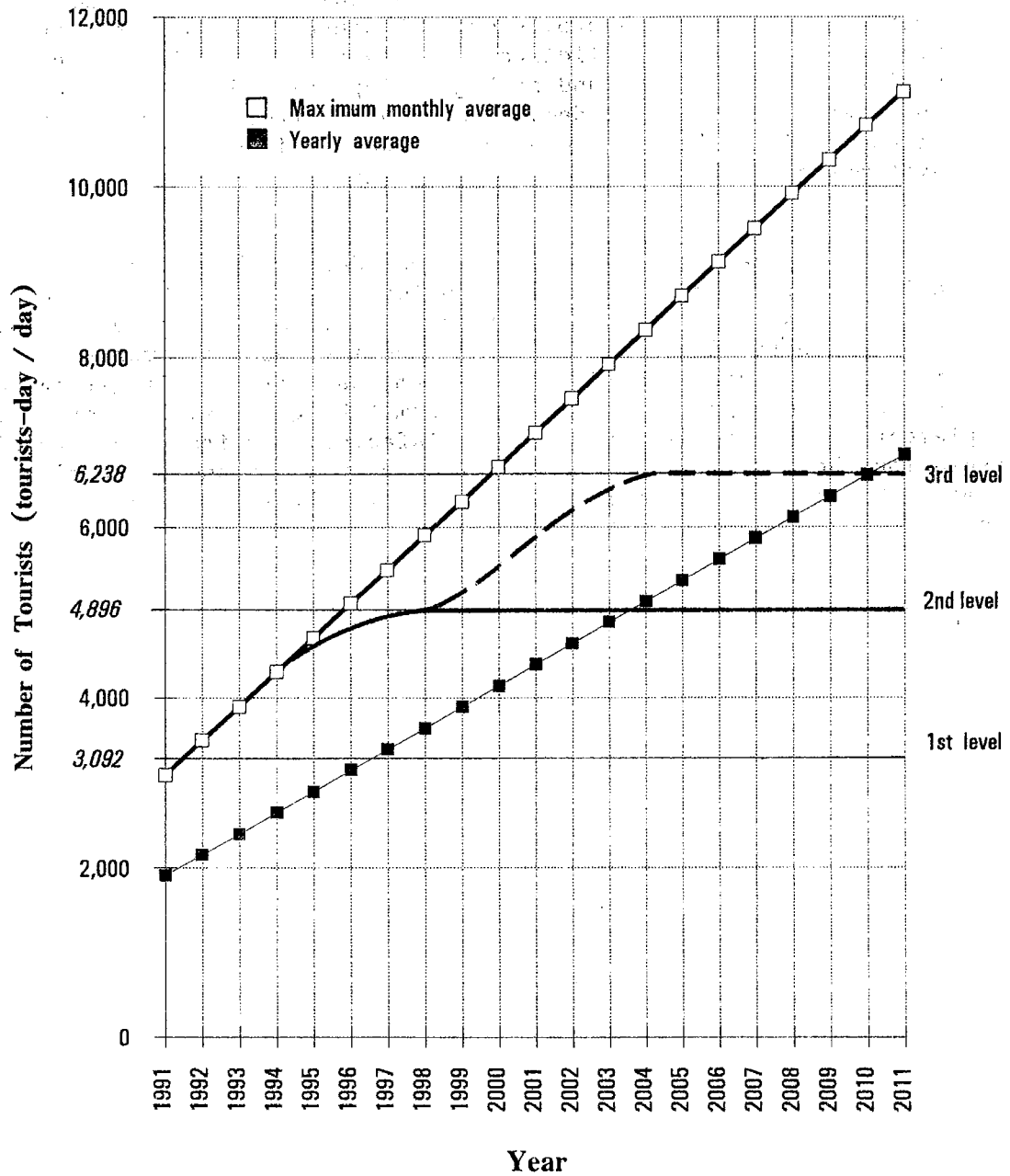


Figure 6 The Carrying Capacity Level and 3 Alternatives

Scenario 3 Number of tourists is still allowed to grow in short-term to reach 6,236 person-day daily in average during tourist season. Accommodations also can increase to 2,287 guest-rooms. In order to meet this scenario, infrastructures, public utilities, and tourist accommodations must be developed more in the vacant lands. Lands will be more intensively used and eventually leading to more stringent measures on coral reefs conservation. Consumption water provision must be carried out in a large-scaled project, similar to many other infra-structure provisions. Landuse plan must be urgently formulated. Landuse and buildings controls must be strictly enforced by the laws. Solid wastes and garbages disposal and sewage treatment must be systematically provided. Compensation from the investment to nature and society must be increased. However, investment still must be systematically and properly encouraged, by caring for the environment.

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5. MANAGEMENT GUIDELINES

From the analysis, the study has clearly pointed out the saturation stage of Ko Phi Phi's tourism development under the direction of preserving the island to be a nature abound destination. Therefore, the tourism development should keep its role and restrain its growth in a limited scale.

5.1 Management to Keep Carrying Capacity Level

The carrying capacity levels of Ko Phi Phi can shoulder accumulated tourist volumes up to 3,092, 4,896, and 6,238 person-day daily, with maximum 1,100, 1,795, and 2,287 guest-rooms respectively, according to the 3 scenarios. At present, Ko Phi Phi has received tourists in a bigger volume than the scenario 1 level already. If the existing growth rate is allowed to continue, within the year 1995 and 1998, tourist volumes will exceed the estimated levels in scenarios 2 and 3 respectively. This study has determined that for the most appropriate level of development in the year 1995 number of tourists should not reach the estimated level of scenario 3.

In order to manage to keep the desirable level of carrying capacity, there are 2 strategies which should be followed -- to solve and eradicate the problems and to formulate tourist volume controlling measures. The recommended guidelines include :

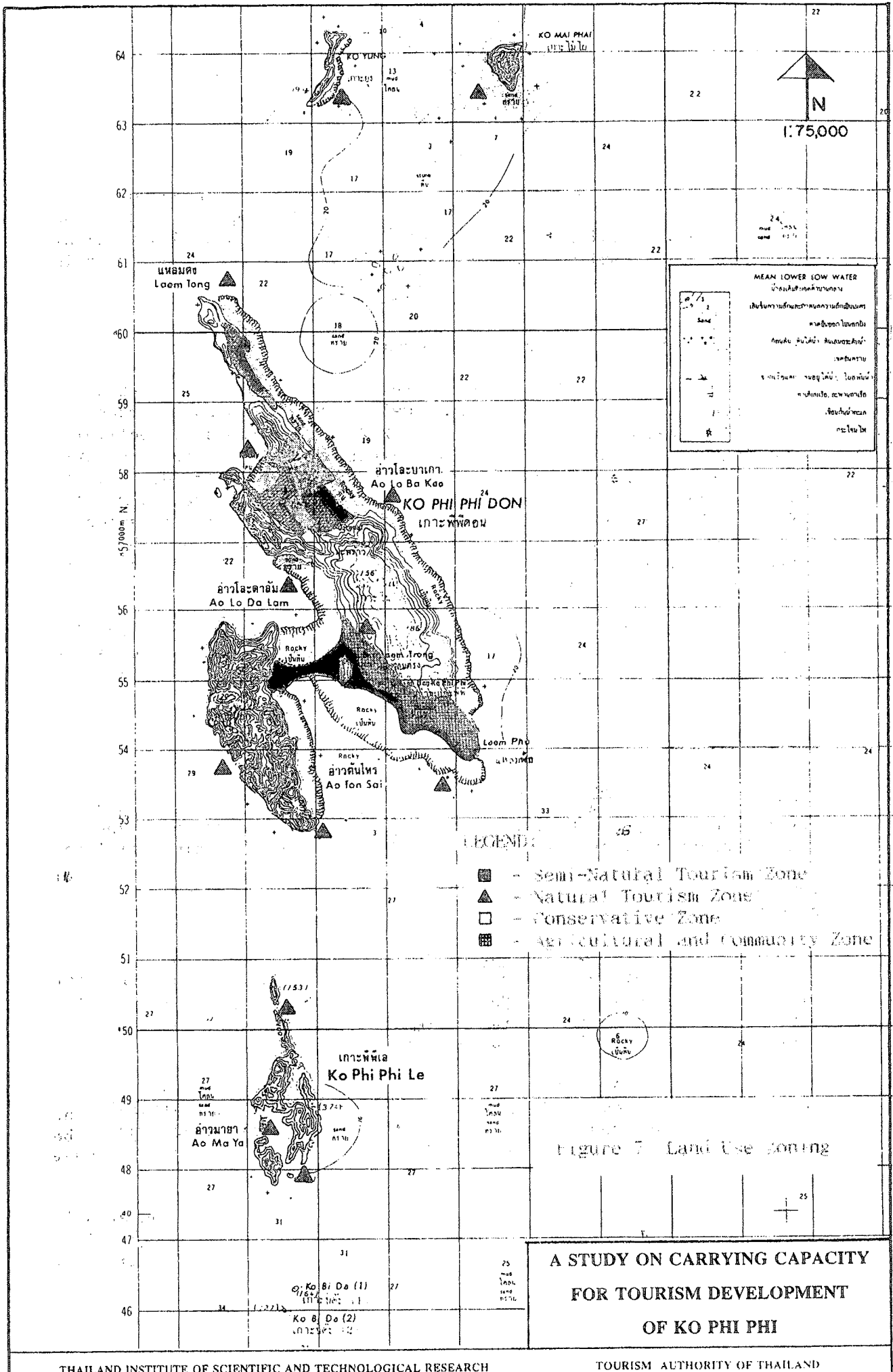
1) Landuse zoning (Figure 7) consists of :-

(1) Semi-natural tourism development zone : In this zone, land area is allowed to be fully utilized for tourism development, under the conditions stated in the carrying capacity control prerequisites. Tourism activities will be the main activities in this zone. But natural conditions must be conserved as a basis of tourism. Buildings construction will be permitted according to the required conditions.

(2) Natural touristic zone : This zone is the nature-abound zone that must be preserved. Tourist facilities are not allowed to be developed. But the zone may be partly utilized, for instance, for trailing paths, temporary pier, rest area, buoys installation for tourist boats, and etc.

(3) Agricultural and community zone : This is the zone which the local people still utilize their land for agricultural and residential purposes. Natural condition of this zone must be preserved by not allowing any buildings construction except ordinary residential buildings.

(4) Conservation zone: This zone covers all the area in the national park, except those categorized into zone (1) - (3). This zone must be subject to be strictly under control and supervision of



the national park's regulations.

2) Tourism area management

(1) To strictly follow the regulations of the National Environmental Board's Declaration and the ministerial decree and order of Science, Technology and Environment Ministry, in order to enhance Mu Ko Phi Phi as an effective pollution control and environmental conservation zone.

(2) To formulate landuse master plan for the whole island and to lay out community landuse plan in the semi-natural tourism development zone (out of the national park boundary).

(3) To strictly enforce laws and regulations on the area within the national park boundary and to accelerate the natural condition rehabilitation of the area.

(4) To urgently urge the Royal Forestry Department and Lands Department to coordinate to solve the land ownership legitimacy problem

(5) To promote agricultural tending on the land owned by the populace, and to keep its conditions with changes as less as possible.

3) Buildings construction control management

(1) To declare buildings control regulations: Within 50 metres away from the sea, the land will be allowed to be used not more than 20% of the plot. And in the first 20 metres from the sea, there is no buildings permitted to be constructed, while deep further part is subject to only 6-meter high building control. For the rest, only 50% of the land will be allowed for utilization, also with only 6-meter high building control.

(2) To formulate measures limiting growth of tourist accommodations and entertainment places: For immediate terms, there is no increases allowed. For the longer terms, the accommodation may be gradually permitted to grow to not more than 1,714 guest-rooms.

4) Coral reefs management

Under the National Master Plan for Thailand Coral Reefs Management, Ko Phi Phi is designated to be natural touristic zone. The zone is allowed to be utilized for low to moderately intensive use for tourism purpose. The tendency to increase the intensivity is imminent. The uses for fishery purpose is rather low. There are many prohibitions and controlling measures specified for the zone. Using such measures adopted in the Master Plan will also be beneficial to development control on the shore. However, there is a need to install buoys in order to mark off the coral reefs, to be used by tourist boats for mooring and to clearly separate various use zones. Besides, educational training, public relations, educational signs and instruction boards for public, entrepreneurs, employees, and tourists

also are needed to seek their cooperation in caring for and utilizing the resources in appropriate manners. The illegal offenders also must be caught and severely prosecuted.

5.2 Management for Problem-solving and Tourism Promotion

1) Infra-structure

- To improve boat pier, foot-path and drainage collector in the community area
- To improve trailing path to the view-point
- To promote electricity generating and potable water production by using brackish water filter.
- To conduct a study and design of suitable drainage and sewerage system by making a comparison between a central treatment plant and separate on-the-site unit system, say 5-10 enterprises for each unit.
- To equip garbages incinerator in the community and tourist business compound, and also to formulate measures preventing impacts from garbage burning.

2) Services

- To enhance cleanliness and service standards
- To support the entrepreneurs' grouping together
- To limit or prohibit the illegal services
- To support small-scaled investment
- To beautify the service zone and building forms in the aspects of tidiness and crowdingness.

3) Other measures

- To coordinate the understandings between different sector of entrepreneurs, between government and private sectors, and especially between Phuket and Krabi provinces.
- To adopt measures in collecting landing fees from tourists to finance Ko Phi Phi's conservation and development needs.
- To terminate swallow nest collection concession of the island and let the national park or the provincial administration to manage instead.
- To support the agricultural productions on the remained plots of lands.
- To increase public health services by upgrading the existing health station, providing beds for in-patients services and having regular medical doctors stationed.
- To promote education on conservation subjects to the local youths.

5.3 Improvement of Ko Phi Phi's Tourism Management Organization

The improvement guideline is to encourage the participations of the private sector and to let the various interest groups playing the roles of supervision and supporting. This organization will be a

committee which responds to the policies set by the central government, but receives supports from the locality which will appoint committee members from many local interest groups and give advices and recommendations for the committee to implement. The organizations practical procedures will be as shown in Figure 8. Concerning Ko Phi Phi's management works, the responsibilities will be divided into sanitary works and infra-structure works. The private sectors will be invited to submit technical, administration and benefit sharing proposal to the supervision and control body to consider and select.

5.4 Management Programmes and Projects

Interpreting from many recommended measures, the study team has drafted an operation plan in the form of projects list, aiming to be used by the agencies concerned for formulating their own action plans or for implementation. All the recommended projects and programmes are consistent and related to each other in the aspects of objectives, methodologies, forms and responsible agencies; and have a common ultimate goal to develop side by side with to conserve Ko Phi Phi as the best, long-lasting, and sustainable natural destination.

All the 23 projects responding to the recommended management measures are being classified according to their objectives, implementing methods, estimated budget, responsible agencies as well as ranking priorities as shown in Table 3.

5.5 Expected Development Results

Should all the recommended measures, projects and programmes are fully implemented, the positive impacts which are expected to be induced into tourism development of Ko Phi Phi will be as follow :

1) The tourism expansion will be consistent with the resources quantity and grow in a suitable manner which is beneficial to long-term utilization.

2) The density of Ko Phi Phi will not be too high, too crowdy, and the island will be capable to retain its unique identity.

3) Landuse zoning will maintain the land price to the level not higher than realistic ceiling. The development and buildings construction will be able to keep Ko Phi Phi's atmosphere for a very long time.

4) Community regulations will make the community good looking, beautiful, tidy and pleasant to live.

5) Tourist volume is suitable to the endowed resources.

6) Coral reefs will be able to retain its interesting quality.

7) The conflicts between the residents and entrepreneurs will be eliminated.

To develop Ko Phi Phi's tourism in a systematic approach, having a clear and suitable goal in consistent with the natural resources endowment, and regulating all the development within the carrying capacity level, will eventually render benefits to the nature-abound tourism of the island for a long lasting period.

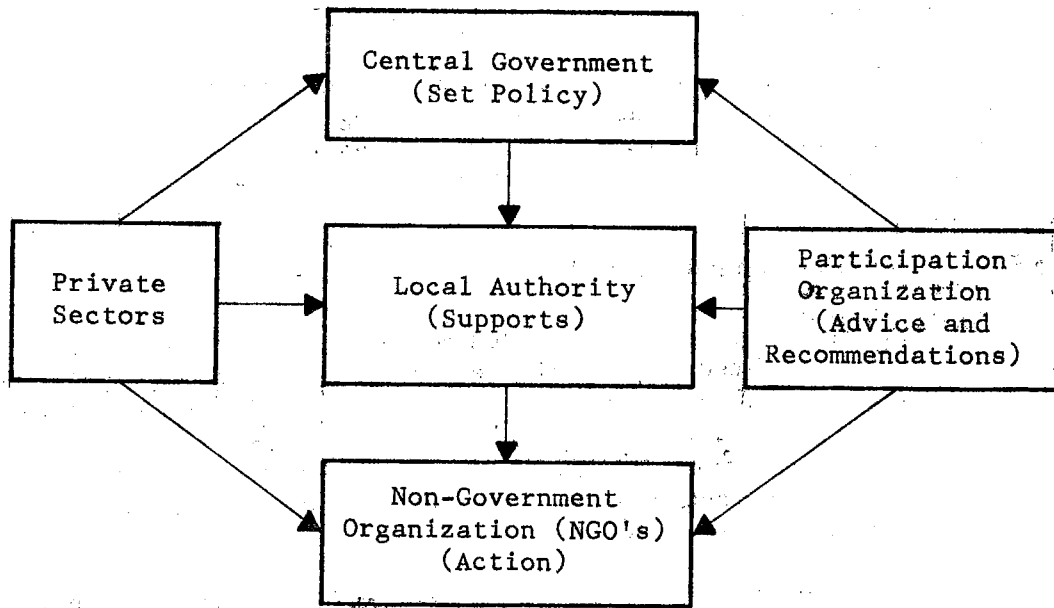


Figure 8 Guidelines for Administration/Organization

Table 3 Draft inventory of programmes and projects for management of Ko Phi Phi's tourism under its carrying capacity level

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
Group 1 : Projects/programmes for management and maintenance of carrying capacity						
Buildings and landuses aspect						
1. Ko Phi Phi Don's Landuse Master Plan Formulation Project	A	<ol style="list-style-type: none"> To designate appropriate land utilization and zoning To solve the land tenancy problem To be a supporting measure for pollution control and environmental conservation declaration 	<ol style="list-style-type: none"> Appointing provincial working group Setting up policy, measures on land tenancy and implementings procedures Doing survey and zoning Setting up conditions for each zone's utilization Holding public hearing session and revising the plan Declaring landuse plan for enforcement 	1 year (1993)	100,000	<ul style="list-style-type: none"> - RFD - Land Dept. - TAT, - EPP, - Muang Dist. - DTCP - Krabi Province
2. Ko Phi Phi Don's community site planning project	B	<ol style="list-style-type: none"> To regulate the community in accordance with landuse To be framework for public utilities and facilities provision 	<ol style="list-style-type: none"> Doing survey and analysis of community condition Doing site planning and land adjustment Setting guidelines for implementation 	1 year (1994)	100,000	<ul style="list-style-type: none"> - DTCP - PWD - TAT
3. Buildings control	B	<ol style="list-style-type: none"> To set up framework for issuing buildings permits in harmony with environment To control building density and landuse within the carrying capacity 	<ol style="list-style-type: none"> Setting up prerequisites Declaring buildings control regulations Revising regulations Issuing ministerial decree 	starting in 1993	-	<ul style="list-style-type: none"> - PWD (Office of Buildings Control Committees) - TAT

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Table 3 (Cont'd)

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
<u>Coral reefs aspect</u>						
4. Buoys installation project	A	<ol style="list-style-type: none"> To delineate the tourist zone from coral reefs formation To mark the coral reef zone and to provide moorings for boats 	<ol style="list-style-type: none"> Doing survey and demarcating zone for tourism according to its quality Setting up activities allowed in each zone Installing 48 buoys Publicizing and training on buoy maintenance and utilization 	2 years (1994-5)	buoys 720,000 training 100,000 media 50,000	- EEP - National Park - Diving Club - Educational Institute
<u>Environmental aspect</u>						
5. Campaign for Ko Phi Phi's environmental conservation and development project	B	<ol style="list-style-type: none"> To mobilize public participation in environmental conservation and development To solve environmental problems To cultivate awareness 	<ol style="list-style-type: none"> Setting up working group Formulating implementing process Undergoing campaigns 	1993	100,000	- Joint committee - Krabi Province - Tourism - Business Club - National Park - EPP
6. Dissemination of natural resources and environmental conservation knowledges project	B	<ol style="list-style-type: none"> To educate the public entrepreneurs, tourists on understanding of conservation knowledges 	<ol style="list-style-type: none"> Setting up signboards Producing pamphlets, brochures, posters, and leaflets Holding demonstration and training 	1993-4	300,000 (150,000 annually)	- Joint committee - EPD - National Park
7. Fencing off national park boundary project	B	<ol style="list-style-type: none"> To have a clear cut mark on land tenancy To be a sign of conservation area boundary To publicize the national park 	<ol style="list-style-type: none"> Doing field survey according to the results of land holding problems resolution Pinpointing signs, signboards, or natural setting 	2 years (1994-5)	50,000 annually	- RFD - Lands Dept. - Muang District - Krabi Province

(to be continued)

Table 3 (Cont'd)

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
8. Tourism market management project	A	<ol style="list-style-type: none"> To receive tourist in suitable volume To coordinate in the tourist business circle 	<ol style="list-style-type: none"> Setting up information center for market place Determining regional tourist network Developing other tourist destinations Promoting excursionist travellers Systematizing coordination between surrounding tourist attractions 	1994	500,000	<ul style="list-style-type: none"> - TAT - Provincial Administration - TOT - CAT - Tourism Business Club

Group 2 : Project/programmes on problem-solving and promotion of tourism

Pollution control aspect

9. Community sewage collecting and treatment project	A	<ol style="list-style-type: none"> To treat sewage from community to the acceptable environmental standard To improve environment and to conserve coastal water quality 	<ol style="list-style-type: none"> Issuing rule requiring every building to install wastewater treatment system Doing survey and design of central and on-site treatment systems Giving instructions on installing ready made systems or system for group of business Installing the system Monitoring the implementation (or doing detail design for central treatment system) 	2 years starting in 1993	<ul style="list-style-type: none"> Undergoing (central treatment 20 mil. baht land cost 10 mil. baht operating cost 1,800 baht/day) - PCD - PWD - TAT - Joint Committee - Private company - Operators - Krabi Province
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Table 3 (Cont'd)

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
10. Garbage disposal Project	A	<ol style="list-style-type: none"> To collect and to dispose of the garbages To set up management system of garbage disposal 	<ol style="list-style-type: none"> Upgrading responsible organization Doing survey of origin and quantity of garbages Constructing incinerator Setting up garbage collection system Collecting ashes from incinerator for land-fill Collecting fees Redressing behaviours of excursionists on littering 	continuing from 1993	under-construction	<ul style="list-style-type: none"> Joint committee Private Provincial Administration PPW TAT
11. Footpath and drainage pipe-line improvement project	B	<ol style="list-style-type: none"> To serve and regulate the community To provide rainwater drainage systems To implement according to community site plan 	<ol style="list-style-type: none"> Doing field surveys for laying of pipelines Purchasing, requesting, expropriating, or doing land adjustment Doing detail designs of footpath and drainage system Implementing 	1994-5	100,000 for detail design (excluding land cost or land adjustment)	<ul style="list-style-type: none"> Provincial Administration PPW DTCP Private
12. Trailing path to view point improvement project	A	<ol style="list-style-type: none"> To facilitate the tourists To improve environment 	<ol style="list-style-type: none"> Designing trailing paths (including steps and fences) Constructing Providing directional signs 	1994	2.0 mil.	<ul style="list-style-type: none"> TAT National Park PPW

(to be continued)

Table 3... (Cont'd)

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
13. Community power supply improvement project	B	1. To provide the community with a reasonable price and quality power supply	1. Surveying of demands 2. Doing detail designs 3. Setting up electricity generating plant 4. Installing power line and selling electricity	1994	-	- PEA - Private - Joint committee
14. Communications system set-up project	B	1. To provide efficient communications system within and between outside and community 2. To supplement marketing drive	1. Surveying demands volume 2. Selecting suitable system 3. Developing and equipping the system	1994	-	- TOT - Private - Joint committee
15. Potable water provision project	A	1. To provide potable water for consumption 2. To increase carrying capacity of water supply	1. Installing brackish water purifying equipments 2. Laying pipelines or constructing pumping station	1994	10 mil. (240,000 annually)	- PWA - Private - Provincial Administration
16. Health care station upgrading project	A	1. To upgrade public health services around Hat Ton Sai area	1. Upgrading health care station 2. Providing more doctor, nurses, patient beds	1994	5 mil.	- Public Health District Office
17. Supporting medium-scaled entrepreneur project	B	1. To help various levels of entrepreneurs to survive 2. To uplift service standards	1. Encouraging entrepreneurs grouping 2. Securing more capital for investment 3. Training on investment principle, and service provision	1995	100,000	- Joint committee - TAT

(to be continued)

Table 3 (Cont'd)

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
18. Improvement of hotels and bungalows' sanitation project	C	<ol style="list-style-type: none"> To improve sanitary systems in hotels and bungalows up to hygienic standards To increase capability of entrepreneurs to operate by their own To improve environment to meet tourists' satisfaction 	<ol style="list-style-type: none"> Educating the entrepreneurs by training Disseminating academic knowledges Following up, monitoring, and giving advices 	1994	50,000	<ul style="list-style-type: none"> Provincial Public Health Office TAT Tourist Business Club
19. Project on promotion on control of tourist boat business	B	<ol style="list-style-type: none"> To supervise tourism within a suitable extent To be supplementary measure in maintaining the appropriate tourist volume 	<ol style="list-style-type: none"> Setting up tourist boat business club Systematizing marketing, servicing, and tour programmes Training and being stringent on cleanliness of the boats and sea Educating tourist boat operators and employees 	1994	120,000 annually	<ul style="list-style-type: none"> Operators Joint committee Krabi Province Phuket Province
<u>Group 3 : Other projects/measures</u>						
20. Organization improvement project	A	<ol style="list-style-type: none"> To have an efficient organization in : <ul style="list-style-type: none"> environmental management tourism management 	<ol style="list-style-type: none"> Issuing provincial regulations Inviting private sector for bidding Selecting Improving provincial organization able to respond to tourism development 	1994	-	<ul style="list-style-type: none"> Krabi Province Phuket Province Private TAT
21. Collecting fees from tourists project	B	<ol style="list-style-type: none"> To mobilize funds for island's conservation and development (short term) 	<ol style="list-style-type: none"> Coordinating between government and private sectors concerned Producing coupons for tourists sold through passenger boat fares or attractions entrance fees 	1993-5	-	<ul style="list-style-type: none"> Krabi Province Phuket Province Joint committee Passenger boat operators

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Table 3 (Cont'd)

Programmes/ Projects	Ranking	Objectives	Actions	Time frame	Budget (baht)	Responsible Agencies
			3. Setting up financial and accounting systems 4. Evaluating and improving the system			
22. Setting up consumer products center project	C	1. To lower cost of products 2. To lower retail price 3. To have sufficient good	1. Setting up the center 2. Recruiting warehouse 3. Contacting suppliers and retailers	1995	-	- Provincial Commerce Office - Private
23. Ensuring tourist safety project	B	1. To provide and facilitate safety for tourists 2. To maintain peace on the island	1. Setting up patrol units 2. Setting up 2-3 check point stops 3. Setting up safety maintenance center (PR, communications, robber catching unit)	1994-5	Setting up center, 2 years, 400,000 yearly, operating cost 100,000	- Police Dept. - Provincial Police - Marine police - Tourist police - Joint committee

Remark :

RFD = Royal Forestry Department
TAT = Tourism Authority of Thailand
EPP = Environmental Policy and Planning Department
PCD = Pollution Control Department
PMD = Public Works Department
EPD = Environmental Promotion Department
TOT = Telephone Organization of Thailand
CAT = Communications Authority of Thailand
PEA = Provincial Electricity Authority
PWA = Provincial Water Authority
PPW = Provincial Public Works Office
DTCP = Department of Town & Country Planning

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