An Economic Valuation of Coastal Ecosystems in Phang Nga Bay, Thailand

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IN PHANG NGA BAY, THAILAND

Udomsak Seenprachawong

EXECUTIVE SUMMARY

Thailand's Phang Nga Bay is under threat from unregulated tourism and the proposed Southern Seaboard Development Project. The project would involve construction of many infrastructure and industrial projects very close to important and sensitive tourist sites in the Bay. This study assessed the value placed on changes to the Bay's ecosystems by Thais so that these values can be taken into consideration when decisions are made on the expansion of environmentally damaging commercial activities. The population sample was chosen from Thais between ages 18 to 75 years, living in and traveling to Phang Nga Bay area. The study found the annual value of a 35% to 65% increase in environmental quality to be 5,784 million Baht (USD 144.6 million), equivalent to 8% of the gross provincial products of the combined provinces of Phuket, Phang Nga, and Krabi. The study also assessed environmental attitudes and found Thais to be strong advocates of environmental protection. The welfare estimates of improving the Bay's ecosystem showed that diversity of flora and fauna, which provides recreational and tourism benefits, is the most important attribute of the Bay. Local livelihood and ecological functions are equally important attributes while the rare and endangered species attribute is the least important.

Over 35% of respondents considered protecting natural habitats and wildlife to be the most important issue for Thailand. Nearly 50% of the sample strongly agreed that they had a duty to protect the environment from development regardless of the cost. Eighty percent of respondents believed that natural resources were of value because of the benefits they could provide to future generations. Fifty-seven percent of respondents disagreed that Thailand needed to develop her forests, sea, and land to increase jobs and incomes, regardless of the environmental damage. Eighty-eight percent of the respondents agreed that mangroves and coral reefs should be protected because rare birds and marine lives depended on them. Fifty-six percent of respondents recognized the importance of non-use values. Sixty-three percent of respondents agreed that even if they did not use the mangroves and coral reefs now, they were prepared to pay a nominal sum to protect them for future use. Three-fourths of respondents showed a high appreciation of the indirect value of the mangroves. Finally, about 60% of the respondents disagreed that they had more important things to think about than the loss of the mangroves and coral reefs.

This study focused on the willingness of the Thai people to pay for improved environmental quality in Phang Nga Bay and on their attitudes towards environmental protection. Many studies from Thailand and other parts of the world provide important lessons on ways to manage the impact of tourism and on mechanisms for financing environmental protection in similar sites. The following are recommendations for managing tourism impact, supported by findings from these studies.

(1) It is proposed that the government should impose an official moratorium on all new hotels and related tourist accommodation developments, including condominiums

and time-sharing projects, for an initial period of seven years during which no new permits for such development will be issued.

(2) All major development proposals must be accompanied by a thorough environmental impact study conducted by an independent qualified expert. A permit should be obtained for the erection of advertisement signs and billboards, which must conform to certain specified standards. The operation of jet skis and similar high-powered marine crafts should be totally prohibited in the environmentally sensitive areas.

(3) It is recommended that the government introduce a two-tier basic entrance fee for marine parks in Phang Nga Bay, with different rates for residents and foreigners. Thais pay an entrance fee of 40 Baht (USD 1) while foreigners pay 400 Baht (USD 10). The use of a hotel room tax can also be implemented. It is suggested that a room tax of 40 Baht (USD 1) per bed-night be imposed.

(4) It is proposed that the government raise money at the site level. The park manager at Mai Khao beach can implement a 'Friends of the Sea Turtle' program. Alternatively, the park manager can raise money for sea turtle protection by selling 'deeds' for 100 Baht (USD 2.50) per turtle protected.

1.0 INTRODUCTION

1.1 Background

Thailand's 2,705 km long coastline gives it a high coastline to landmass ratio. The seacoast bordering the Gulf of Thailand is 1,840 km long, while that lining the Andaman Sea is 865 km. Thailand's main coastal resources are marine resources, mangrove and sea-grass beds, and coral reefs. In the past decade, largely due to uncontrolled economic activities, all of these have come under the threat of degradation or depletion. Between 1961 and 1993, Thailand's mangrove forests have been reduced from 367,000 ha to less than 168,676 ha (Tokrisna 1994) when it was converted to other uses, such as aquaculture, mining, settlement sites, ports and roads, salt ponds and most significantly, marine shrimp aquaculture. Damages to coral reefs are caused by man as well as by natural forces. One of the major anthropogenic causes are increased tourism activities (such as snorkeling), which have resulted in localized cases of disturbance and damage to coral reefs (OEPP 1995). Sea-grass beds are generally in good condition, especially along the Andaman coast. Those found offshore in Phang Nga Bay are considered Thailand's largest.

1.2 Issues and Significance of the Problem

It is widely accepted that mangroves and coral reefs are very valuable because they possess unique, rare, or endangered plant or animal species. They play multifunctional roles like nutrient purification, provision of habitat for fish and migratory birds, and erosion control. Therefore, conserving mangroves and coral reefs has become an increasingly important topic of public debate in developing countries like Thailand. This is of particular concern for mangroves and coral reefs in areas such as Phang Nga Bay, covering the coast of the provinces of Phuket, Phang Nga, and Krabi. This Bay was designated as an area for the Southern Seaboard Development Project (SSDP) in the Sixth National Economic and Social Development Plan (1987-1991). The SSDP is intended to

combine the national development goals of industrial development to capitalize on domestic natural resources, attract foreign development, and decentralize economic growth. The basic components of the SSDP are two deep-sea ports, industrial estates, urban centers, and highways. There is a strong motivation for coastal area development as some people have argued that net benefits of the development often exceeded those of mangrove forests preservation in the context of a conventional cost-benefit analysis (CBA). In order to address this conflict between conservation and conversion of coastal resources, there is an urgent need to understand trade-off for a balance between coastal resources conservation through sustainable utilization and coastal resources conversion by assessing the values of their multiple functions. Furthermore, local communities in Phang Nga Bay are totally dependent on the mangroves and coral reefs for their livelihood. The rapid rate of destruction is evident throughout the area and sustainable coastal resources management options are urgently needed to be identified for the area.

2.0 ECONOMIC VALUATION OF COASTAL ECOSYSTEMS

Coastal ecosystems are quite complex as they represent a conglomeration of goods and services, which perform significant ecological functions that arise out of interdependence between their different components. For instance, coral reefs and mangroves require different conditions for optimal growth. Mangroves thrive in calm nutrient-rich environments, whereas coral reefs need clear, nutrient-poor waters. However, reefs and mangroves may be closely linked as they are often found together. Mangroves protect reefs from terrestrial sediments and provide shelter among their roots for juvenile reef fish, like snappers. Coral reefs protect mangroves from erosion during storms and strong wave action.

It may be difficult to reach their accurate benefit estimates. Nonetheless, for a useful means of decision-making on conflicts between their preservation and development, various economic valuation techniques have been adopted in the evaluation of preservation value. Environmental economists employ a total economic value approach that focuses on monetizing a set of human preferences on natural system. The analysis of economic values of coastal resources can be done based on the following functions:

(a) Ecological function: The existence of biodiversity helps to keep ecosystems stable and functioning. Mangroves and coral reefs perform many important ecological functions for man. They are valuable in providing protection against coastal erosion and coastal storms.

(b) Consumption: Plants and animals in the mangroves and coral reefs provide many goods which satisfy human needs. Mangroves and coral reefs provide natural nurseries for large numbers of commercially important species. Many coastal people have lived, fished, and hunted within mangroves, deriving valuable commodities from them such as timber, fuel, medicine and food.

(c) Aesthetic value: Coastal tourism appears to be on the rise throughout coastal cities around the world. Mangroves and coral reefs' potential for tourism are increasingly being explored in recent years.

(d) Future: The importance of conservation of the mangroves and coral reefs' ecosystems in general, takes on an added dimension as scientists are increasingly turning to the biodiversity of the sea in their search for medical cures and unique compounds.

(e) Existence**:** The diverse plants and animals species in the mangroves and coral reefs ecosystems has a need to exist, regardless of their use to us. Some people wish to see them preserved, although they do not currently make use of them.

Each of these functions has an economic value and these values together can be taken to calculate the total economic value of mangroves and coral reefs ecosystems. The total economic value has been classified into use and non-use values derived from individual preferences. In economic literature, natural resource values that are independent of people's present use of the resources have been variously termed as existence, intrinsic, passive use, preservation or conservation values. For decision-making purposes, however, what is of most interest is the change in value that results from a positive or a negative impact on the resource. In other words, how does the value of the resource change if it is degraded or improved by a specific human intervention?

3.0 OBJECTIVES OF THE STUDY

The general objective of this study is to estimate the economic value of changes to the quality of the mangroves and coral reefs ecosystems in Phang Nga Bay. The specific objectives are as follows:

(a) to estimate the economic value of changes to the quality level of flora and fauna of coastal ecosystems in Phang Nga Bay

(b) to estimate the economic value of changes to the quality level of local livelihood of rural community living in Phang Nga Bay

(c) to estimate the economic value of changes to the quality level of ecological function of coastal ecosystems in Phang Nga Bay

(d) to estimate the economic value of changes to the quality level of rare and endangered species in Phang Nga Bay.

4.0 LITERATURE ON THE COASTAL ECOSYSTEM VALUATION

Economic valuation studies pertaining to coastal ecosystems in Thailand are scanty. To date, only three had been done on coastal ecosystems in southern Thailand. These three studies are reviewed here.

Sathirathai (1998) assessed the economic value of mangroves in Surat Thani emphasizing only the use value, which comprised direct and indirect use values. The author identified four components including direct use value of mangroves in terms of (i) local community usage and indirect use value in terms of (ii) off-shore fishery linkages, (iii) coastal line protection, and (iv) carbon sequestration. However, the study had emphasized on the first two components. The direct use value of the mangroves based on local use were assessed from the net income generated by the locals from the mangroves in terms of timber, fuel wood, and other wood and animal products such as birds and crabs collected directly from the mangrove swamps. Indirect use value was determined by the contribution of resources in terms of their environmental and ecological services to support current production and consumption. The study attempted to value the mangroves in terms of their support to offshore fisheries by adopting the Ellis-Fisher (1987) and Freeman (1991) models in which

the value in focus was determined by a change in consumer surplus. The author found that the economic value of mangroves was estimated to be in the range of USD 513.05 to USD 658.55 per rai (1 rai = 0.16 ha).

Chuenpagdee (1998) argued that research of the past had not provided reliable methods for measuring the economic value of most non-marketable environmental goods. The author used a damage schedule as an alternative approach to assess coastal resources in southern Thailand. A damage schedule is constructed based on scales of relative importance obtained from people's judgement about values of various resource losses and activities causing losses. An attempt was made to obtain monetary values of the resource losses using the method of paired comparisons. Respondents were asked to choose between loss of resource and loss of money. It was found that the monetary estimate for partial damage to mudflats in Ban Don Bay was 1,350 Baht (USD 33.73). For Phang Nga Bay, the estimate was 850 Baht (USD 21.25) for partial damage to sandy beaches and 2,850 Baht (USD 71.25) for severe damage to sandy beaches.

Seenprachawong (2001) focused only on economic values of coral reefs in the Andaman Sea of Thailand. Phi Phi, the site analyzed, is rich in reefs and is envisioned as an ecological tourism destination by government planners. It has been found that Phi Phi provides large economic values through recreation. The consumer surplus estimated by a travel cost method reveals an annual value of 8,216.4 million Baht (USD 205.41 million). The study also employed a contingent valuation method to estimate both use and non-use values of Phi Phi's coral reefs representing an annual value of 19,895 million Baht (USD 497.38 million).

Each of the previous studies has particular limitations that affect the interpretation of the results. Although Sathirathai's study attempted to estimate the economic value of coastal resources, its findings did not include the non-use values. Moreover, the study did not address the complexities of the coastal ecosystems (i.e., the joint values of mangroves and coral reefs). Only mangrove ecosystems were emphasized. Likewise, Seenprachawong's study focused only on coral reefs ecosystems. Although Chuenpagdee's study incorporated ecological linkages among three coastal ecosystems (i.e. mangroves, sea-grass beds, and coral reefs), it did not give an estimate of total economic value of the whole ecosystems.

This research extends the previous research on economic valuation of coastal ecosystems in two ways. Firstly, it addresses the joint value of the coastal ecosystems. This study emphasizes two coastal ecosystems, mangroves and coral reefs, since they are often found together and may be closely linked. Economic values of changes to the quality of the joint habitats were estimated.

Secondly, this study uses a conjoint analysis to estimate the value of changes to the ecosystems. Conjoint analysis is a hedonic method that presents differentiated goods to people in terms of their attributes, and survey respondents are asked to evaluate assigned combinations of the attributes on a variety of scales. Conjoint response scales include rating each posited combination of attributes on a bounded, integer scale from very undesirable to very desirable, ranking alternatives from most desirable to least desirable, and choosing one of the specific alternatives. This study employs a choosing-one format, so called a choice experiment method.

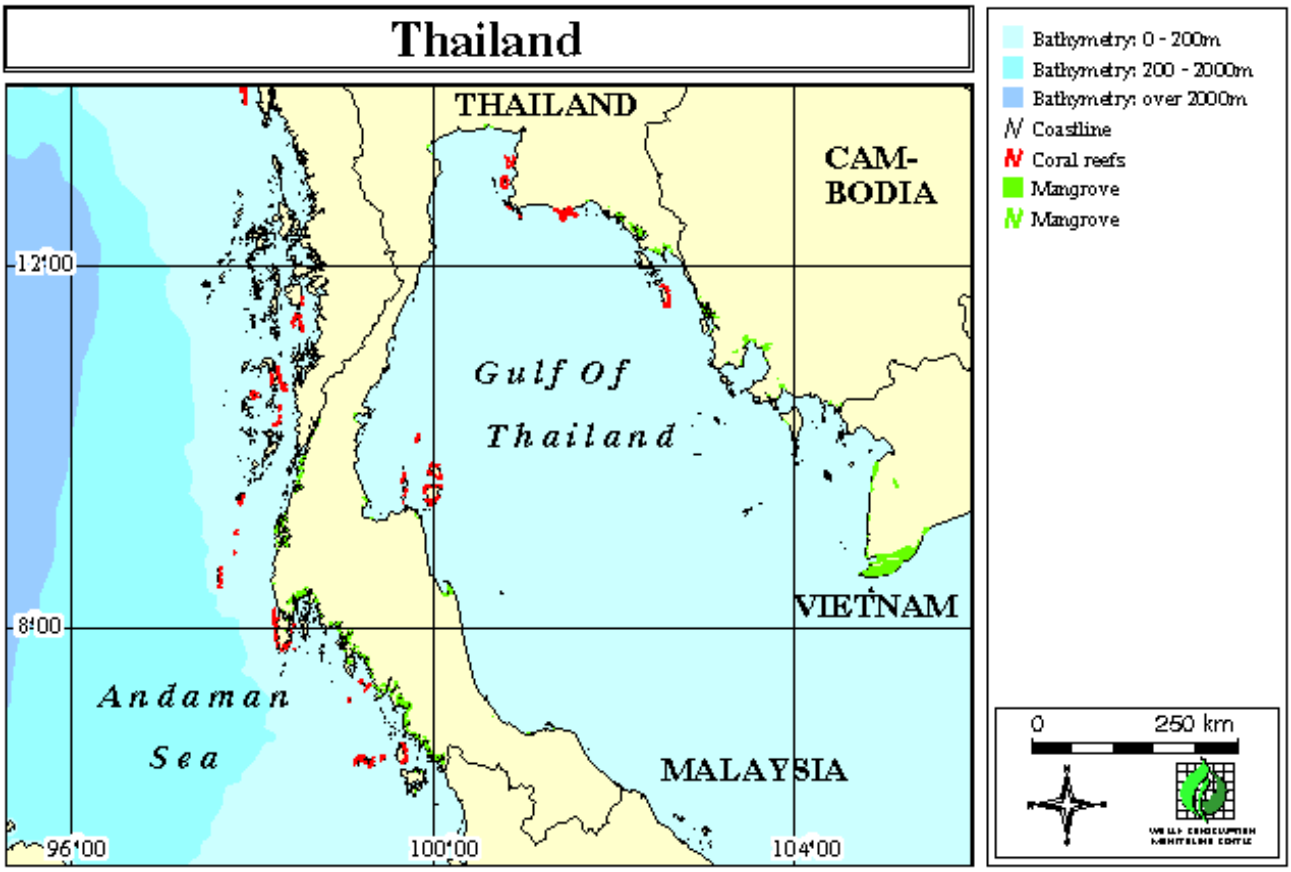
5.0 DESCRIPTION OF THE SITE

Phang Nga Bay is a large bay in the Andaman Sea, located on the west sea border with its coastline covering the coast of Phuket, Phang Nga and Krabi provinces. The bay is wide and has many archipelagic islands. It is dominated by two monsoons. The southwest monsoon prevails during the months of May to October and is characterized by storms and heavy rainfall and a stirred up sea. The northeast monsoon prevails during the months of November to April and is characterized by calm waters and dry season. Mangroves, coral reefs, and sea-grass beds are dominant coastal ecosystem along the coast of Phang Nga Bay. (Figure 1)

The existing mangrove area, totaling 60,227.60 ha, is located along the coast of Phang Nga Bay (Tongchai and Jirawan, 1997 cited in Aksornkoae 1998). One of the most important marine habitats in the bay area is the coral reef, distributed along the coastline and offshore areas in relatively deep water. The abundant coral reef is distributed mostly along the near-shore islands of Phang Nga and Krabi. Sea-grass beds exist throughout 1,700 ha of the coast in the bay area at shallow water depths of about five meters. The major beds are located around the islands of Ao Nang and Ao Tha Len of Krabi province, and the Yao Yai Island of Phang Nga province.

Phang Nga Bay can be considered as a protective area in terms of fisheries (fish and shrimp). Mariculture takes place along the bay coastal belt. The active areas are in Phang Nga and Krabi provinces. The sea surrounding Phi Phi Island, south of Lanta Island, and east of Yao Yai Island is found to be the spawning ground for mackerels. The aquaculture activities have been operating intensively in the 118 ha coastal area. The major operations, up to 85%, are found in Phang Nga province, with emphasis on shrimps and cockles. The minor operations are oysters and other bivalves, which produced a harvest of a few tonnes. The stakeholders in the bay area are given below:

- the local rural population which derives a use value from the bay, mainly through the collection of fuel wood and fish
- the local urban population which benefits from incomes generated by the hotel and tourism industries
- the management which is responsible for the maintenance of the ecological health of the bay such that the economic benefits continue to accrue
- the community of scientists and ecologists who put a premium on existence value of the coastal and marine ecosystem
- people from the other parts of Thailand who understand the importance of the use and non-use value of coastal ecosystems in Phang Nga Bay



Source: UNEP World Conservation Monitoring Center

Figure 1. Map of Major Mangroves and Coral Reefs in Thailand

Source: Tourism Authority of Thailand

Figure 2. Map of Phang Nga Bay Thailand

Phang Nga Bay (Figure 2) is blessed with distinctive and attractive tourism assets like beaches co-existing with good urban amenities in Phuket, and magnificent coastal views of Phang Nga and Krabi. Phuket's glory lies in its magnificent coastline. Beaches range from gentle crescents of white sands and calm waters to rocky headlands pounded by raging surf. Counterclockwise, from Phuket's northern tip, where Sarasin Bridge connects the island with the mainland, Phuket's major places of interest are as follows:

- **Nai Yang Beach**

This is where the Sirinat National Park office is located. The beach itself is on a long curving bay lined with evergreens that provide shade to picnickers. The large coral reef is home to many different species of fish, and Nai Yang Beach is well known as a site where sea turtles come to lay eggs from November to February. The population of these turtles has however, dwindled gradually.

- **Mai Khao Beach**

Many kilometers of deserted beach characterized Mai Khao Beach where there is little tourist business. This pine-lined stretch of sand is Phuket's longest beach. The water is safe for swimming during the dry season. The rainy season brings big waves and strong currents that can be hazardous. This lonely beach is another site where sea turtles come to lay their eggs. It is also a home to a form of marine life called sea cicada by the Thais.

- **Bangthao Beach**

Bangthao is a large open bay with one of Phuket's longest beaches. It was once used for tin mining, but has since been developed into a luxury resort. Most of it is occupied by the Laguna complex, a massive five-star hotel development with a golf course. There are also accommodations available outside Laguna at the bay's south end. Swimming is excellent during the dry season. At the bay's north end is another small bay, almost completely enclosed, at the mouth of which are some fine corals.

- **Patong Beach**

Patong Beach, Phuket's most developed beach, offers numerous leisure activities like sporting, shopping and recreational options, along its 3-kilometre long crescent bay. Windsurfing, snorkeling, sailing, swimming and sunbathing are some of the popular daytime activities.

- **Ko Hay**

This island is well known for its coral reefs that it is often referred to simply as Coral Island. This is one of the most popular destinations from the southern end of Phuket. The water is clear and beautiful, perfect for water sports such as parasailing, snorkeling, skiing, sailing and scuba diving.

- **Ko Racha**

These islands lie directly south of Phuket. Racha Yai, the nearer one, has two beaches, a few bungalows and some food stalls. A small village of Muslim fishermen are increasingly turning to tourism for their high-season living. Colorful coral gardens that fringe the island and the exceptionally clear waters make this a popular destination for day-trip divers.

Inland, the green hills and coconut plantations offer pleasant walks. Racha Noi, farther to the south with only one beach, is not inhabited. The site between Racha Yai and Racha Noi is usually good for diving and sometimes there is a chance to see some big fishes. However, this diving trip is only for advanced divers as the current is very strong.

Phang Nga's principal attraction is Ao[1]Phang Nga National Park. The Park was declared a national park on April 29, 1981. It comprises a large, shallow marine component (34,700 ha) in Phang Nga Bay and a small terrestrial area (5,300 ha). Over hundreds of limestone islands rise steeply from the sea. There are a few areas of coral in the west and some islands have beaches (UNEP/IUCN 1987). Ao Phang Nga has been featured in several international movies and contains some 100 largely uninhabited limestone islands scattered around almost perpetually calm waters. Many islands are riddled with aquatic grottoes, and are best explored aboard sea canoes, which are able to enter inner chambers. The timeless 'Jurassic Park' atmosphere of such islands contrast vividly with more popular venues such as Khao Tapoo (James Bond Island) and Ko Panyee which supports a Muslim village built on stilts embedded in the sea. Places of interest within the Park include:

- **Ko Panyee**

This small island has a picturesque village, which rests precariously on small pilings and extends out to the water. Cut off from the mainland and most modern facilities, the island is inhabited mainly by Muslim fishermen, whose unique culture has existed for more than a hundred years.

- **Khao Ping Gan**

The name literally means 'leaning mount'. It is really a huge rock split into two; the smaller half has slid down and the remaining one appears now to be leaning. Though Khao Ping Gan is a very small island, Khao Tapoo or James Bond Island, is in a little bay of Khao Ping Gan where visiting boats pull up. 'Tapoo' means nail, and this shoreless rock projects up from the sea as its name implies - flat and wide at the top, and very narrow at the waterline. It is a striking sight. This landmark became famous internationally when it was featured in the James Bond movie "The Man with the Golden Gun".

- **Ko Hong**

Ko Hong is the largest island of Mu Ko Hong. This limestone island has a beach and coral reefs in both deep and shallow water levels. A few years ago, aerial surveys first revealed the Hong[2] that lies inside some of Phang Nga's island. These fabulous microcosms, hidden realms rich in unspoiled flora and fauna, are collapsed cave systems opened to the sky and surrounded by towering limestone walls. Entering this hallow out island by boat is much like floating through a giant reception hall with two doors.

- **Ko Yao**

Ko Yao consists of two large islands, Ko Yao Noi and Ko Yao Yai, surrounded by many smaller islands. The total area is 137.9 $km^{2.}$ It is largely unaffected by the booming developments in Phuket. Ko Yao retains its traditional Muslim culture. There are a few bungalows in operation providing basic but very charming accommodations.

[1] The word 'Ao' in Thai means bay.

[2] The word 'Hong' in Thai means room.

Krabi's major attractions are located largely along its extensive coastline, which has several well-known beaches and bays, and numerous offshore tropical islands. Most of such attractions fall within the aegis of national parks. The major national park is Hat Noppharat Thara-Mu Ko Phi Phi National Park, which is popular with yachtsmen, scuba divers, snorkelers and day-trippers from Phuket. The Park comprises 32,900 ha marine and 6,096 ha coastal land. It includes two limestone archipelagoes, the Poda Group (some 1-2 km south of Hat Nopharat Thara) and the Phi Phi Group (about 8 km further south). Mainland coastal features include extensive beds of fossilized mollusks accumulated during the Mesozoic era. Places of interest within the Park include the following:

- **Hat Nopharat Thara**

This 2-km long beach is about 18 kilometers northwest of Krabi. It is a scenic beach lined with casuarina trees and is popular among locals especially during weekends.

- **Ao Nang**

Ao Nang is a large bay with scenic beaches and 83 small islands. Its famous beaches stretch to the foot of a limestone mountain. Accommodation and other facilities include diving shops, boats for rent and sightseeing by canoe. From Ao Nang, tourists may hire boats to visit nearby islands of Poda, Thap and Mo, and enjoy their white sandy beaches, clear water and colorful fishes and corals.

- **Mu Ko Phi Phi**

This is an archipelago of six islands consisting of Ko Phi Phi Don and Ko Phi Phi Le as the major islands. Both islands feature precipitous and heavily weathered cliffs. The superb scenery of the islands include high hills with jutting cliffs surrounded by marvelous beaches and emerald sea, below which are a bank of coral reefs and colorful marine life. Places of interest of Mu Ko Phi include Ko Phi Phi Don, Ko Phi Phi Le, Ko Phai, and Ko Yung.

- **Ban Laem Pho or Susan Hoi (Fossil Shell Beach)**

The shell graveyard at Ban Laem Pho was once a large fresh water swamp, home to a type of snail. Over 40 million years ago, these snails lived and died by the millions until the dead snails formed a layer upon which living snails exist. Eventually, weather changes precipitated the swamp's disappearance and the layer of fossilized snail shells became forty centimeters thick, resting on ten centimeters of lignite below which is the subsoil. Because of geographical upheaval, this shell limestone is now distributed in great broken sheets of impressive magnitude on the seashore of Laem Pho.

- **Ko Lanta National Park**

Ko Lanta National Park, conveniently accessible by regular boat services from Krabi, offers several coral-fringed islands, and prime diving sites, and comparative solitude. The largest island, Ko Lanta Yai, is the site of park headquarters, and is also home to Chao Le (sea gypsies) who are mainly fishermen. The islands are best visited during the non-monsoon months from October to April.

6.0 CHOICE EXPERIMENTS

The growing public interest in the management of coastal and marine environment in Thailand has presented coastal zone managers with the need to better understand public preferences. Table 1 shows an overview of stated preference elicitation methods used to elicit public preferences. Contingent valuation has traditionally been used to estimate the non-market value of environmental resources (Carson et al. 1995). Contingent valuation asks respondents' willingness to pay or to accept compensation for an environmental change in question. Contingent valuation evaluates the total economic value of single-attribute environmental goods. However, the value of each attribute cannot be distinguished using contingent valuation in multi-attribute environmental goods. Environmental economists have recently begun to pay attention to attribute-based methods, including rating-based conjoint analysis, ranking-based conjoint, and choice experiments, as new valuation techniques that can identify the value of each attribute of a multi-attribute environmental goods. A rating-based conjoint asks respondents to rate their preference among profiles on a scale. A ranking-based conjoint asks respondents to rank alternatives in order of preference from most desirable to least desirable. A choice experiment asks respondents to choose the profile they prefer most.

Table 1. Stated Preference Approach

Technique	*Description*
Contingent valuation (Single-attribute preference-elicitation)	Ask respondents their willingness to pay or willingness to accept compensation
Conjoint analysis (Multi-attribute preference-elicitation) • Rating-based conjoint Choice experiment (Or choice-based conjoint) Contingent ranking (Or ranking-based conjoint)	 • Ask respondents their preference on a rating scale (e.g., 1-6) • Ask respondents for their most preferred choice • Ask respondents to rank choices in order of preference

Boyle et al. (1997) have summarized five important issues regarding a debate over the relative merits of rating-based conjoint, choice experiment, and ranking-based conjoint. Firstly, there are researchers that advocate the use of ranking data because "values are often thought to be inherently comparative and competitive" (Rokeach 1973: p.6). Ranks are also consistent with ordinal interpretations of utility. A disadvantage of having respondents rank alternatives is that it is believed to be inherently more difficult and time consuming relative to rating alternatives. Secondly, the reliability of rank data declines with decreases in rank (Ben-Akiva et al. 1991). That is, individuals seem to provide better information about their most preferred alternatives and spending less cognitive efforts with lower rank alternatives. Thirdly, the relative ease of selecting ratings may reduce "respondents' willingness to make more precise distinctions about the relative importance of valued qualities" (Feather 1973: p.229). Fourthly, ratings allow a cardinal interpretation of utility on a bounded, integer scale (Roe et al. 1996). Specifically, the debate focuses on whether a ranking approach provides better data by forcing respondents to make distinctions across alternatives (like not allowing ties), or whether ratings - because ties are allowed - provide better data by allowing equal treatment of alternatives to which the

respondents are indifferent. Fifthly, some have advocated a choice experiment since it is felt to mimic most closely actual choice behavior. One drawback with this approach is that it provides the least amount of information about preferences.

A relatively large body of previous attribute-based valuation studies in environmental economics include Mackenzi (1993), Adamowicz et al. (1994), Griner and Faber (1996), Boxall et al. (1996), Roe et al. (1996), Adamowicz et al. (1997), Boyle et al. (1997), Machado and Mourato (1998), Morrison et al. (1998), and Kuriyama 1998). Four studies are reviewed in more detail: Boyle et al. (1997), Machado and Mourato (1998), Morrison et al. (1998), and Kuriyama (1998).

(1) Boyle et al. (1997) used independent samples to compare rating, ranking, and choose-one response formats. Preferences of residents of the state of Maine for timber harvesting practices on public land in the state were solicited using a mail-out, mail-back survey instrument. Respondents were asked to consider seven timber harvesting attributes: the density of forest roads, dead and dying trees left in the harvest area, live trees left after harvesting, maximum size of harvest openings, percentage of forest land available for timber harvesting, watershed protection zones, and disposal of slash. Respondents were presented with four management plans to consider. Each management plan was composed of randomly assigned levels of each of the forest practices (attributes). The ratings data was analyzed using both a double-hurdle tobit model and an ordered probit model; the rankings data was analyzed using an ordered probit model; and the choose-one data was analyzed using a binary probit model. The results suggest that ratings, rankings and choose-one response options to conjoint questions result in different structural models of people's preference.

(2) Machado and Mourato (1998) used contingent valuation and contingent ranking techniques to evaluate the multiple benefits of improving the quality of marine recreational waters at the Estoril Coast (Portugal). The contingent survey uncovers the value of water related health symptoms. The contingent ranking survey elicits the total use value of water quality improvements in Estoril Coast beaches. The contingent valuation survey was administered to 401 Lisbon respondents, randomly selected, using beaches along the Estoril Coast. Face-to-face interviews were conducted on-site, on 11 beaches, with varying degrees of water quality. Respondents were asked to evaluate in terms of pain and inconvenience, three health states potentially associated with bathing in polluted water: gastroenteritis, eye irritation and respiratory illness. The monetary welfare gain of avoiding the symptoms was obtained by using the payment ladder. The contingent ranking survey was undertaken in 11 beaches along the Estoril Coast. The random sample consisted of 195 beach users, resident in Lisbon, who were interviewed face-to-face. Respondents were asked to rank four hypothetical beaches, varying in terms of water quality and cost of travelling there, and identical in all other aspects (congestion, sand quality, on-site facilities, and distance from home). Each respondent was asked to conduct this ranking exercise with three different sets of four hypothetical beaches. The two beach attributes (water quality and cost of access) were offered at three different levels each.

(3) Morrison et al. (1998) presented the results from three separate choice modeling (choice experiment) applications. Estimates were made of the value of improving the quality of wetlands. The first survey was conducted in Sydney, a major urban

center, and the second was conducted in Moree, a rural center close to the Gwydir Wetlands. The third survey, which was also conducted in Sydney, focused on the Macquarie Marshes, another wetland in New South Wales. The questionnaires for the Macquarie Marshes and Gwydir Wetlands were identical, except for specific site information. The questionnaires informed respondents that there were three broad alternatives available for the management of the wetlands: to continue the current situation (status quo), to increase water for the wetlands, or to increase water for irrigation. The scenario presented to respondents was that it would be possible to purchase water for the wetlands from farmers on the existing water trading market. Respondents were told that the Government did not have sufficient money to purchase water from existing revenue and that it would be necessary to charge households in New South Wales a one-off levy on water rates in 1998. No mention was made of the other site. Respondents were then presented with six choice sets showing various options for the wetlands. The options in the choice sets were defined using five different attributes: water rates, irrigation related employment, wetlands area, frequency of water bird breeding and endangered and protected species present. The data was analyzed by using a multinomial logit model.

(4) Kuriyama (1998) estimated an environmental value of recycled wood wastes using conjoint analysis. A comparison of pair-wise rating method and the choice experiment elicitation method was made. The questionnaire was composed of four parts: (i) an explanation of the difference between normal water-cleaning filters and recycled filters, (ii) a question concerning the importance of the attributes, (iii) 10 pair-wise rating questions, and (iv) 10 choice experiment questions. The attributes considered were cleaning performance, replacement time, and price. The pair-wise ratings data was analyzed by using an ordered probit model. The choice experiment data was analyzed by using a conditional logit model.

An attempt at valuing the characteristics of biodiversity within coastal ecosystem is a difficult task. Its dominant value arises out of ecological considerations not always reflected in market situations and the nature of interdependence between its components is ill defined. In valuing natural resource rich habitats, both in terms of their components and as parts of systems, the links between aggregation levels, nature of value associated with each component and approaches to valuation are of significance. This research used a choice experiment in valuing economic value of changes to the quality of coastal ecosystems in Phang Nga Bay. Conducting a choice experiment, we were able to calculate the estimates of value to quality changes of different ecosystem attributes in Phang Nga Bay. In a choice experiment, individuals were given a hypothetical setting and asked to choose their preferred alternative among several alternatives in a choice set, and they were usually asked to perform a sequence of such choices. Each alternative is described by a number of attributes or characteristics. A monetary value is included as one of the attributes, along with other attributes of importance, when describing the profile of the alternative presented. Thus, when individuals make their choices, they implicitly make trade-offs between the levels of the attributes in the different alternatives presented in a choice set.

7.0 THEORETICAL FRAMEWORK

The random utility model provides the theoretical framework for analyzing the data from the choice experiment exercise. The choice of an alternative (one of three scenarios in the choice experiment) represents a discrete choice from a set of alternatives.

According to this framework, each alternative is represented with the indirect utility function that contains two parts: a deterministic element (V_i) and a stochastic element (ε_i)- which represents unobservable influences on individual choice. The overall utility of alternative *i* is shown in equation (1).

$$U_i = V_i + \varepsilon_i \tag{1}$$

An individual will choose alternative *i* if $U_i > U_j$ for all $j \neq i$. However, since the utilities include a stochastic component, one can only describe the probability of choosing alternative *i* as

$$prob(i \ \ chosen) = prob(V_i + \varepsilon_i > V_j + \varepsilon_j; \forall j \in C) \tag{2}$$

where C is the set of all possible alternatives. In the choice experiment, the V_i contains attributes of the situation and there are three alternatives (status quo, plan A, and plan B). McFadden (1974) showed that if the error terms in equation (2) independently and identically distributed (IID) with a type I extreme value distribution (a Gumbel distribution), then the probability of choosing alternative *i* has the following closed-form representation

$$prob(i) = \frac{e^{\lambda V_i}}{\sum_{j \in C} e^{\lambda V_j}} \tag{3}$$

This distribution is characterized by a scale parameter λ (which is inversely proportional to the variance of the error term) and a location parameter δ. In practice, the distribution chosen is the standard Gumbel distribution with λ=1 and δ=0 (Ben-Akiva and Lerman 1985). McFadden's model is known as the conditional logit model. There are two problems with the conditional logit model: (1) the alternatives are independent and (2) there is a limitation in modeling variation in taste among respondents.

The first problem arises from the IID assumption (constant variance), which results in the independence of irrelevant alternatives (IIA) property. This property states that the ratio of choice probabilities between two alternatives in a choice set is unaffected by changes in that choice set. If this assumption is violated, the conditional logit should not be used. One type of model that relaxes the homoskedasticity assumption of the conditional logit model is the nested logit model (McFadden 1978; Daganzo and Kusnic 1993). In this model the alternatives are placed in subgroups, and the variance is allowed to differ between the subgroups but is assumed to be the same within each group.

The second problem arises when there is taste variation among respondents due to observed and/or unobserved heterogeneity. Observed heterogeneity can be incorporated

into the systematic part of the model by allowing for interaction between individual characteristics and attributes of the alternatives or alternative specific constants.

An estimated linear-in-parameters utility function for alternative *i* often takes the form:

$$V_i = \alpha_i + \sum_{j=1}^{n} \beta_j X_j + \sum_{k=1}^{m} \gamma_k \alpha_i Z_k \qquad (4)$$

where α_i is an alternative specific constant, X_j is the ecosystem attributes associated with the alternative, Z_k is a vector representing individual characteristics and α_i, β_j and γ_k are parameters. Individual characteristics can be included in the model by interacting them with the alternative specific constants (as shown in equation (4)) and /or the attributes (not shown). All ecosystem attributes are entered the model using effect codes (the utility of the average quality level is the negative sum of the utilities of the good and excellent quality levels).

Welfare estimates are obtained in choice experiment studies, using the following general formula described by Hanemann (1984):

$$CV = \frac{1}{\mu}[\ln \sum_{i \in C} e^{V_{i1}} - \ln \sum_{i \in C} e^{V_{i0}}] \qquad (5)$$

where μ is the marginal utility of income, V_{i0} and V_{i1} represent the indirect observable utility before and after the change under consideration, and C is the choice set. When the choice set includes a single before and after policy option, equation (5) reduces to:

$$CV = \frac{1}{\mu}[\ln e^{V_{i1}} - \ln e^{V_{i0}} l] = \frac{1}{\mu}[V_{i1} - V_{i0}] \qquad (6)$$

From equation (6) it is easily seen that for a linear utility function, the marginal rate of substitution between two attributes is simply the ratio of their coefficients (Hensher and Johnson 1981), and that the marginal willingness to pay for a change in attribute is given by

$$MWTP_j = -\beta_j / \mu \qquad (7)$$

8.0 SURVEY DESIGN

This research intends to estimate the value that resource users place on marine and coastal ecosystem quality changes. It is assumed that the current quality of ecosystems in Phang Nga Bay is at its average level (status quo). Respondents will be presented with two new management plans (plan A and plan B) which will protect endangered birds and other marine lives; maintain fish stocks; and improve recreational and educational facilities for residents and tourists. The plans will ensure that coastal ecosystems will be improved to higher quality levels (good and excellent). Each plan is defined using four ecosystem attributes: living coral cover (a proxy for recreational use), income from fishery (a proxy for consumptive use), flood occurrence (a proxy for indirect use), and area protected (a proxy for non-use value). The increase in income tax in 2002 is included as a WTP measure attribute, which will provide the link between the parameter weights of the

ecosystem attributes (recreational use, consumptive use, indirect use, and existence value) and money.

8.1 Pre-test Survey

The questionnaire was pre-tested using a payment ladder approach on 60 individuals to derive the implicit prices for each discrete change in marine ecosystem quality level. An example of a choice situation is presented in Table 2-A. Face-to-face interviews with individuals were conducted in two locations: Phang Nga Bay area (Phuket, Phang Nga, and Krabi Provinces); and other major provinces not in the Bay area. A payment ladder is a type of payment card, which sequentially lists a range of values from low to high. For each management plan, respondents were asked to tick the amounts they were sure they would pay and to cross amounts that they were sure they would not pay.

The payment ladder used in the pilot study is presented in Table 2-B. The values represent possibly an increase in income tax in 2002 to finance the Biodiversity Fund. Respondents were asked to begin with the lowest values and, considering each value in turn, they had to put a tick against those amounts that they were almost certain that they would be willing to pay. Respondents were then asked to consider the values at the high end of the ladder, and to cross those amounts that they were almost certain that they would not be willing to pay. In the example provided, the respondent is almost certain that he would be willing to pay as much as 250 Baht (USD 6.25) per year for plan A and 300 Baht (USD 7.5) per year for plan B, and equally certain that he would not be willing to pay as much as 750 Baht (USD 18.75) per year for plan A, and 1,000 Baht (USD 25) per year for plan B. Between these two values, the respondent was unable to mark either a tick or a cross, indicating that willingness to pay was uncertain over this range.

Table 2-A. Description of a Choice Situation

	Status quo	*Plan A*	*Plan B*
Increased living coral cover	No change	25 %	65 %
Increased income from fishery	No change	35 %	60 %
Flood occurrence	Every year	Every 2 years	Every 4 years
Increased area protected	No change	20 %	50 %

Table 2-B. Payment Ladder

Plan	*A*
Baht	✓, ✗
0	✓
50	✓
100	✓
150	✓
200	✓
250	✓
300	
350	
400	
450	
500	
550	
600	
650	
700	
750	✗
800	✗
850	✗
900	✗
950	✗
1,000	✗
1,100	✗
1,200	✗
1,300	✗
1,400	✗
1,500	✗
1,600	✗
1,700	✗
1,800	✗
1,900	✗
2,000	✗

Plan	*B*
Baht	✓, ✗
0	✓
50	✓
100	✓
150	✓
200	✓
250	✓
300	✓
350	
400	
450	
500	
550	
600	
650	
700	
750	
800	
850	
900	
950	
1,000	✗
1,100	✗
1,200	✗
1,300	✗
1,400	✗
1,500	✗
1,600	✗
1,700	✗
1,800	✗
1,900	✗
2,000	✗

Note: 40 Baht = 1 USD

The pre-test survey highlighted remaining problems in the wording of the questionnaire, the format used, and the choice of payment vehicle. In addition it allowed the testing of the visual aids. Key points resulting from the pre-test survey, that facilitated the design of an effective final survey instrument were (1) eliciting ranking was found to be more difficult than eliciting a single most preferred choice; (2) the design including dominated options to allow for rationality tests on consumers' choices was found to be difficult to understand by respondents, and so was dropped in the final survey; (3) the pre-test willingness to pay responses were used to define a choice experiment willingness to pay elicitation format to be used in the main survey.

8.2 Questionnaire Design

The questionnaire in the final survey contains three sections as shown in Appendix 1. The main sections of the questionnaire addressed: attitude towards the environment; current use of the mangroves and coral reefs; the choice experiment; and socioeconomic characteristics. The questionnaire and the attributes used in the choice experiment were developed in cooperation with researchers specialized in marine ecosystems from Marine Science Institute of University of the Philippines. Several focus group discussions and a pilot study were conducted in the process. In the introduction of the choice experiment, the purpose of Phang Nga Bay ecosystem valuation was briefly explained. The respondents were then informed about the particular coastal area in Phang Nga Bay that was about to be improved, and were informed that we were interested in their views on the best possible management plan. Next the attributes used in the choice experiment (see Table 3) were explained. The respondents were provided with a separate fact-sheet describing the attributes. Maps, text, graphics and concepts such as biodiversity, were used to communicate information on the mangroves and coral reefs of Phang Nga Bay. The current uses of the mangroves and coral reefs of Phang Nga Bay, its global importance as a habitat for rare and endangered birds, and the current threats the area is facing, were presented to respondents

The four ecosystem attributes were offered at three different levels (average, good, and excellent) and varied to reflect consistent ecological linkages. The cost variable varies between 200 Baht (USD 5) to 1,500 Baht (USD 37.5). In the choice experiment, each respondent answered four choice sets. The upper and lower bounds on the cost variable was identified in the piloting stages of the questionnaires; non-linear spacing of the fee levels ensured that choice experiment questions incorporated the maximum possible number of implicit price for each ecosystem quality levels. In each choice set respondents were asked to choose among three alternatives (see Table 4). The first alternative was always the base alternative, in which there would be no improvements to the Bay, at no cost. The two other alternatives implied a number of improvements to the Bay.

Table 3. Attributes and Attribute Levels

Attributes	*Level*
Increased living coral cover	Average (no change), Good (25%), Excellent (65%)
Increased income from fishery	Average (no change), Good (35 %), Excellent (60%)
Flood occurrence	Average (every year), Good (every 2 years), Excellent (every 4 years)
Increased area protected	Average (no change), Good (20 %), Excellent (50 %)
Increased income tax in 2002 (Baht)	0, 200, 700, 1000, 1500

Note: 40 Baht = 1 USD

Table 4. Example of a Choice Set from Phang Nga Bay Questionnaire

YOUR CHOICE ⇒			
	Status quo	*Plan A*	*Plan B*
Increased living coral cover	No change	25 %	No change
Increased income from fishery	No change	No change	60 %
Flood occurrence	Every year	Every 2 years	Every 4 years
Increased area protected	No change	20 %	50 %
Your increased income tax in 2002 (Baht)	0	200	700

Note: 40 Baht = 1 USD

To summarize the information in the data, effect codes were set up following Louviere (1988). Effect codes translate category-rating scales to a coding system that can be used in econometric analysis. The effect codes used in the econometric analysis for the flora and fauna attribute correspond to FFE (excellent flora and fauna), FFG (good flora and fauna), FFA (average flora and fauna, is the benchmark for comparison). The coefficients on FFE and FFG provide the "marginal utility" of these levels of the attributes, while –1 times the sum of these coefficients provide the "marginal utility" of the average level of flora and fauna. Effect codes for three other attributes (local livelihood, ecological function, and rare and endangered species) were coded in the same way (see table 5).

Table 5. Effect Codes for Ecosystem Attributes

Quality Level	FFE	FFG	LLE	LLG	EFE	EFG	REE	REG
Excellent	1	0	1	0	1	0	1	0
Good	0	1	0	1	0	1	0	1
Average	-1	-1	-1	-1	-1	-1	-1	-1

Note: EFA = Average Ecological Function

EFE = Excellent Ecological Function

EFG = Good Ecological Function

FFA = Average Flora and Fauna

FFE = Excellent Flora and Fauna

FFG = Good Flora and Fauna

LLA = Average Local Livelihood

LLE = Excellent Local Livelihood

LLG = Good Local Livelihood

The choice sets were created using the OPTEX procedure in SAS, which is a linear D-optimal design procedure (Kuhfeld 2001). The design is selected from the collective

factorial, where collective factorial is a L^{AC} factorial, C is the number of alternatives and each alternative has A attributes with L levels. Using the OPTEX procedure we created 40 alternatives in the orthogonal design. A cyclical design is applied as an extension of the orthogonal approach. First, each of the alternatives in the orthogonal design is allocated to different choice sets. Attributes of the additional alternatives are then constructed by cyclically adding into the choice set based on the attribute levels.

Table 6. Orthogonal Design

Set	*Living coral cover*	*Fishery income*	*Flood Occurrence*	*Area protected*	*Cost (Baht)*
1	Good	Good	Good	Average	200
2	Good	Good	Excellent	Average	200
3	Good	Good	Average	Good	1000
4	Good	Good	Average	Excellent	1000
5	Good	Excellent	Good	Excellent	1500
6	Good	Excellent	Good	Excellent	700
7	Good	Excellent	Excellent	Good	1500
8	Good	Excellent	Excellent	Average	700
9	Good	Average	Good	Good	1000
10	Good	Average	Excellent	Good	1500
11	Good	Average	Average	Excellent	700
12	Good	Average	Average	Average	200
13	Excellent	Good	Good	Good	700
14	Excellent	Good	Good	Average	1500
15	Excellent	Good	Excellent	Excellent	1500
16	Excellent	Good	Excellent	Excellent	1000
17	Excellent	Good	Average	Average	1500
18	Excellent	Excellent	Good	Good	200
19	Excellent	Excellent	Good	Average	1000
20	Excellent	Excellent	Excellent	Good	700
21	Excellent	Excellent	Excellent	Average	200
22	Excellent	Excellent	Average	Good	1000
23	Excellent	Average	Good	Excellent	200
24	Excellent	Average	Excellent	Excellent	200
25	Excellent	Average	Average	Good	700
26	Excellent	Average	Average	Average	1500
27	Average	Good	Good	Good	1500
28	Average	Good	Good	Good	200
29	Average	Good	Excellent	Good	200
30	Average	Good	Excellent	Average	700
31	Average	Good	Average	Excellent	700
32	Average	Excellent	Good	Excellent	1500
33	Average	Excellent	Excellent	Average	1000
34	Average	Excellent	Average	Good	200
35	Average	Excellent	Average	Excellent	200
36	Average	Excellent	Average	Average	1500
37	Average	Average	Good	Average	1000
38	Average	Average	Good	Average	700
39	Average	Average	Excellent	Good	1500
40	Average	Average	Excellent	Excellent	1000

Note: 40 Baht = 1 USD

The attribute level in the new alternative is the next higher attribute level to the one applied in the previous alternative and if the highest level is attained, the attribute level is set to its lower level. These 40 choice sets were then blocked into 10 versions each containing 4 choice sets.

Ecosystem attributes were arranged into three hypothetical options for the respondents to elicit their most preferred choice. This information together with their most preferred choice indicates the relative importance among these ecosystem attributes and money. Socioeconomic characteristics of the respondents were included in the estimation and entered in the estimating equation interactively. The conditional logit model was used to analyze this choice experiment data and the unknown parameters were estimated by maximizing the likelihood function. This information was then used to calculate the value of each ecosystem attribute, which is essentially the marginal rate of substitution between ecosystem attribute and money.

8.3 Main Survey

Most of Phang Nga Bay benefits accrue at the local level (local livelihood) and national level (recreational values) and some at the global level (existence values). Therefore foreigners were excluded from the survey. The population sample was chosen from Thais between ages 18 and 75 years, living in and traveling to Phang Nga Bay area, a total of 2,555,703 persons. A sample of 300 individuals was randomly selected. The main survey was conducted from November 2001 to January 2002. Each individual answered four choice sets. Four teams of surveyors conducted face-to-face interviews. Each team consisted of two persons. A training course of two days was given in order to minimize biases due to misunderstanding of the questions by the interviewers. The training course consisted of a careful explanation of all questions, simulation of interviews among the surveyors and a pilot interview on an individual in order to check that the questions were clear enough to the respondents and that the time required to complete the interview were not too excessive. The initial survey and the main survey were divided into 4 trips, each trip lasting 5 days.

9.0 EMPIRICAL RESULTS

9.1 Attitudes on and Use of Phang Nga Bay

The opening section of the survey consists of a set of attitudinal questions intended to lead respondents into an exploration of their personal views on environmental issues in general, including mangroves and coral reefs habitats and species protection, in preparation for the valuation section. These questions also seek to reveal respondents' underlying motives for supporting the protection of Phang Nga Bay. Respondents were asked to specify from a list of five social and environmental problems, which they considered to be the most important in Thailand in which the Thai government should invest money on.

Table 7. Ranking of Social and Environmental Problems in Thailand

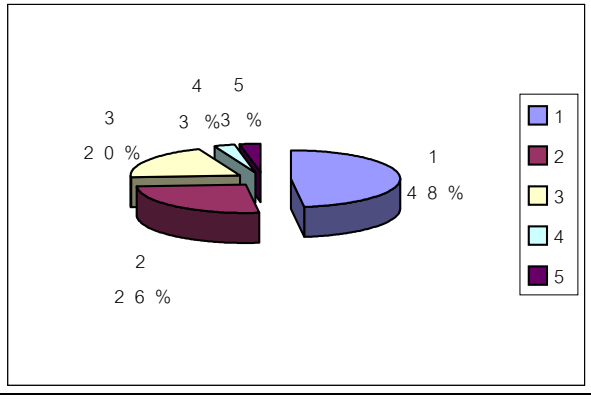
Problems	*Rank*
Protecting natural habitats and wildlife	35% (1)
Reducing water pollution	23% (2)
Improving quality of education	16% (3)
Increasing agricultural productivity	12% (4)
Inflation	9% (5)
Other social and environmental problems	6% (6)

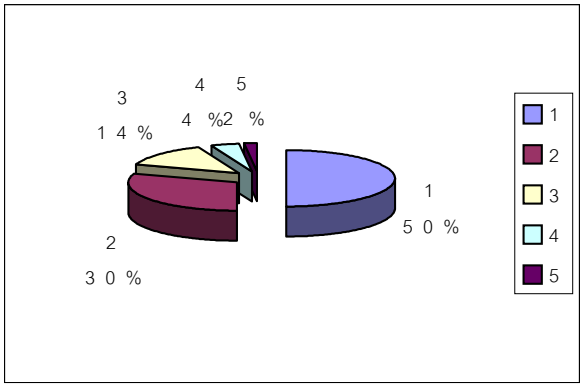
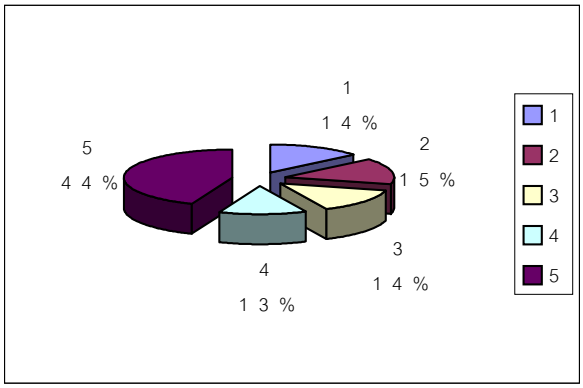
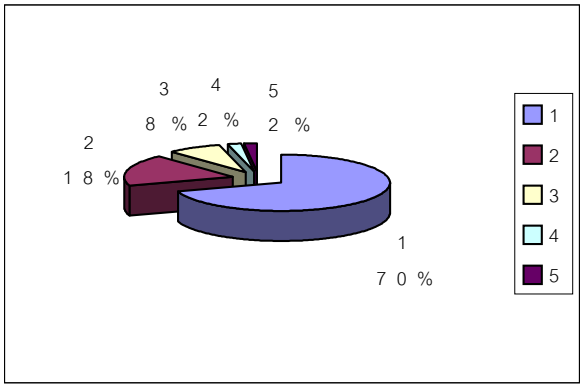
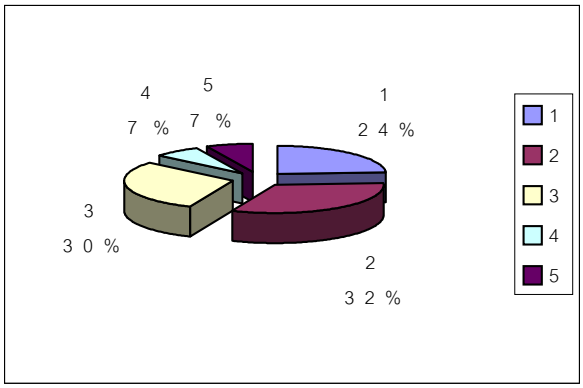
Table 8. Ranking of Environmental Problems in Thailand

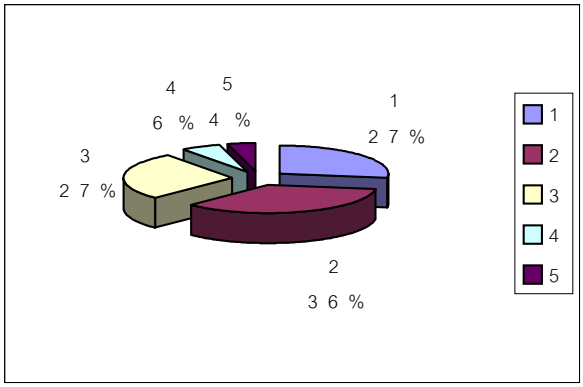
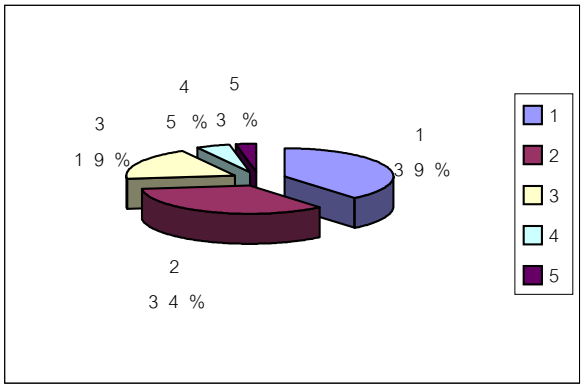
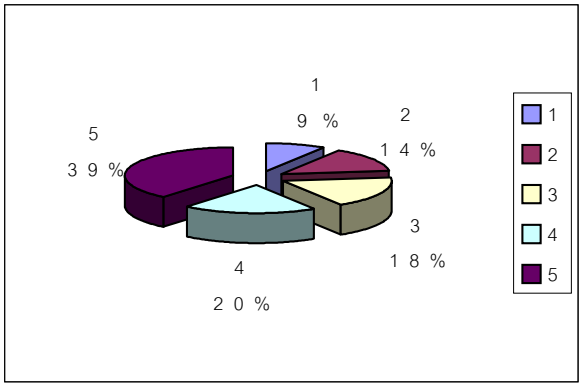
Problems	*Rank*
Degraded mangroves and coral reefs	44% (1)
Deforestation	22% (2)
Floods	11% (3)
Other environmental problems	11% (3)
Water pollution	10% (5)
Air pollution	2% (6)

Thirty-five percent of respondents consider protecting natural habitats and wildlife to be the most important issue for Thailand. In terms of environmental problems, degraded mangroves and coral reefs are the main concerns. For the purposes of the choice experiment analysis, the attitude of respondents to protection of mangroves and coral reefs habitat was further explored. Respondents were presented with a series of attitudinal statements about habitat and wildlife protection and asked whether they agreed or disagreed with each statement. These are summarized in Table 9. Overall, the responses reveal a high positive value placed on natural resources.

Table 9. Attitudinal Statements on Coastal Resource Management

Value/Statement	*1= Strongly agree 2=Agree 3=No opinion 4=Disagree 5=Strongly disagree*
(1) Intrinsic value We have a duty to protect the environment from development regardless of the cost	

(2) Bequest value We should minimize the damage to the environment now so that our grandchildren may benefit from it	
(3) Role of environmental assets in development Thailand needs to develop her forests, sea, and land to increase jobs and incomes, regardless of the environmental damage	
(4) Existence value Mangroves and coral reefs should be protected because rare birds and marine lives depend on them	
(5) Selfish use value motive I should pay for the protection of parks and nature reserves even if I do not visit them	

(6) Option value Even if I do not use the mangroves and coral reefs now, I am prepared to pay now to protect them in case I want to use them in the future	
(7) Indirect use value It is worth spending money to protect mangroves because they help to protect agricultural productivity in the area	
(8) Putting issue in context We have more important things to think about than the loss of the mangroves and coral reefs	

(1) The first question asked respondents if they felt that one had a duty to protect the environment from development, regardless of the cost. This question sought to reveal whether respondents felt that natural resources were of 'intrinsic value' and if we therefore have a duty to protect them. Two hundred and twenty-three of the respondents agreed that we do have such a moral duty, with 48% of the overall sample strongly agreeing with this statement.

(2) Bequest value is a type of option value. It refers to the fact that even if we do not use natural resources now, we have a duty to pass on these natural assets to our children so that they may also benefit from them. A very high percentage of respondents, 80%, agreed with this statement. That is, respondents believe that natural resources are of value because of the benefits they can provide to future generations.

(3) A pertinent question in a country like Thailand, which experienced very high growth rates over the past decade, is the extent to which natural resources may be sacrificed in this development process. In order to measure respondent's attitudes on the role of environmental resources in the development process, respondents were presented with

the statement: 'Thailand needs to develop her forests, sea, and land to increase jobs and incomes, regardless of the environmental damage'. Over 172 respondents disagreed with this statement (57%), and only 14% strongly agreed.

(4) This study was particularly interested in revealing the value respondents placed on rare birds and marine lives found in the study area. It is assumed that part of the value of rare species is pure existence value. Existence value is not related to any type of 'use' of the environmental resources. It relates to the value derived simply from the knowledge that the goods and services exist. As mentioned above, existence values can only be inferred through the CVM process. Affinity with existence value concept was sought through the statement: 'Mangroves and coral reefs should be protected because rare birds and marine lives depend on them'. A high number, 88% of the respondents agreed with this statement.

(5) Another probing question on the importance of non-use values to the respondent was: 'I should pay for the protection of parks and nature reserves even if I do not visit them'. Affirmation with this statement would suggest that a park or nature reserve is recognized for its non-use value (i.e., they incorporate other values such as option and existence value). Fifty-six percent of respondents agreed with this statement. Fourteen percent of the sample disagreed, suggesting that such areas were of value only for their use benefits.

(6) As stated above, option value refers to an additional premium placed on a good or service, for the 'option' to be able to use it in the future. The following statement was asked to assess the appreciation of the option value concept among respondents: 'Even if I do not use the mangroves and coral reefs now, I am prepared to pay now to protect them in case I want to use them in the future'. Sixty-three percent of respondents agreed with this concept, confirming mangroves and coral reefs' option value.

(7) Indirect use value, refers to the benefits provided by a mangrove environmental functions and services. The most important indirect mangrove use value is the role they play in supporting inshore and offshore fisheries. Within the study area, an important function of mangroves is the protection they provide to agricultural land situated behind the mangroves, by acting as a buffer to shoreline erosion and possible saltwater intrusion. In order to assess the appreciation of the indirect functions of the mangroves, respondents were asked the following statement: 'It is worth spending money to protect mangroves because they help to protect agricultural productivity in the area'. Nearly 220 of respondents agreed with this, suggesting a high appreciation of the indirect value of the mangrove.

(8) Finally, in order to put the issue of the loss and degradation of mangroves and coral reefs into context, respondents were asked the following statement: "We have more important things to think about than the loss of the mangroves and coral reefs". Fifty-nine percent disagreed with this statement. This result is consistent with the findings that the protection of mangroves and coral reefs is of relatively high priority within the study area. In Table 10, the descriptive statistics of the sample used in the estimations are presented.

Table 10. Descriptive Statistics Included in Estimations

Variable	*Description*	*Mean*	*Std.Dev.*	*Min.*	*Max.*
Male	=1 if respondent is male	.50	.50	0	1
Single	=1 if respondent is single	.48	.50	0	1
Age	Respondent age	32.24	9.21	18	63
Nedu	Numbers of years of education	13.95	3.03	1	22
Hnum	Household size	4.69	3.20	1	7
Inc	Personal monthly income (Baht)	12,158.33	9,600.50	2,500	50,000
Hinc	Household monthly income (Baht)	24,933.33	15,240.39	2,500	50,000
Total respondents	300				

Note: 40 Baht = 1 USD

9.2 Econometric Results

Results for the conditional logit specifications with two different models: no interaction (Model 1) and with interaction (Model 2) are presented in Table 11.

Table 11. Estimation Results

	Model 1			*Model 2*		
Variable	*Coefficient*	*T statistic*	*P value*	*Coefficient*	*T statistic*	*P value*
Constant	0.801	5.268	0.000	-0.595	-1.008	0.313
Cost	-0.000541	-6.542	0.000	-0.000544**	-6.570	0.000
Good Flora and Fauna	0.149	2.859	0.004	0.144**	2.765	0.005
Excellent Flora and Fauna	0.230	4.408	0.000	0.236**	4.494	0.000
Good Local Livelihood	0.142	2.716	0.006	0.140**	2.684	0.007
Excellent Local Livelihood	-0.025	-0.499	0.617	-0.025	-0.490	0.624
Good Ecological Function	0.074	1.415	0.157	0.075	1.432	0.152
Excellent Ecological Function	0.137	2.674	0.007	0.137**	2.672	0.007
Good Rare and Endangered species	-0.112	-2.156	0.031	-0.111**	-2.128	0.033
Excellent rare and Endangered species	0.085	1.619	0.105	0.086*	1.630	0.103
Age				0.005	0.449	0.653
Inc				0.000005	0.489	0.624
Male				0.0064	0.038	0.969
Single				0.365*	1.788	0.073
Nedu				0.062**	2.349	0.018
Hnum				0.029	1.039	0.299
Log-likelihood	-1,147.17			-1,141.46		
No. of respondents	300			300		
No. of observations	1,200			1,200		

** Significant at 5 %

* Significant at 10 %

Both models include one common alternative specific constant for the two alternatives that imply quality improvement of Phang Nga Bay ecosystem, i.e. the non-status quo alternatives, since these were presented in a generic form. An increase in the log-likelihood function indicates the advantage of applying Model 2. All ecosystem attributes except for "excellent local livelihood" and "good ecological function" are significant. These attributes are also insignificant in Model 1. The mean coefficient is negative for "good rare and endangered species", so a majority of respondents dislike this attribute. Among the socio-characteristics, both single and higher educated person is more likely to choose an improved Phang Nga Bay ecosystem.

The interpretation of the coefficient values is not straightforward, except for the significance and relative size. It is meaningful to compute the marginal rates of substitution between the attributes using the coefficient for the cost as numeraire. This implies that one can interpret the ratios as average marginal WTP for a change in each attribute, as argued by Hanemann (1984). The results are presented in Table 12.

Table 12. Marginal WTP for a Change in Each Attribute

	(Baht/person/year)		
Attributes \ Quality Level	*Average*	*Good*	*Excellent*
Flora and fauna	-699	265	434
Local livelihood	-257	257	-
Ecological function	-252	-	252
Rare and endangered species	46	-204	158

Note: 40 Baht = 1 USD

Using equation (6) to estimate the welfare implications of moving from status quo (average) to non-status quo (good and excellent) produces mean welfare estimates (compensating variation-CV) as shown in Table 13. The numbers are computed as follows.

CV for improving flora and fauna from average to excellent = 434 - (-699) = 1,133

CV for improving local livelihood from average to good = 257 - (-257) = 514

CV for improving ecological function from average to excellent = 252 - (-252) = 504

CV for improving rare and endangered species from average to excellent = 158 - 46 = 112

The welfare estimates of improving Phang Nga Bay ecosystem as shown in Table 13 indicates that diversity of flora and fauna, which provides recreational and tourism benefits is the most important attribute of Phang Nga Bay. The welfare estimate indicates that an individual is willing to pay 1,133 Baht (USD 28) per year for improved diversity of flora and fauna in Phang Nga Bay. Local livelihood (e.g. income from fishery) and ecological function (e.g. flood protection benefits) are equally important attributes of Phang Nga Bay (Figure 3). The rare and endangered species attribute is the least important attribute of Phang Nga Bay. The aggregate benefits in this report were computed by multiplying

numbers of people in the beneficiary groups[3] with welfare estimate of improving Phang Nga Bay ecosystem - 2,263 Baht (USD 57) per person, yielding 5,784 million Baht (USD144.6 million) per year.

Table 13. Welfare Estimates of Moving from Status Quo to Non-status Quo

Attributes \ Welfare estimates	*WTP to improve Phang Nga Bay Baht (USD)/person/year*	*Percentage (%)*
Flora and fauna (direct use values e.g. recreation and tourism)	1,133[a] (28)	50
Local livelihood (direct use values e.g. fishery income)	514[b] (13)	22
Ecological function (indirect use values e.g. flood protection)	504[c] (13)	22
Rare and endangered species (non- use values)	112[d] (3)	6
Total	2,263 (57)	100

[a] welfare estimate of moving from average to excellent was selected for flora and fauna

[b] welfare estimate of moving from average to good was selected for local livelihood

[c] welfare estimate of moving from average to excellent was selected for ecological function

[d] welfare estimate of moving from average to excellent was selected for rare and endangered species

[3] The number of people in beneficiary groups was taken from National Statistical Office, 1999. The groups included 348,369 adjacent dwellers, 133,767 tourism operators, and 2,037,567 tourists.

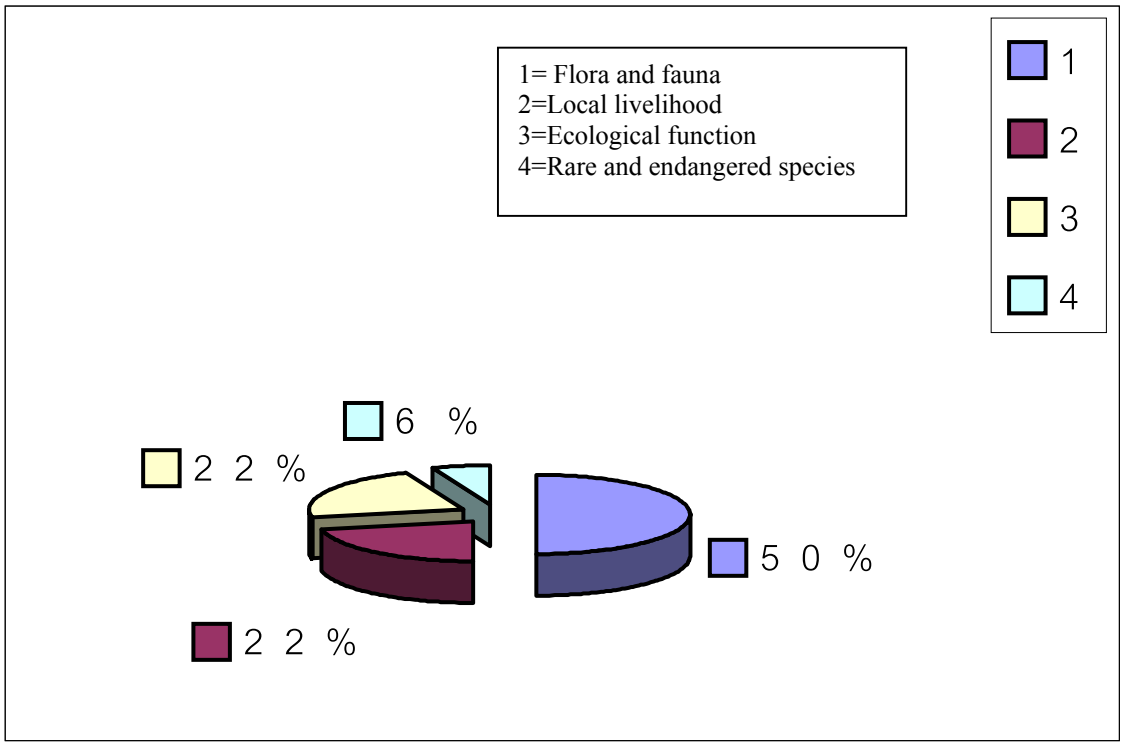


Figure 3. Percentage of WTP to Improve Phang Nga Bay by Its Attributes

10.0 CONCLUSION AND POLICY RECOMMENDATIONS

10.1 Methodological Issues

This study uses a choice experiment to value coastal ecosystems in Phang Nga Bay. The advantages of the choice experiment are that values for each attribute as well as marginal rate of substitution between non-monetary attributes can be estimated. The success of the choice experiment depends on the design of the experiment, which is a dynamic process. It involves definition of attributes, attribute levels and customization, context of the experiment, experimental design and questionnaire development. Through the pre-test survey process it was possible to put to rest a number of concerns over the feasibility of the choice experiment approach as a valuation technique at the chosen site. The early drafts of questionnaire was carefully discussed with marine scientists. Considerable attention was paid to the wording of ecological attributes occurring in the questionnaire, in an effort to ensure that these could be easily followed and understood by respondents. There were ten ecosystem attributes in the original design. These were narrowed down to four since this is the number which most respondents can deal with. The survey instruments had been largely modified after the focus groups and pre-tests. During the course of the pre-test survey, visual aids (maps, texts, and graphics) appeared to be an effective means of communicating information, and they were consequently heavily relied upon in the main survey. The quality of the photographs plays an important role in communicating information on the mangroves and coral reefs of Phang Nga Bay. During the main survey, respondents were able to understand hypothetical situations and were very cooperative.

10.2 Environmental Attitudes Towards Phang Nga Bay

A set of questions was presented to respondents with a series of attitudinal statements about habitat and wildlife protection. As noted in Table 9, our survey revealed that respondents placed a remarkably high value on preserving Thailand's environment. Eighty percent of respondents said that we should minimize the damage to the environment so that our grandchildren can benefit from it, while a majority expressed willingness to help pay for nature reserves even if they do not visit these places themselves. These findings show the willingness of Thais to support strong action to protect threatened ecosystems like those in the Phang Nga Bay.

10.3 Implications of the Southern Seaboard Development Project

Tourism is an important source of income and employment in southern Thailand, particularly in the Southern Seaboard Development Project (SSDP) region. Several areas have become major tourist centers, most noticeably Phuket, Phang Nga, and Krabi. The sites for some of the major infrastructural and industrial projects proposed by the SSDP are in or close to the important tourist areas around Phuket, Phang Nga, and Krabi. These developments could have an adverse impact on tourism throughout the area. The economic analysis of the proposed port projects at Krabi was done earlier based on the results of detailed analyses conducted in prior port feasibility studies at Phuket and Songkhla. However, some of the more important values of coastal resources of Phang Nga Bay (such as those for future generations and intrinsic values) were omitted from the earlier economic analysis of the SSDP. The omission of these benefit values in the earlier economic analysis means that coastal resources in Phang Nga Bay are undervalued, which can result in unsustainable use. Phang Nga Bay is blessed with distinctive and attractive coastal resources - water, reefs, beaches, and mountains. These scarce natural resources are the source of many benefits for both residents and visitors. They are also a source of economic rents, and will benefit Thailand with their many potential opportunities.

The SSDP will inevitably result in some damage to the environmental quality of Phang Nga Bay. The available information does not allow us to estimate the magnitude of the damage. But if it results in a 35% to 65% reduction in the quality of the Bay's ecosystems, then we can conclude that the Thai people will suffer a welfare loss of 5,784 million Baht (USD 146.85 million) /year. This is derived from our findings that people accord a value of this amount to a 35% to 65% improvement. (Studies that compare people's willingness to accept compensation for a loss to their willingness to pay for an improvement, show that WTA is at least as large as WTP.) This is a considerable amount. It is approximately 8% of the gross provincial products of Phuket, Phang Nga, and Krabi provinces combined[4]. If it were incorporated into an extended cost benefit analysis of the SSDP that included environmental impacts, it might lead to different decisions about implementing the project. Having the SSDP in Phang Nga Bay area would produce jobs and income. It would also pose significant environmental risks to Phang Nga Bay. The economic loss to society in tourism, coastal protection and sustainable fisheries may outweigh economic benefits of the SSDP.

[4] Gross provincial products (for the year 1999 at the current prices) of Phuket, Phang Nga, and Krabi provinces are 37,463 million Baht (USD 936.57 million), 15,528 million Baht (USD 388.2 million), and 18,864 million Baht (USD 471.6 million), respectively.

10.4 Phang Nga Bay: Paradise Lost?

In the early 1980s, provinces within Phang Nga Bay region, especially Phuket, experienced a rapid growth in tourism. This caused problems however, as the rapidly growing tourism demand outpaced the growth of infrastructure development throughout the island. The tourism industry makes many demands on the environment, such as, pressure on the beaches, use of precious resources for craft items, use of wetlands for waste disposal, removal of sea-grass for swimming beaches and blocking of visual and public access to the coast. These impacts could reduce the desirability of Phang Nga as a tourist destination. Specific impacts on the coastal and marine resources in the most developed tourist beach, Patong, have been reported by Bunapong and Ausavajitanond (1991, cited in Wong 1995). The natural tree cover was removed, wetlands were filled in or converted into open sewers, and the sea and beach were polluted by poorly treated wastewater. Since 1979, researchers of the Phuket Marine Biological Center have studied the condition of reefs around the southeast tip of Phuket. The study showed that corals were experiencing significant changes both on a daily and seasonal basis (Bangkok Post 2000). In addition to natural changes in the environment, the construction of resorts, hotels and other structures, and increased pollution have greatly affected the corals around Phuket. Surveys showed that one of the greatest man-made effects on corals around southeast Phuket was the building of the deep-sea port at Ao Makham in 1987. During its construction, the amount of live corals on nearby reef flats dropped by 30% as a result of dredging and landfilling activities. The corals began to recover within two years but the research team has since observed a slow and steady decline of corals in the area because of elevated sediment in the water from increased shipping traffic and regular dredging of the entrance channel to the port.

This research emphasizes the importance of coastal tourism development in Phang Nga Bay that must be balanced with the risks of continued environmental degradation and greater pressure on protected areas, many of which lack the resources for effective management and are unprepared for significant growth in visitor numbers. It is clear that reclamation and modification of coastal resources in Phang Nga Bay will incur high economic costs in terms of goods and services foregone, and that these costs will accrue to both the broader population in the society. It is however impossible to argue, on the basis of this study, that the conservation of Phang Nga Bay makes more economic sense than reclamation and modification. This is not necessarily the case, and will depend on the full value of the economic benefits associated with coastal resources in Phang Nga Bay, on the profits and income generated by coastal tourism development, and on decisions made by politicians, government policy-makers and urban planners.

As mentioned above, whether Phang Nga Bay coastal resources continue to be reclaimed for development or is sustained, depends ultimately on decisions made at policy and political levels. Nonetheless, if recommendations to manage the Phang Nga Bay as an environmentally sensitive area are taken up, the findings of this research will reveal that management must be based on economic as well as ecological considerations. Of particular importance are issues relating to the financing of management activities, the provision of economic incentives for sustainable utilization and the use of economic instruments to discourage coastal resource degradation.

10.5 Towards a Sustainable Future

Phang Nga Bay tourism's continued expansion offers opportunities to generate increased income and employment, both nationally and locally, and to provide increased incentives for biodiversity conservation in state protected areas and on private lands. These must be balanced with the risks of continued environmental degradation and greater pressure on marine national parks, many of which lack the resources for effective management and are unprepared for significant growth in visitor numbers.

This study is specifically concerned with economic perspectives on tourism development in Phang Nga Bay. Tourism in Phang Nga Bay is an important sector where environmental conservation may effectively be combined with economic development in the Bay area on a meaningful scale. It offers the potential of mobilizing resources through the private sector, which can contribute to local and national economic development while providing incentives for conservation of natural resource uses and helping to finance biodiversity conservation. This is a very appealing prospect, particularly in Thailand where economic development alternatives in rural areas are very limited, biodiversity investments are invariably inadequate, and public funds to support them are usually scarce. The policymaking priorities for Phang Nga Bay generally lie in four areas: (1) increasing and capturing more of the net economic benefits, (2) contributing more to local economic development, (3) mitigating environmental impacts, and (4) helping to finance marine ecosystem management.

10.6 Capturing Rents from Tourism in Phang Nga Bay

Coastal resources in Phang Nga Bay are the source of many benefits for both residents and visitors. These resources are also a source of economic rents, and this attractive environment gives the provinces of Phang Nga Bay many opportunities to benefit from such rents. If the resources that generate rents are not managed properly, rents will be lost or dissipated. Rents are a type of payment for the use of the resource. When access to a particular environmental resource can be controlled, charging user fees provide a simple mechanism to capture part of the rents being generated. There is a simple logic to this - users of the resource derive some benefit from this use. It is reasonable to ask visitors or users to help pay some of the costs associated with management or conservation.

The economic benefit from tourism is represented by visitors' aggregate willingness to pay for their experience. Willingness to pay includes tourist expenditures, but tourist expenditures are an incomplete measure of the economic value of tourism. This is because many visitors to nature tourism destinations pay a total amount for travel, accommodation, park entry, and so on, which is less than the maximum amount that an individual would have been prepared to pay[5] (Dixon and Sherman 1990).

Marine parks in Phang Nga Bay does not presently have adequate secured and sustained funding to finance its existing operations, let alone fulfill all of its objectives under its most recent initiatives. Yet there is notable potential for current programs to effectively take advantage of existing resources, as recognized by the park management authorities, and to tap into new resources and sources of funding.

[5] This difference between what an individual actually pays and the maximum amount he would be prepared to pay is known as consumer surplus.

By capturing a portion of the economic value of the benefits derived from the marine environment, marine parks in Phang Nga Bay will be able to finance management activities to protect and restore its coral reefs, as well as fulfill broader social objectives of providing for scientific research and education.

When considering the economic instrument options to capture net benefit values in Phang Nga Bay, it is imperative that the local economic, social and institutional context be considered. Bunce et al. (1999) provided information regarding the social context for local management, focusing on the three primary user groups – fishermen, water sports operators and hoteliers. Major observations, relevant to the potential implementation of economic instruments for benefit capture in Phang Nga Bay include:

(1) A substantial number of fishermen and water sport employees depend on the direct use of Phang Nga Bay waters for maintaining their livelihood, with many fishermen living simply on subsistence levels. The 2,037,567 visitors to Phang Nga Bay support local water sports and accommodations each year. Ultimately, the reliance on fishing for subsistence is connected to the poor economic conditions experienced by many people in the Phang Nga Bay region.

(2) There is a high degree of awareness and concern among the user groups regarding the deterioration of the marine environment, perceived to be mainly due to pollution from sewage and solid waste disposal. Water sports operators and hoteliers are generally concerned about the impacts of their activities and those of their guests.

(3) There are misunderstandings and a general lack of knowledge regarding marine park activities and regulations, particularly among the fishermen and hoteliers. Trust regarding the ability of the park management authorities to effectively protect the marine environment has waned.

10.7 Benefit Capture Options for Phang Nga Bay

Within the general category of charges or fees, there are two possible options – directly target the producers or directly target the consumers. If the tourists as consumers are to be charged, the instrument could be applied to the activities that physically use the resources, such as water sports (specifically including snorkeling, boating and diving operations), swimming and beach activities. The most obvious complimentary service utilized by all tourists in Phang Nga Bay is the accommodation sector. A charge administered through the use of accommodations would effectively target this consumer group and ease administration and enforcement of the charge.

Another alternative is an annual user fee or resource use charge that would focus on producers, namely fishermen and water sports operators. Huber et al. (1998) argued that there are problems with setting the fee at the appropriate amount and enforcement of the resource use (e.g. ensuring that only those who are licensed are the exclusive users and monitoring to ensure that use by those licensed does not rise above specified or reported levels). The ability to collect fees attached to the licensed use of marine parks in Phang Nga Bay requires that the exclusion of non-licensed users be enforceable. Without an effective ability to control access to the resource, licensed users will be reluctant to pay associated fees because their exclusive rights to the resources are not enforced. User fees also increase the accountability of the management authorities in the delivery of effective

management. A user fee can also target fishermen, as these are the producers physically using the marine resources on a daily basis. However, Gustavson (2000) argued that many of the fishermen would be unable to pay an attached fee as the resource rents earned by this group are marginal and may even be negative. Moreover, it is very difficult to presently control use by fishermen, and limitations on the level of use by water sports operators have not been established (Bunce and Gustavson 2000). Perhaps the greatest challenge is that the successful implementation of a user fee or permit system requires that allocated property rights are secured and that the management authorities are able to enforce those rights.

10.8 Policy Recommendations for Phang Nga Bay

It may take some time before tourism destroys tourism in Phang Nga Bay. Regardless of the ways in which the environment is exploited and manipulated to suit the needs of the tourism industry, it is anticipated that people may continue to come to Phang Nga Bay in large numbers. With the continued growth of cheap excursion airfares and package holidays, mass tourism has displaced elite or specialist tourism as the predominant form of international tourism in Thailand. In a longer term, tourism will destroy itself in Phang Nga Bay, unless certain measures are instituted. Tourism in Phang Nga Bay should develop in a planned and orderly manner so as to provide the maximum benefit to the Bay and its residents. It should ensure that any adverse effects on the social, economic, cultural and general quality of life of the people of Phang Nga Bay and the environment are minimized. The objective should be to achieve a managed growth and a sustainable level of tourism development. This necessitates finding and striking the fine balance between the facilitation of tourism growth and the control of associated developments, bearing in mind that without careful conservation of Phang Nga Bay's primary tourism assets, it may cease to have a viable tourism product. A comprehensive tourism policy is hence essential if the industry is to grow in an orderly manner.

The environment is the greatest economic asset Phang Nga Bay has, and is what it is selling to the world market. But environmental resources are also fragile, and require investments to maintain and manage. The bottom line message is that the environmental resources in Phang Nga Bay generate economic rents that can be used to pay for improved management of Phang Nga Bay's marine parks. This study focused on the willingness of the Thai people to pay for improved environmental quality in Phang Nga Bay and on their attitudes towards environmental protection. However, many studies from Thailand and other parts of the world provide important lessons about ways to manage the impact of tourism and about mechanisms for financing environmental protection in sites like this. The recommendations presented here for managing tourism impact are supported by findings from these studies.

10.8.1 New Hotel Development

The projected growth in tourist accommodation far exceeds the development goal. For example, hotel development in Phuket is more than 1,000 rooms/km of beach, far exceeding the 200 rooms/km of beach for sound environmental conditions recommended by the Japan International Cooperation Agency (Bunapong and Ausavajitanond, 1991). It is proposed that the government impose an official moratorium on all new hotels and related tourist accommodation developments, including condominiums and time-sharing projects, for an initial period of seven years during which no new permits for such

developments would be issued. In addition, all existing permits for new lodging developments and extensions to existing properties should be reviewed and, where appropriate, renegotiated so as to ensure that the total number of lodging units is kept at 200 rooms/km of beach.

It is anticipated that this policy will result in a re-focusing from an emphasis on attracting large new projects to facilitating the upgrading of the existing tourism products and stimulating small business growth. Investments in other viable tourism-related facilities (both local and foreign investors) will be encouraged, provided such projects conform to the guidelines set out in the policy statements.

10.8.2 Protection of the Environment

All major development proposals must be accompanied by a thorough environmental impact study conducted by an independent, qualified expert. The government can submit a developer's plan to an outside independent appraisal funded by the developer. A permit should be required for the erection of advertisement signs and billboards, which must conform to certain specified standards. The operation of jet skis and similar high-powered marine crafts should be totally prohibited in the environmentally sensitive areas. Examples of specific guidelines on tourism development of Phang Nga Bay are as follows:

(1) exclude development from geologically unstable areas (e.g., high erosion areas, flood-prone areas); and provide adequate buffer zones between development and existing shoreline;

(2) define zones for development (e.g., suitable beaches);

(3) ensure that construction materials and methods are compatible with the reef environment; and

(4) control effluent disposal to prevent disturbances to the reef ecology.

Further research should be undertaken by the concerned government agencies to determine the precise carrying capacity of the parks, whether in terms of the maximum number of users or the intensity of use by various categories of users. Establishment of an ongoing program for monitoring changes in the levels of coral covers and in the species composition of corals, fishes, and other marine organisms would be a first step towards determining the carrying capacity of Phang Nga Bay. Information on user attitudes to congestion and apparent degradation within the marine parks is also recommended.

A GIS database focusing on Phang Nga Bay region should be established. Information on the location and structure of the islands, marine community structures, location of moorings, and bottom features in certain areas of the marine parks should be stored in the database. This system provides a tool to measure the effects of changing usage patterns and will assist future management decisions, in particular those relating to the establishment of an artificial reef, the location of additional mooring buoys, and the need to preclude diving from certain areas to allow marine community structures (e.g. coral) to recover.

10.8.3 Rent Capture to Fund Management

The welfare gain of improving recreational and tourism attribute in Phang Nga Bay was estimated to be 1,133 Baht (USD 28) per person per year. By capturing a portion of this welfare gain, the park can finance management activities to protect and restore its mangrove forests and coral reefs, as well as fulfil broader social objective of providing for scientific research and education. To get an optimal entrance fee to the park, it will need the underlying theory for the optimal pricing of protected areas used in recreational activities, from the perspectives of a park authority interested in welfare maximization. Hence, the welfare estimates derived from this research is not sufficient for setting the optimal entrance fee for the park.

Examples of benefit capture mechanisms to finance marine park management can be found in other marine protected areas within the wider Caribbean (Table 14). Table 14 shows benefit capture mechanisms employed in countries of the Caribbean to finance marine park management which include park entrance fees, user fees and earmarked portions of departure taxes.

Based on the existing benefit capture mechanisms to finance marine protected area management in the Caribbean, it is recommended that the Thai government introduce a two-tiered basic entrance fee for marine parks in Phang Nga Bay, with different rates for residents and foreigners[6]. Thais pay an entrance fee of 40 Baht (USD 1)[7] while foreigners pay 400 Baht (USD 10)[8]. This practice both captures sizeable amounts of rent to help pay for the management of the park system, and also recognizes the income differences between residents and foreigners. Supplementary user fees should also be levied when visitors receive additional services from the variety of recreational sites on offer in Phang Nga Bay. It would seem reasonable for the park to impose charges for tourists visiting certain special and ecologically sensitive areas. For example, after having charged a basic entrance fee, the park could impose a diving fee of 200 Baht (USD 5) per person per visit if the visitor chooses to dive in the Coral Island. This user charge would help raise additional revenue for the park by transferring economic rents from high-end consumers to gains, while leaving the low-income visitors unaffected.

[6] There is a certain logic to this. Foreigners do not pay income tax or business tax to the local government. They take the extra benefit from the use of the resource home with them when they leave. As such, failing to charge higher user fees on foreign visitors implies that the country is subsidizing an increase in the social welfare of the visitors from richer countries.

[7] Entry fees for marine parks in Phang Nga Bay have traditionally been very low. At present, a basic entrance fee of 20 Baht (USD 0.50) is charged per person.

[8] Earlier studies on Phi Phi Island (Seenprachawong 2001) indicated that the annual consumer surplus as estimated by the travel cost method was in the magnitude of 10 to 1 (USD 2010 for each foreign visitor and USD184 for each Thai visitor).

Table 14 Benefit Capture Mechanisms in the Caribbean.

Country	*Institution*	*Mechanism*
Antigua	National Parks Authority, Nelson's Dockyard National Park	USD 5 per person entrance fee
Belize	The Coastal Zone Management Authority and Institute (CZMAI)	USD 2.50 per person from departure tax; USD 5 (foreigner) or USD 2.50 (national) entrance fee earmarked for the Protected Areas Conservation Trust (PACT)
Bonaire, Netherlands Antilles	Netherlands Antilles National Parks Foundation (STINAPA), Bonaire Marine Park	USD 10 per diver per year admission fee for scuba diving
Costa Rica	Tortuguero National Park	USD 7 (advance purchase) to USD 15 (gate purchase) per person entrance fee ; USD 3 per person entrance fee for Costa Rican citizens and permanent residents.
Saba, Netherlands Antilles	Saba Conservation Foundation, Saba Marine Park	USD 3 per person per week visitor moorage/anchorage fee; USD 2 per person dive fee; USD 2 per person snorkel fee
St. Lucia	Soufriere Marine Management Area	Marine reserve dive fee of USD 12 (annual) or USD 4 (daily); Coral Conservation Permit for mooring from USD 10 to USD 25 (dependent on size of vessel and duration of stay)

Source: Gustavson (2000, Tab. 2 p. 23)

The use of a hotel room tax can also be implemented. This is preferred since the tax is proportional to resource use. Given the inelastic nature of the demand, the impact on the bottom line for hotel operators is likely to be modest. Earlier prediction (Comb and Elledge 1979) indicated that demand is expected to be inelastic, meaning that a small addition room tax would not substantially affect accommodation business levels. Hiemstra and Ismail (1992) found that the demand for more expensive rooms was more elastic (-0.35 for the least expensive category of room versus –0.57 for the most expensive category of room).

It is recommended that a room tax of 40 Baht (USD1) per bed-night be imposed. This tax should be reduced or waived for Thais. Finally, it is a question of marketing. Brochures can be provided to arriving tourists explaining the sensitive nature of the Phang Nga Bay that they will be enjoying, and the need to fund the care and preservation of this beautiful bay. Instead of a 'lodging tax' on the hotel bill, a 'resource conservation fee' might be more acceptable to the tourist. The key point is that the tax should not be perceived as something designed to discriminate against foreigners, but rather as a user fee for the enjoyment of the environment. The rents collected can be shared between earmarked activities (environmental resource management, trash collection, coastal patrolling, etc.) and general revenues for the national treasury (for example, a statement that 60% of room tax goes to resource management or pollution control). In cases where a division of the

revenues is not possible, it may be necessary to create a separate entity to collect and manage funds, and in some cases to help provide management services.

10.8.4 Fund-raising at the Site Level

The results on environmental attitude surveys show that Thais place a very high value on the environment. A high percentage of respondents (80%) believe that natural resources are of value because of the benefits they provide to future generations. In terms of existence values respondents placed on rare bird and marine lives, 88% of the respondents agreed with the statement "Mangroves and coral reefs should be protected because rare birds and marine lives depend on them". Sixty-three percent of the respondents placed option value on mangroves and coral reefs. These findings show that the park authority can potentially raise money from the general public. Basically there are three steps to successful solicitation from individual donors (Phillips 2000)

- inform and educate them about the conservation program, and what needs to be done;
- inspire and help them to develop a personal view of the difference their contributions will make;
- ask them to help make that difference.

There are many opportunities for raising money at the site level. One alternative is to develop 'site memberships' and 'friends' schemes. Contrary to the 'pay-per-visit' concept of user fees, membership programs provide a vehicle for voluntary support by a constituency that may or may not actually visit the marine parks. The park manager at Mai Khao beach can implement a 'Friends of the Sea Turtle' program. The program provides an excellent opportunity to channel individual contributions directly to marine fauna protection. Staff can collect donations on site, or capture visitor information (names and addresses) for later fund-raising contacts. Members can make other contributions as well: volunteer work, word-of-mouth publicity, providing information, buying products and tickets to benefit events, and identifying potential donors.

Alternatively, 'adoption program' can be used to generate revenue for a specific site. For example, the park manager can raise money for sea turtle protection by selling 'deeds' for 100 Baht (USD 2.50) per turtle protected. The donor receives a certificate acknowledging his adoption of the turtle. Having a group of volunteers to help will be an advantage as the work involved is time-consuming. The work involves producing certificates and mailing them, writing thank-you letters and answering correspondence. The park manager can also obtain revenue by charging 'publicity fee' to corporations using the site as a location or backdrop for advertisements, posters and other uses. Sales of locally made crafts can be an excellent way of bringing financial benefits to local communities living near marine parks. Even if the direct financial returns from these sales for the marine parks are small, the support of the local people will be an obvious advantage.

Tourism, if carefully planned, managed and promoted, can become the mainstay of the economy of Phang Nga Bay. The hospitality industry affects and embraces people from all walks of life, and the increasing economic benefits, which it can bring, will benefit everyone. However, it is necessary to strike a balance between the economic benefits that it may bring and the possible negative impacts on the natural and cultural environment of Phang Nga Bay.

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APPENDIX 1

QUESTIONNAIRE ON MANGROVES AND CORAL REEFS IN PHANG NGA BAY

- INSTRUCTION TO INTERVIEWERS ARE IN CAPITALS
- IN THE CASE OF A REFUSAL TO RESPOND NOTE THIS WITH A CAPITAL 'R'. DO NOT MERELY LEAVE A BLANK
- NEED RESPONDENTS WHO ARE PAYING INCOME TAX
- INTRODUCE YOURSELF AS FOLLOWS:

Good morning /afternoon, sir/madam. My name is … I am involved in a study being conducted by Sukhothai Thammathirat Open University on the mangroves and coral reefs in Phang Nga Bay. We are carrying out a survey to find out how much people value the mangroves and coral reefs in Phang Nga Bay, and would like to ask you a series of questions. All answers are confidential and there are no right or wrong answers. Your opinion and the information provided will be used to improve the quality of mangroves and coral reefs in Phang Nga Bay. Therefore your honest response is essential for the success of this research project.

Name of Interviewer: …… Date: …/… /2001 Serial No. ……..

Time interview starts: …….. Time interview ends: ……

Area: 1. Phuket 2. Phang Nga 3. Krabi 4. Others, please specify ……

A. GENERAL ATTITUDES AND BEHAVIOR

A1. Suppose that the Thai government is going to invest money to help with one of the problems listed below. Which of these problems do you consider to be the most important one to solve in Thailand?

□ 1. Increasing agricultural productivity

□ 2. Inflation

□ 3. Reducing water pollution

□ 4. Protecting natural habitats and wildlife

□ 5. Improving quality of education

□ 6. Others, please specify _____

A2. What in general do you think are the three most important problems related to nature and human impact on the natural environment in Thailand, which you personally find worrying?

□ 1. Water pollution

□ 2. Deforestation

□ 3. Air pollution

□ 4. Degraded mangroves and coral reefs

□ 5. Floods

□ 6. Others, please specify _____

A3. Please indicate your opinion on a scale of 'strongly agree' to 'strongly disagree'. There is no right or wrong answer.

	Strongly Agree	*Agree*	*No Opinion*	*Disagree*	*Strongly Disagree*
(1) We have a duty to protect the environment from development regardless of the cost	1	2	3	4	5
(2) We should minimize the damage to the environment now so that out grandchildren may benefit from it	1	2	3	4	5
(3) Thailand needs to develop her forests, sea, and land to increase jobs and incomes, regardless of the environmental damage	1	2	3	4	5
(4) Mangroves and coral reefs should be protected because rare birds and marine lives depend on them	1	2	3	4	5
(5) I should pay for the protection of parks and nature reserves even if I do not visit them	1	2	3	4	5
(6) Even if I do not use the mangroves and coral reefs now, I am prepared to pay now to protect them in case I want to use them in the future	1	2	3	4	5
(7) It is worth spending money to protect mangroves because they help to protect agricultural productivity in the area	1	2	3	4	5
(8) We have more important things to think about than the loss of the mangroves and coral reefs	1	2	3	4	5

B. USE OF MANGROVES AND CORAL REEFS IN PHANG NGA BAY

SHOW FIGURE 1: This map shows the major mangroves and coral reefs in Thailand. You can see that the mangroves and coral reefs of Phang Nga bay are one of these areas.

SHOW FIGURE 2: MANGROVES AND CORAL REEFS OF PHANG NGA BAY

B1. Have you ever visited mangroves and coral reefs of Phang Nga Bay?

□ 1. Yes □ 0. No

B2. What benefits do you currently get from using marine and coastal resources of the Phang Nga Bay ?

□ 0. No benefit

□ 1. Swimming

□ 2. Bird watching

□ 3. Boating/sailing

□ 4. Diving/Snorkeling

□ 5. Research/Education

□ 6. Income from fishery

□ 7. Tourist related income

□ 8. Mangrove forest products

□ 9. Enjoy the scenery

□10.Savour seafood from the Bay in the past 5 years

□11.Others, please specify _____

B3. Are you likely to visit mangroves and coral reefs of Phang Nga Bay in the next 5 years?

□ 1. Yes/Likely □ 0. No/Unlikely

B4. Have you ever heard of the concept of biodiversity before?

□ 1. Yes □ 0. No

SHOW CARD A: READ INFORMATION ON MANGROVES AND CORAL REEFS BIODIVERSITY

SHOW CARD B: READ BACKGROUND INFORMATION ON THE MANGROVES AND CORAL REEFS OF PHANG NGA BAY

PRESENT CARD C: READ SCENARIO A AND SCENARIO B

C. WILLINGNESS TO PAY
* * BIODIVERSITY FUND * *

As described, management and protection of mangroves and coral reefs in Phang Nga Bay is necessary to protect the area's rare bird species and to enhance the quality of life of the local communities by providing a continuous source of seafood and by protecting agricultural land.

Obviously, the implementation of this protection project would cost money and people would have to pay their share of the costs on a continuing basis if they want to enjoy the benefits protection of mangroves and coral reefs offer.

As such, in order to protect the mangroves and coral reefs, you would be asked to pay a fee to a PHANG NGA BAY BIODIVERSITY FUND, which will be established and managed by the local government unit to help protect the mangroves and coral reefs of Phang Nga Bay. Possible projects to increase biodiversity in Phang Nga Bay are

- planting mangroves and coastal plants to reduce impacts of run-off
- treating of sewage to a high standard
- building new drainage system for storm waters
- monitoring of fish, plant life and mangroves
- promoting environmental sensitive tourism activities
- establishing visitor centers
- encouraging proper disposal of garbage and other waste to reduce pollution

Suppose a proposal to establish a PHANG NGA BAY BIODIVERSITY FUND was on the ballot in the next nationwide election. How would you vote on this proposal? Remember that by law, the funds could only be used to protect the mangroves and coral reefs in Phang Nga Bay. If the PHANG NGA BAY BIODIVERSITY FUND was the only issue on the next ballot, how would you rank the desirability of each of the proposed management plans for Phang Nga Bay with one (1) being most desirable and three (3) being least desirable?

Please keep in mind:

The issues discussed here are only a few among many other environmental problems Thailand faces.

This interview is on the mangroves and coral reefs of Phang Nga Bay and not on other environmental issues or other mangroves and coral reefs around the country.

Your own personal income is limited and has important alternative uses.

There is no right or wrong answers and you should answer for yourself.

Please choose one of these three options according to your preference

YOUR CHOICE ⇒			
	Status quo	*Plan A*	*Plan B*
Increased living coral cover	No change	No change	65 %
Increased income from fishery	No change	35 %	60 %
Flood occurrence	Every year	Every 2 years	Every 4 years
Increased area protected	No change	20 %	No change
Your increased income tax in 2002 (Baht)	0	200	700

Note:40 Baht = 1 USD

D. SOCIO ECONOMIC BACKGROUND

The following are a few questions on your background that will only be used for statistical purposes

D1. Gender of the respondent: □ 1.Male □ 0.Female

D2. Age: _____years

D3. What is the highest level of education you have obtained?

□ 1. No formal education

□ 2. Primary

□ 3. Secondary

□ 4. Technical Diploma

□ 5. Bachelor Degree

□ 6. Masters Degree

□ 7. Others, please specify _____

D4. What is your occupation?

□ 1. Civil servant

□ 2. Own business

□ 3. Private employee

□ 4. Laborer

□ 5. Student

□ 6. Retired

□ 7. Others, please specify _____

D5. Number of members in your household: _____persons

D6. Your monthly income

0-2,500 Baht	1
2,501-5,000 Baht	2
5,001-7,500 Baht	3
7,501-10,000 Baht	4
10,001-15,000 Baht	5
15,001-20,000 Baht	6

D7. Your household income

0-2,500 Baht	1
2,501-5,000 Baht	2
5,001-7,500 Baht	3
7,501-10,000 Baht	4
10,001-15,000 Baht	5
15,001-20,000 Baht	6

20,001-25,000 Baht	7
25,001-50,000 Baht	8
50,001 Baht and above	9

20,001-25,000 Baht	7
25,001-50,000 Baht	8
50,001 Baht and above	9

Note: 40 Baht = 1 USD

D8. Present address : City _____ Province _____

D9. Last of all, what do you think of this questionnaire?

	Yes	No
1. Interesting	1	0
2. Too long	1	0
3. Difficult to understand	1	0
4. Educational	1	0
5. Unrealistic / not credible	1	0
6. Others, please specify _____	1	0

♥♥♥ END INTERVIEW, THANK RESPONDENT ♥♥♥

APPENDIX 2

CARDS

CARD A

BACKGROUND INFORMATION ON MANGROVE AND CORAL REEF BIODIVERSITY

Biodiversity is defined as the totality of genes, species and ecosystems in a region. Genetic diversity refers to the variation of genes within species. Species diversity refers to the variety of species within a region. Ecosystem diversity refers to the variety of systems, of living things and their environment, within a region.

Mangrove biodiversity refers to the total number and variety of plants, animals and fish species found in the mangroves. These mangrove plants, animals and fishes live and interact within different types of mangrove environments.

Coral reef biodiversity refers to the different habitats for fish, coral, mollusks, shellfish and other sea animals, and also vegetation, fungi and bacteria. The kind and number of such habitats depend upon the total number of coral species, dominant species in an area, and the complex patterns that occur in coral reefs over time and space.

To protect the individual plant and animal species diversity, it is necessary to protect mangrove and coral reef environment

CARD B

BACKGROUND INFORMATION ON MANGROVES AND CORAL REEFS IN PHANG NGA BAY

Mangroves and coral reefs are dominant coastal ecosystems in Phang Nga Bay. Mangrove forests of Phang Nga bay serve as nursery and feeding grounds for marine organisms like fish, shellfish, and crabs. They also help prevent coastal soil erosion and provide protection from storms. Coral reefs in Phang Nga Bay are found around Ko Hong, Ko Dam Hok, and Ko Yao Noi. They provide habitats for marine organisms like fish and shellfish. They also provide recreational opportunities and natural beauty.

Phang Nga Bay has 60,791 ha of rich mangrove resources all around its coastline. However, only 20% of these are protected. Currently, mangrove habitats in Phang Nga Bay are diminishing due to urban development, and conversion to fishponds and agricultural land. If mangrove areas are further reduced, some fishermen dependent for their livelihood on coastal fisheries will be affected. As a result, these people will observe a decline in the fishery yields. In addition, a plan to develop a southern seaboard project in Phang Nga has been proposed. This project coupled with the expanding tourism-related business will result in the destruction and degradation of the coastal ecosystem, starting from the mangrove forests to coral reefs.

A coastal management plan prepared for Phang Nga Bay by the Ministry of Agriculture and Cooperatives recommend that:

"The mangrove forests and coral reefs in Phang Nga Bay should be designated as a coastal protected area"

That is it should be protected. The benefits of this would include:

- conservation of important flora and fauna
- maintenance of a substantial offshore fishery
- provision of a sustainable harvest of mangrove products
- protection of coral reefs, marine turtle nesting beaches, and recreation areas.

CARD C

MANAGEMENT SCENARIOS

SCENARIO "A": PRESENT STATE OF AFFAIRS – NO PROTECTION

- mangroves in Phang Nga Bay vulnerable to illegal encroachment and deforestation
- loss of mangrove areas to urban development
- potential loss of globally important bird species
- deterioration of recreational facilities (sandy beaches, coral reefs) and aesthetic beauty

SCENARIO "B": PROPOSED MANAGEMENT PLAN: PROTECTION OF MANGROVES AND CORAL REEFS IN PHANG NGA BAY AS A COASTAL PROTECTED AREA

- protection of globally significant birds and other wildlife and habitat currently under threat
- maintenance of fish stocks and shell fish which is of benefit to local communities
- improved recreational and educational facilities for residents and tourists
- reduced pollution
- protection from illegal activities

APPENDIX 3

GLOSSARY

CBA	Cost Benefit Analysis
CVM	Contingent Valuation Method
EFA	Average Ecological Function
EFE	Excellent Ecological Function
EFG	Good Ecological Function
FFA	Average Flora and Fauna
FFE	Excellent Flora and Fauna
FFG	Good Flora and Fauna
GIS	Geographic Information System
LLA	Average Local Livelihood
LLE	Excellent Local Livelihood
LLG	Good Local Livelihood
OEPP	Office of Environmental Policy and Planning
OPTEX	Optimal Experiment
REA	Average Rare and Endangered Species
REE	Excellent Rare and Endangered Species
REG	Good Rare and Endangered Species
SAS	Statistical Analysis Software
SSDP	Southern Seaboard Development Project
WTA	Willing to Accept
WTP	Willingness to Pay