Understanding the Environmental and Social Impacts of Coral Reef Use: A Study of the Snorkeling Environment and Experience in Koh Chang Marine National Park, Thailand

by

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B.B.A., Wilfrid Laurier University, 1994

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Abstract

Koh Chang Marine National Park is a popular tourist destination located off the east coast of Thailand. Coral reefs are one of the park's main attractions, and thousands of visitors from around the globe enjoy the opportunity to snorkel or dive in the park's clear, warm waters. Rapid growth in Koh Chang's marine tourism industry over the last decade raises concerns about the ability of some reefs to sustain a healthy and attractive environment. Ecological and social impacts associated with increased levels of marine recreation can transform and even permanently destroy both the character of coral reef ecosystems and the quality of the recreation experience, ultimately resulting in declines in tourism demand.

The broad objective of this study was to establish a baseline understanding of the social dimensions of the snorkeling industry in Koh Chang, Thailand, and to recommend a suite of management actions that will sustain economic benefits while still yielding the benefits of protecting aesthetic and biological values. The recreation carrying capacity, Recreation Opportunity Spectrum, and Limits of Acceptable Change concepts were used to guide and inform the research.

Data were collected using three primary methods: participant observation, unstructured interviews, and structured questionnaires. Personal observations and unstructured interviews allowed for an assessment of the park's environmental, social, and managerial settings. The tour operator questionnaire was designed to measure the size and

characteristics of the snorkeling industry, awareness of environmental impacts, and support for visitor management strategies. The questionnaire was completed by eight tour operators. The visitor survey was designed to gain an understanding of the demographics of snorkelers, satisfactions, knowledge and awareness, and crowding. The survey was completed by 716 snorkelers.

Results of the visitor survey suggest that snorkelers have a similar demographic profile compared with reef visitors in other parts of the world. Features of the snorkeling trip that had the greatest potential to add to, or detract from visitor experiences were related to the quality of the natural environment, a finding that is consistent with other studies of snorkelers and divers in coral reef settings. The social conditions were rated among the least important influences on visitors' experiences, a somewhat surprising finding as the number of other people is an important indicator of quality of the visitor experience in terrestrial environments.

Overall, visitors were generally satisfied with the physical, natural, and social conditions, but the degree of satisfaction varied among individual snorkeling trip features. The lowest levels of satisfaction were expressed for the social conditions and several features related to the quality and condition of the natural environment. Low levels of satisfaction were also expressed for a number of service features.

Results from personal observations, unstructured interviews, and questionnaires suggest that the environmental impacts of use may be significant. On a daily basis, reefs were touched, abraded, kicked, and stepped on by snorkelers, and these inappropriate behaviours can cause considerable damage to benthic organisms and the aesthetic appeal of the reefs. Tour operators' perceptions of impact were close to those defined in the recreation ecology literature, but operators may not be aware of the impact of their own behaviour on the marine environment. Over half of visitors perceived the impact of snorkeling on the reef to be "large/very large", suggesting that visitors have some awareness of the environmental impacts of use. The social impacts of use were also significant, as over 90% of visitors reported feeling at least slightly crowded, and 20% felt extremely crowded.

Study results also showed that snorkelers are not a homogenous group. Variability in visitor response was explained in part by the recreation specialization framework, and country of origin. Differences between visitors' level of commitment to snorkeling and the underwater world were apparent between specialists and generalists, and specialization

helped explain variability in environmental preferences, sensitivity to environmental impact, knowledge and awareness, and sensitivity to crowding. Visitors with different cultural backgrounds also had significantly different participation characteristics, satisfaction levels, knowledge and awareness, and crowding perceptions.

Snorkelers are not homogenous, but unfortunately, the recreation settings provided are. Results from personal observations and interviews suggest that tour operators provide a single, uniform type of snorkeling experience that can be characterized as undeveloped with low levels of regimentation and moderate to high levels of use. Given the variability in the visitor population, provision of a single recreation opportunity may leave many snorkelers less than fully satisfied.

This study identified several imminent threats to the quality of the visitor experience, reef conservation, and the sustainability of the snorkeling industry. Active visitor management planning and resource protection programmes are urgently needed to balance park uses with the capability of the reefs to sustain such use indefinitely. Recommendations that contribute to improved visitor management and reef conservation are provided.

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CHAPTER 1 Study Overview

1.1 Introduction

The opportunity to SCUBA dive and snorkel in clear, warm waters attracts millions of visitors to coral reefs each year, and substantial markets for coral reef tourism now exist in several regions around the world, including South East Asia. Thailand, in particular, boasts some of the region's best coral reef communities, attracting thousands of visitors each year and contributing substantially to local and national economies through the generation of foreign exchange earnings and employment opportunities (Chettamart & Emphandu 2002). The dive industry, for example, generates in excess of US$52.8 million annually in direct revenues, and an additional US$102 million in spin-off effects for Phuket alone (Bennett, 2002). In 2004, more than 500,000 tourists from all over the world traveled to Thailand to enjoy the country's spectacular dive sites, a 20-fold increase compared to 25,000 divers in 1985 (TAT, 2004, cited in Asia Dive Expo 2007).

Close to forty-two percent of Thailand's reefs lie within the nation's system of 21 Marine National Parks (MNPs) (13 MNPs include coral reef ecosystems), but in most cases protected area status has done little to safeguard the reefs from pressures of over use and misuse (Arceo & Cheung, 2002). Because reef-based tourism is an important commercial activity in Thailand involving millions of visitors each year, it requires careful management. Unfortunately, very few parks manage visitor use of marine resources, raising concerns about the impacts visitors are having on the range of natural, cultural, and aesthetic values that parks and protected areas are intended to protect.

Research on the ecological impacts associated with the growing numbers of visitors to coral reefs and the expanding diversity of recreational activities is fairly well established (e.g., see Allison, 1996; Barker & Roberts, 2004; Harriott, 2002; Julie P. Hawkins & Roberts, 1992, 1993, 1997; Kay & Liddle, 1989; Rogers, McLain, & Zullo, 1988; Tabata, 1989), but visitors' awareness of the impacts of use and how environmental awareness affects perceptions of the quality of the environment has yet to receive any serious attention. Perceptions of resource quality can have a significant influence on visitors' satisfaction, and low levels of satisfaction can negatively affect the sustainability of the tourism industry. There is also a dearth of information on the social impacts of increasing use, such as crowding. As the use of marine parks and protected areas increases, such highly regarded

values as solitude and intimacy with nature are threatened, and the quality of some experiences declines (Manning, 1985). New ways to plan for and manage increased recreational use of fragile coral reefs are urgently needed to balance protection of rich ecological resources and the use of the same resources for long-term economic gain.

A concept arising out of the recognition that natural attractions may have potential limits for tourism is that of *carrying capacity*. Carrying capacity is conventionally defined as the number of visitors an area can sustain without degrading natural resources and visitor experiences (Manning & Lawson, 2002; Stankey, 1990). Carrying capacity is an important issue in park and wilderness management and is likely to increase in importance as the popularity of protected areas continues to grow. A number of frameworks have been developed to provide managers with a basis for making decisions about the carrying capacity of parks, including the Limits of Acceptable Chang (LAC). While the carrying capacity concept focuses attention on *how many* people an area can sustain, the LAC framework places an emphasis on the social and biophysical *conditions desired* or deemed appropriate at a destination (Ahn, Lee, & Shafer, 2002).

The Recreation Opportunity Spectrum (ROS) framework has also caught the attention of recreation resource managers. This planning and management tool explicitly recognizes that experiences derived from recreation are related to the settings in which they occur. A recreation setting is the combination of physical, biological, social, and managerial conditions that give value to a place, and by describing ranges and alternative combinations of these conditions, management can provide a variety of opportunities for recreationists (Clark & Stankey, 1979; Warzecha, Manning, Lime, & Freimund, 2001). The ROS seeks to answer questions concerning both the allocation and management of opportunities for recreation, and also provides a framework for considering how to separate incompatible recreation uses and minimize conflict between and among park user groups (Manning, 1986). Like carrying capacity, ROS is a conceptual or organizing framework for thinking about recreation opportunities and for managing increasing conflict over use of scarce resources.

On the whole, recreational carrying capacity and LAC studies have taken place in terrestrial environments in temperate regions of the world. Despite substantial increases in visitation, recreation research in tropical marine environments has, until recently, been largely overlooked. Effective management of human use of tropical marine parks,

particularly coral reefs, is hampered by a lack of research and in many cases, limited opportunities to apply research findings from other studies. Recreational carrying capacity studies that have been conducted in tropical marine environments have focused almost exclusively on SCUBA divers recreating in coral reefs, and a majority of these studies have focused on the relationship between the density of users and impacts on biological resources (i.e., determining *ecological/ environmental* carrying capacities) (e.g., see 1994; Hawkins & Roberts, 1997; Roberts & Harriott, 1994). As a result, there is very little information available on the impacts of other recreational activities on coral reefs, and very little is known about the social science of recreation in coral reef settings.

The environmental and social impacts associated with increased participation in recreation activities is a significant issue for managers in several of Thailand's marine parks, but managers are ill equipped to address the impacts because of a lack of information to inform decision making. Many marine parks in Thailand simply do not know how many visitors use the park, for how long, or in what ways. Generally, marine park managers also have a weak understanding of park visitor characteristics, motivations, expectations, or levels of satisfaction with marine recreation experiences. Such information is essential to formulating recreation policy. Furthermore, very few parks have sponsored research to gain an understanding of the range of recreational opportunities that visitors seek within parks, the types of conditions that have the greatest influence on experiences and satisfactions, or how people perceive use levels and a lack of solitude/privacy in marine environments. In order to manage visitors, park managers have to be able to identify them and understand what sorts of outcomes they seek. If a basic purpose of managing outdoor recreation is to provide satisfaction to visitors, then objective and systematically collected information is needed about what affects satisfaction (Manning, 1985). Knowing user characteristics can also provide guidance for the development of appropriate infrastructure to support tourism and recreation, and visitor services such as education and interpretation (Moscardo & Ormsby, 2004). For example, experienced recreationists will have different preferences for the amount and type of infrastructure provided than will novice recreationists. An understanding of the differences can help managers design park settings that match visitor expectations and improve the quality of the visitor experience, and can help guide where limited resources should be directed, or saved.

Tour operators are also an important component of many protected areas, but not surprisingly, management agencies typically focus on how best to regulate and/or influence operators and their activities (Ormsby, Moscardo, Pearce, & Foxlee, 2004). As a result, they have only a limited understanding of the tourism industry, including capacity, characteristics of the recreation experience(s) offered, economic contribution to the local economy, and tour operators' awareness of environmental impacts, level of support for management, and contribution to marine conservation. Tour operator support for park management is essential since the practices of tourism operators can have a significant influence on both the quality of the natural environment and the visitor experience. An understanding of both the demand and supply side of tourism is fundamental to sound park management, as it enables the design of management actions that will serve the needs of the majority of visitors and local businesses.

1.2 Purpose of This Study

The overall goal of this research is to establish a baseline understanding of the social dimensions of the snorkeling industry in Koh Chang, Thailand, and to recommend a suite of management actions for marine park managers and snorkeling tour operators that will sustain economic benefits while still yielding the benefits of protecting aesthetic and biological values. This will be achieved by obtaining an enhanced understanding of: the snorkeling tour providers; the visitors; the marine park's physical, natural, managerial, and social conditions, and; visitors' evaluations of those conditions. Research effort focuses on the snorkeling industry because snorkeling is the most popular marine-based activity in the park.

Three related concepts are used to guide and inform the research: recreational carrying capacity, the Recreational Opportunity Spectrum (ROS), and the Limits of Acceptable Change (LAC) framework. Results from this study will be used to guide future visitor and resource management strategies that seek to balance the economic, aesthetic, and biological values of the reefs.

1.2.1 Research Objectives

With the literature as a guide, this thesis has six principal objectives:

1. To describe and characterize the snorkeling tourism industry in Koh Chang Marine National Park by asking the following:
   i. What is the size and structure of the industry?
   ii. What services are offered to snorkelers?
   iii. What are tour operators' perceptions of resource conditions?
   iv. What activities do tour operators feel have the largest negative impact on resource conditions?
   v. What is the level of support for park management strategies?
   vi. How is the snorkeling industry regulated?
   vii. What are the patterns of use, and what are the use levels?

2. To describe and characterize marine park visitors by asking the following:
   i. What are the demographic characteristics of snorkelers?
   ii. How committed are visitors to snorkeling as a recreation activity?
   iii. What do snorkelers know about coral reef ecosystems?
   iv. What are visitors' perceptions of the impact of snorkeling on coral reefs in Koh Chang?

3. To take an initial step in applying the Recreation Opportunity Spectrum (ROS) and Limits of Acceptable Change (LAC) concepts to Koh Chang Marine National Park by surveying resource users to establish the conditions that are of most concern to them. Potential indicators of snorkeling conditions that are of value to visitors will be identified by asking the following:
   i. What physical, environmental, managerial, and social conditions/features are important to snorkelers?
   ii. How satisfied are snorkelers the physical, environmental, managerial, and social conditions/features present?

4. To formulate LAC standards of quality that define acceptable conditions for the number of other snorkelers to guide management actions in the study area.

5. To examine the influence of visitor characteristics such as experience and cultural background on evaluations of the snorkeling conditions and standards of social quality.

6. To make recommendations towards:
   i. Improving the visitor experience.
   ii. Managing the snorkeling industry's negative impacts on coral reefs in Koh Chang.
   iii. Improving the long-term economic sustainability of the snorkeling industry.

1.3 Thesis Structure

This thesis is organized into seven chapters. Chapter 2 briefly reviews the theoretical concepts used in this study, and Chapter 3 provides an overview of the study site, and data collection and analysis methods. Chapter 4 profiles the snorkeling industry with a summary of descriptive results from the tour operator and visitor surveys, as well as personal observations of the physical, natural, managerial, and social settings. Chapter 5 looks at visitors' evaluations of the importance of various physical, natural, managerial, and social features, and visitors' satisfaction with those features. Importance and satisfaction data are integrated through the use of action grids. Results are first summarized for the entire sample, and then visitors are segmented into smaller groups on the basis of specialization and cultural background. Chapter 6 reviews visitors' perceptions of the environmental and social impacts of use at the aggregate and disaggregate level. Finally, Chapter 7 summarizes research findings, provides recommendations, and offers suggestions for future research.

CHAPTER 2 Literature Review

This chapter begins with a brief review of the carrying capacity and crowding literature, followed by a review of normative theory, and the Recreation Opportunity Spectrum and the Limits of Acceptable Change frameworks. The chapter concludes with a brief summary of studies that are similar to this one in intent, research design, setting, and recreation activity.

2.1 Theoretical Framework

2.1.1 Carrying Capacity

In many parts of the world, the demand for experiences provided by natural environments has increased dramatically, raising concerns about the impacts visitors can have on the range of natural, cultural, and aesthetic values that parks and protected areas are intended to protect (McCool & Lime, 2001; Shafer & Inglis, 2000; Simon, Narangajavana, & Marques, 2004). The tourism industry was once considered a 'smokeless' industry, but there is now widespread recognition that increased visitation and/or inadequate control over the patterns of visitor use can result in unacceptable deterioration of resource conditions, and the diminution of opportunities for people seeking more specialized recreational experiences, such as solitude and intimacy with nature (Buckley, 1998; Clark, 1990; Inglis, Johnson, & Ponte, 1999; Lawson, Manning, Valliere, & Wang 2003; Saveriades, 2000; Wagar, 1974). In seeking a rationale for limiting use to protect conservation values and high-quality recreation opportunities, protected area managers borrowed the concept of carrying capacity from the fields of range and wildlife management (Belnap, 1998; Wagar, 1974).

Original recreation uses of the carrying capacity concept focused on the biophysical aspects of outdoor settings, such as the impacts of visitor use on soil, vegetation, water quality, and wildlife. However, Wagar (1964) was the first to draw attention to the social dimensions of carrying capacity, recognizing early on that application of the carrying capacity concept to wilderness recreation required consideration of human values. Wagar (1964) defined carrying capacity as the "level of recreational use an area can withstand while providing a sustained quality of recreation" (p.3). Implicit in this definition, as well as other definitions of carrying capacity, is recognition of at least two central aspects: 1) the biophysical component, which relates to the integrity of the resource-base and implies some threshold or tolerance level after which further exploitation or use may impose strains on the natural ecosystem, and 2) the behavioural component, which relates to the quality of the

recreation experience, which may also decline when a threshold or tolerance level has been reached (Ormsby, Moscardo, Pearce, & Foxlee, 2004; Prato, 2001; Saveriades, 2000).

As a result of this early work, the concept of recreation carrying capacity is categorized into four types: physical, facility, ecological or environmental, and social carrying capacity. Physical carrying capacity is concerned with the maximum number of "use units" (i.e., people, vehicles, boats, etc.) that can be physically accommodated within an area (Sowman, 1987). Physical carrying capacity is generally fixed, but can be increased through more efficient utilization of space (Shelby & Heberlein, 1986). Facility carrying capacity, which can almost always be increased through additional expenditure, involves the types and amounts of facilities intended to support visitor needs, such as parking lots, boat rams, and administrative personnel (Shelby & Heberlein, 1986). Ecological or environmental carrying capacity is concerned with impacts on the ecosystem, and attempts to define the amount of recreational use that can be accommodated in an area or an ecosystem before unacceptable or irreversible declines in ecological values occur (Sowman, 1987). Ecological carrying capacities determine how use levels affect plants, animals, soil, water, air quality, etc. The concept of social carrying capacity addresses the issue of crowding and conflict. Conflict can arise from the social encounters and interactions among recreationists ranging from basic competition for space, to conflicts between forms of activity and related expressions of appropriate use. Defining social carrying capacity requires establishing a specific number that defines the minimum acceptable level of crowding based on visitor preferences and expectations (Lawson & Manning, 2001; Stankey & McCool, 1984). Stankey & McCool (1984) state that the essential elements of social carrying capacity include the ideas that: (1) recreationists seek multiple satisfactions from their chosen activities, and dependent upon these, encounters with others might add, detract, or be neutral in the effect on those experiences; and (2) visitor satisfaction is a function of more than use levels – the type, frequency, and location of encounters are important intervening variables.

Despite a large and diverse volume of scientific studies, efforts to determine and apply the carrying capacity concept have often failed. The principal difficulty lies in determining how much impact is too much (Manning, Wang, Valliere, Lawson, & Newman, 2002). In order to be useful, carrying capacity must be measured. But is this possible? According to Ormsby et al. (2004), the point at which deterioration in the social or ecological environment occurs is not easily managed or predicted, making it difficult to

determine how much is too much. Defining a safe minimum standard for levels of tourist activity is extremely difficult because relationships between use levels and impacts are poorly understood (Lindberg, McCool, & Stankey, 1997). There is no consistent relationship between the number of people using an outdoor environment and the influence, positive or negative, users have on recreational experiences, i.e., impacts are not directly associated with numbers of visitors. Much of the adverse impact caused by a specific number of users is not the result of too much use, rather a combination of other factors relating to the behaviour of users, their level of skill, types of activities, and resilience of the biophysical environment (McCool & Lime, 2001; Ormsby et al., 2004). Several other problems have been identified with application of the carrying capacity concept, and they include:

- There can be no one carrying capacity for a recreation setting. For example, the carrying capacity of an area can vary depending upon the objectives for which it is managed. In addition, visitors vary in terms of the types of experiences they want, and as a result, the same setting can attract different types of visitors, who in turn can have different thresholds for social carrying capacity.

- The concept implies a single number, misleading and obscuring the role of management judgements.

- Carrying capacity is perceived as a scientific, objective concept, but every criterion is inherently subjective.

- Carrying capacity assumes that social and biophysical systems are stable, but such systems are highly dynamic (McCool & Lime, 2001; Simon et al., 2004).

- The concept implies undue emphasis on use limitations, which are often the least preferred management action (McCool & Lime, 2001).

Failures in establishing numerical carrying capacities have led to searches for alternative management paradigms that shift focus away from searching for numerical capacities to approaches that focus on sustaining acceptable, appropriate, or desirable conditions for recreational use of an attraction or region. The limits of acceptable change (LAC) framework (later discussed in greater detail), is one example. Other researchers, such as Graefe, Vaske, & Kuss (1984), Manning & Lawson (2002) and Shelby & Heberlein (1986), suggest distinguishing descriptive components of carrying capacity from evaluative and/or

prescriptive components. The descriptive component of carrying capacity focuses on objective characteristics of recreation systems, such as the relationship between the amount of visitor use and perceived crowding. It tells "how a particular recreation system works, but it doesn't give any indication of how it should be managed" (Shelby & Heberlein, 1986, p.15). The descriptive component involves management parameters (factors that can be directly manipulated by managers, such as use levels), impact parameters (the outcomes associated with different amounts and kinds of use), and the relationship between the two (Shelby & Heberlein, 1984).

The evaluative component concerns the seemingly more subjective issues of how changes in the recreation environment are judged, how much impact or change is acceptable, and how a particular recreation system should be managed (Manning & Lawson, 2002). The implementation of carrying capacity requires both components, i.e., a description and understanding of the relationships between use conditions (e.g., types of use, site factors, amount of use) and the impacts associated with these conditions (e.g., how recreationists impact each other and the environment), and an evaluative component which incorporates value judgments about the acceptability of various impacts (Graefe et al., 1984). Two basic approaches to the evaluative component of social carrying capacity are reflected in the literature: visitor satisfaction and perceived crowding.

2.1.2 The Visitor Satisfaction Model

Many researchers have examined the relationship between satisfaction with the recreation experience and use level to determine whether satisfaction is a useful evaluative standard for determining social carrying capacity (Shelby & Heberlein, 1984). However, visitor satisfaction is no longer considered a useful measure for carrying capacity. The "satisfaction model" presumes that increased use level leads to dissatisfied visitors, and that declining satisfaction signifies that capacity has been reached. But existing research has failed to document the empirical relationship between use levels and visitor satisfaction, which is necessary for the development of evaluative standards and the identification of a capacity limit (Graefe et al., 1984; Hendee, Stankey, & Lucas, 1978). Satisfaction "cannot be predicted from user density or contact variables because visitors' multiple expectations may be affected in different ways by use levels and because changes in attitudes and/or behaviour may cause satisfaction to remain high under varying levels of density" (Graefe et al., 1984, p.409). Even

though satisfaction may not be a useful evaluative standard for determining social carrying capacity, information on recreationists' experiences and levels of satisfaction is crucial, because "the principal measure of quality in outdoor recreation has long been defined by visitor satisfaction" (Manning, 1986, p.6).

2.1.3 The Traditional Crowding Model

Crowding is generally recognized as a better evaluative standard than satisfaction. The traditional crowding model predicts that use levels influence the number of contacts between visitors, and contacts influence perceived crowding (Graefe et al., 1984). Crowding has become one of the most frequently analyzed issues in outdoor recreation settings. When evaluating crowding, it is important to distinguish between density and crowding. Density refers to the number of individuals in a particular setting, while crowding is the negative evaluation of a certain density (Graefe et al., 1984; Vaske & Donnelly, 2002).

Measurement of crowding has been standardized by the use of a scale developed by Heberlein & Vaske (1977). The nine-point scale ranges from "not at all crowded" to "extremely crowded". Shelby, Vaske, & Heberlein (1989) propose that perceived crowding levels can be used as an evaluative standard for making carrying capacity judgments based on a set of parameters. For example, if fewer than 35% of the respondents feel crowded (3-9 on scale), managers should preserve the experience. If 80% to 100% of visitors feel crowded the area is considered "much more than capacity", and managers should consider "sacrificing the area" or manage for conflict (Shelby et al., 1989). This scale is easy to interpret and compare across studies and it appears to be an accepted measurement of perceived crowding, although it is criticized for the subjectivity of its categories (Needham, 1999; Shelby et al., 1989).

In theory, visitors' perceptions of crowding should be most heavily influenced by use levels (Shelby et al., 1989), but previous research shows little empirical evidence to support a strong correlation between use level and crowding (Ditton, Fedler, & Graefe, 1983; Vaske & Donnelly, 2002). A weak relationship between use levels and crowding suggests that there are other variables that influence the point at which use is interpreted negatively as crowding (Needham, 1999). The behaviour of other users, for example, may be as important as the total number of others encountered (West, 1982). "A high number of parties might be encountered but if their behaviour is perceived to be acceptable, feelings of crowding might

be less than if their behaviour is considered to be objectionable in some way" (West, 1982, p.97).

Since crowding is a subjective judgment by an individual, it will vary across individuals depending on a variety of social and psychological factors. For example, the standards individuals use to evaluate a setting can be influenced by their expectations for that experience, which are often based on the setting of the first encounter (Ditton et al., 1983). "Presumably, if a person first experiences a place at a certain level of use, this will condition subsequent experience evaluations. Upon returning to find the area (or a similar place) at a much higher level of use intensity, the latter condition will be evaluated more negatively than if the visitor's initial exposure had been to such higher levels already" (Absher & Lee, 1981, p.236). Manning (1985a) and Tarrant, Cordell, & Kibler (1997) describe a list of factors that give basis to people's perceptions of crowding:

- visitor characteristics: their motivations, preferences, and expectations, their levels of experience, their attitudes toward wilderness, and their demographic characteristics;
- characteristics of the recreationists that are encountered: the type and size of the group, the group's behaviour, and perceptions of alikeness between the groups; and
- situational variables: type of area where encounter occurred, location of the encounter within the area such as trail versus campsite, and environmental factors of the area such as proximity of campsites, insufficient facilities, or a degraded environment.

The inherent diversity in perceptions of use density and crowding illustrate the complexity of determining appropriate encounter levels, and suggests the need for diversity in use density opportunities. This is explored in greater detail in section 2.2.4.

As stated previously, research on crowding suggests that visitor satisfaction may remain relatively high, even when use levels of a park or related area increase (Manning & Valliere, 2001). One possible explanation is that some recreationists may adopt one of several coping mechanisms to deal with the negative impacts of perceived crowding. It is widely hypothesized that recreationists employ three primary coping mechanisms to avoid crowding: *displacement*, *rationalization*, or *product shift*.

'Displacement' is a behavioral coping mechanism that involves changes in recreation behaviour to avoid crowding or resource impacts caused by crowding. Individuals less

tolerant of high use levels are 'displaced' by recreationists more tolerant of higher use levels. Displacement can involve intersite displacement (i.e., leaving the area, presumably to participate in the activity elsewhere), intrasite displacement (i.e., leaving the immediate area to move to an alternate location at a single site with lower use levels), and temporal displacement (i.e., timing visitation to avoid high use levels) (Manning & Valliere, 2001; Shelby, Bregenzer, & Johnson, 1988).

'Rationalization' and 'product shift' are cognitive coping mechanisms involving changes in the ways individuals think about recreation experiences and opportunities (Kuentzel & Heberlein, 1992a; Manning & Valliere, 2001). 'Rationalization' involves changes in the ways visitors think about recreation experiences and opportunities (Schneider & Hammitt, 1995). Some recreation activities involve a substantial investment of time, money, and effort, and as a result, some individuals may rationalize their experience and report high levels of satisfaction, regardless of conditions (Manning & Valliere, 2001). 'Product shift' is a coping response to crowding where visitors who experience higher use levels than are expected or preferred may alter their definition of the recreation opportunity to match the condition experienced (Manning & Valliere, 2001). Kuentzel & Heberlein (1992a) assert that these three primary coping strategies may suggest a hierarchical structure to the way people deal with increased use levels and perceived crowding:

> "People who feel most crowded are presumed to be most prone to leaving the area...at lower levels of perceived crowding, participants may only require a cognitive reappraisal to diminish the negative effects of crowding...Where cognitive coping strategies fail, recreationists may then need to use behavioral coping measures such as intra-locational movement to less crowded places, or leaving an area. For those who are displaced elsewhere, no cognitive coping mechanism may be sufficient to alleviate the negative impacts, and leaving the area may be the only perceived option to deal with crowding" (p.379).

Crowding appears to be an important cause for displacement, but individuals may leave a site or area due to any changes in the environment that recreationists view as a threat to their satisfaction (Anderson & Brown, 1984). According to Schreyer (1970), displacement is a behavioral adjustment to any change in the social, managerial, or resource conditions. Under this definition, essential components of displacement are a behavioral change, a time dimension, and changes in the environment. Visitor characteristics, discussed in the next section, also influence whether or not users are displaced (Schreyer, 1970).

2.1.4 Visitor Characteristics and Perceptions of Crowding

Participants in the same activity demonstrate significant differences in their patterns of behaviour, their orientations to the environment, and their preferences for, and perceptions of, a protected area's biophysical, social and managerial conditions (Inglis et al., 1999; Manning, 1985a; Salz, Loomis, & Finn, 2001; Simcox, 1993). Management prescriptions based on the "average visitor" may fail to provide distinct and important subgroups with satisfying experiences, and so researchers have emphasized the importance of differentiating users into homogenous subgroups with identifiable recreational participation patterns (Cole & Scott, 1999; Gobster, 2002; Iwata, 1977; Tatham & Dornoff, 1970; Virden & Schreyer, 1988). An understanding of the differences among participants is important for effective marketing, allocating resources, designing management interventions, and maximizing the conservation potential of the activity (Bennett, Dearden, & Rollins, 2005).

Segmentation efforts have been based on a variety of situational and personal variables including length of stay, motivations, and demographic characteristics. Perhaps the most widely studied personal characteristic thought to influence crowding is experience level or recreation specialization. Experience level is thought to influence perceptions of crowding through refinement of tastes or by virtue of exposure to lower density conditions as a result of earlier participation in the recreation activity (Manning, 1986). As a tool to identify, describe, and plan for subgroups, recreation specialization has received a lot of attention since its conception almost three decades ago. More recently, studies of cultural diversity in recreation environments have become more evident in the literature, although use of culture or country of origin as a segmentation tool in studies of crowding is not well developed.

Recreation Specialization

Bryan (1977) was the first to conceptualize recreation specialization, defined as a "continuum of behaviour from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences" (p.175). At one end of the continuum is the "expert" who participates in the sport frequently and has specific needs for setting preferences; at the other end is the "novice" who has more general recreational interests and less specific needs with regard to setting attributes (Bryan, 1977, 1979; Cole & Scott, 1999). Four levels of specialization, reflected by the amount of participation and technique and setting preferences, were identified by Bryan (1977) in a population of trout

anglers: (1) occasional fishermen (new to the sport), (2) generalists (fishing is a regular leisure activity), (3) technique specialists (specialization in a particular fishing method to the exclusion of other methods), and (4) technique-setting specialists (highly committed fishers with distinct preferences). More highly specialized anglers are part of a leisure social world with a shared sense of group identification derived from similar attitudes, beliefs, and experiences (Bryan, 1977, 1979).

Scott & Shafer (2001) recently revised the definition of recreation specialization slightly. They envisaged recreation specialization as a progression reflected by a) a focusing of behaviour, b) the acquisition of skill and knowledge, and c) personal and behavioural commitment (involvement) such that it becomes a central life interest. These three dimensions of specialization – cognitive (i.e., skill level), affective (i.e., involvement), and behaviour (i.e., past experience) - are conceptually different, do not necessarily covary, and do not progress in a lock step fashion as Bryan's (1977) original conceptualization implied (Scott & Shafer, 2001).

There is little consensus about how best to measure specialization. Some studies use a single-item measure of specialization to segment participants, while other studies have taken a multidimensional approach by incorporating several variables into a specialization index (additive index approach). There is, however, some controversy surrounding the additive index approach. It is analyzed according to researcher-determined subgroups, and it assumes that dimensions are related (Lee & Scott, 2005). In addition, some researchers caution that combining the dimensions into a single index to produce a continuum of specialization (e.g., low, medium, high) masks the differential effects of the behavioural, cognitive and affective dimensions (Donnelly, Vaske, & Graefe, 1986; Kuentzel & Heberlein, 1992a; Lee & Scott, 2005; McFarlane, 2004; McIntyre & Pigram, 1992; Salz et al., 2001). Results of studies by several researchers suggest that specialization dimensions should be measured separately and examined for their individual effects on the dependent variable in question (Bricker & Kerstetter, 2000; Kuentzel & Heberlein, 1992b; Scott, Baker, & Kim, 1999).

A variety of independent variables have been used to measure level of specialization including frequency of participation, amount and types of equipment purchased or used, number of activity-related books owned or used, number of sites visited, centrality to life style, enduring involvement, and past experience (Lee & Scott, 2004; Miller & Graefe, 2000;

Scott & Shafer, 2001). Recent research has explored the utility of a self-classification measure of recreation specialization (Needham, Rollins, & Vaske, 2005, p.17), whereby respondents are asked to select a definition that best describes their level of specialization. For example, Cole & Scott (1999) provided definitions of "committed", "active" and "casual" birders and asked respondents to select the category they felt was most representative of their birding specialization, and Needham (2005) asked hikers and mountain bikers to rate their ability in their activity as "novice", "intermediate", "advanced", or "expert". Recreationists' *self-reported skill level* in an activity is recognized as an important dimension of specialization, and is one of the most frequently used measures (Needham et al., 2005). According to Needham et al. (2005), understanding recreationists' skill in an activity is important because it: 1) provides a more comprehensive understanding of the types of recreationists in a setting, and 2) can inform management actions such as zoning.

Since Bryan's conceptualization, many specialization studies have been conducted on a variety of activities including skiing, kayaking, hunting, birdwatching, boating, climbing, wildlife watching, SCUBA diving, and snorkeling (see Needham, 2005 for a review of the specialization literature). These recreation studies have shown that more-specialized users differ from less-specialized users in a number of ways, including: motives for participation, preferences for management strategies, outcome preferences, equipment preferences, sensitivity to various depreciative behaviours, environmental preferences, conservation attitudes, and perceptions of crowding (Bryan, 2000; Cole & Scott, 1999; Dearden, Bennett, & Rollins, 2006; Ditton, Loomis, & Choi, 1992; McFarlane, 2004; McIntyre & Pigram, 1992; Oh, Ditton, Anderson, Scott, & Stoll, 2005; Salz et al., 2001; Scott & Shafer, 2001; Williams, 1988).

A number of studies suggest that there is a positive correlation between specialization and perceptions of crowding (Salz et al., 2001; Vaske, Donnelly, & Heberlein, 1980). According to Manning (1986), "the bulk of the empirical evidence supports the notion that more experienced users are more sensitive to higher use levels and crowding... this appears true regardless of how experience is measured" (p. 64). Specialization may also influence visitors' response to crowding and other changes in the managerial and resource conditions (Anderson & Brown, 1984).

Duffus & Dearden (1990) integrated existing literature regarding different tourist types and degrees of specialization, and related them to changes in destination site

characteristics within the context of non-consumptive wildlife-oriented recreation (Figure 2.1). The authors suggest that a site is first dominated by 'exploratory users' or 'wildlife specialists', who require little infrastructure or interpretative facilities. Their presence is usually absorbable by existing site conditions. As popularity of the site and the associated activity grows, wildlife specialists are replaced by the 'less ambitious user', and "there is a concomitant demand for more facility development, more mediation and increased pressure on both the social system and the ecosystem of the host area" (Duffus & Dearden, 1990, p.222). As the number of visitors increases over time, the site, which caters to generalists, will no longer fulfill the expectations of specialists, who may be displaced to other, less developed sites. Eventually, even wildlife generalists may be displaced from the area if recreational use of the site exceeds ecological and/or social carrying capacity. Results reported by Bennett (2002) in a study of SCUBA divers in Phuket, Thailand support Duffus & Dearden's (1990) wildlife tourism model.

Cultural Influences on Crowding Perceptions

Recognizing that different cultural and ethnic groups may not share the same attitudes and beliefs regarding acceptable recreation experiences, researchers are paying more attention to cultural diversity as a tool to differentiate users into more homogenous subgroups. This is driven in large part by the management concerns surrounding the rapid diversification of visitors to urban and wildland-urban interface areas, a reflection of the cultural and demographic trends of developed countries like the United States (Simcox, 1993). The topics that have been investigated include cultural variability and/or patterns in: outdoor recreation participation (Carr & Williams, 1993; Floyd, Gramman, & Saenz, 1993), urban park use (Gobster, 2002; Hutchison, 1987), preferences and behaviours (Floyd, Mcguire, Noe, & Shinew, 1994; Kaplan & Herbert, 1988), landscape preferences (Kaplan & Herbert, 1987), and crowding (Budruk & Manning, 2002; Gillis, Richard, & Hagan, 1986b; Homma, 1990; Chalsa Loo & Paul Ong, 1984; Vaske, Donnelly, & Petruzzi, 1996).

Studies that examine the relationship(s) between culture[1] and crowding are of particular interest here. Most of the research on crowding effects appear to be atheoretically based; there is, as a result, little empirical evidence for discerning whether attitudes about

[1] Culture is defined loosely as a set of shared values, beliefs, and world views that are learned and socially transmitted (Simcox, 1993).

crowding are subject to cultural differences (Chalsa Loo & Paul Ong, 1984). Conjectures prevalent in the literature suggest that attitudes about acceptable distance norms and adaptability to high levels of density are subject to cultural differences, and that certain cultures can tolerate or adapt to higher levels of encounters better than others:

> "There is impressionistic support for the notion that people vary across gross socio-cultural categories regarding their adaptability to relatively high levels of density. Asians, with their long history of high-density living, seem most able to resist crowding. In contrast, Europeans seem more susceptible to crowding, with the British representing an extreme" (Gillis et al., 1986b, p.690).

Anderson (1972), for example, observed that Chinese in Hong Kong and Malaysians in Penang did not exhibit any increase in social stress under extreme high-density situations: "The Chinese have developed ways of managing space, time and people such that even the most extreme crowding does not lead to any particular increase in social stress" (p.148). Homma (1990) suggests that the Japanese have developed various personal, cultural, and environmental coping strategies for crowding that have enabled the Japanese to adjust to high density living conditions, thus avoiding demonstration of the strong negative consequences of crowding. Behavioural norms for interacting with others have become formalized into a hierarchy of prescribed behaviours that enable the Japanese to live efficiently in crowded conditions. For example, compensatory processes operate to maintain appropriate interpersonal distances – if people approach too closely because of limited space, interpersonal distance is regulated by avoiding fixed eye contact and adjusting interpersonal distance according to status (Altman & Chemers, 1980; Homma, 1990).

In contrast with Asians, the British may be particularly susceptible to the effects of high density (Hall, 1966; Gillis, Richard, & Hagan, 1986). According to Hall (1966), the English are an intensely private people, and they try to cope with crowding by "cocooning" – avoiding eye contact, maintaining a reserved demeanour, and withdrawing psychologically when physical escape from crowds is impossible. Gillis et al. (1986) concluded that "Asians are best equipped to handle high density, Anglos seem least able to tolerate it, and Southern Europeans [Greeks, Italians, Maltese, Portuguese, Spanish] are somewhere in between" (p.701). However, other researchers have arrived at different conclusions.

Results from an empirical study by Loo & Ong (1984) on crowding perceptions, attitudes, and consequences among the Chinese living in San Francisco's Chinatown are contrary to findings reported by Anderson (1972) and Gillis et al. (1986). "Chinatown residents evaluated crowding as undesirable and harmful. Personal effects of crowding included environmental health problems, social conflict, and psychological stress" (Chalsa Loo & Paul Ong, 1984, p.55). Iwata (1974) conducted an experiment where subjects were placed in a room with varying levels of density (low, medium, high). Results from this experiment suggested that higher densities produced higher crowding perceptions for American Japanese than Caucasians. In a subsequent investigation conducted in Japan, Iwata (1977; 1978) asked respondents to indicate the maximum number of other people with whom they could share a room without feeling uncomfortable; when the number of people in the room exceeded the respondent's personal norm, respondents reported feeling crowded.

Earlier works on the relationship between culture and crowding have focused exclusively on urban settings. The study conducted by Vaske, Donnelly, et al. (1996) was one of the first efforts to examine crowding norms reported by people from different countries in natural resource environments. The authors examined the relationships among norms, reported encounters, and perceived crowding reported by people from five different countries of origin (Canada, United States, Japan, Germany, and England) in a frontcountry setting. The authors found few apparent differences for perceived crowding levels among the five visitor groups, despite comparable levels of reported encounters. Budruk & Manning (2002) also investigated crowding related norms across different countries of origin using data from multiple studies conducted in the U.S. national park system. Their findings indicated relatively few differences between U.S. and international visitors regarding a variety of crowding related norms and associated measures. Due to insufficient sample sizes and variation in the ethnicity measure over different studies, the authors did not compare differences in crowding norms between various ethnic groups among U.S. visitors.

The research examining the impact of density and encounters on perceived crowding among different cultures is inconclusive (Vaske, Donnelly et al., 1996). Some investigators indicate that Asians seem most tolerant of high density living conditions, while Europeans are most susceptible to crowding (Anderson, 1972; Gillis et al., 1986; Hall & Shelby, 1996; Homma, 1990). In contrast, other researchers have found that the Chinese and Japanese

evaluated high density conditions negatively (Iwata, 1977; Chalsa Loo & Paul Ong, 1984). However, these studies do have one finding in common: across all cultures examined, when densities or encounters exceed the norm, individuals feel more crowded (Vaske, Donnelly et al., 1996).

To determine the evaluative component of social carrying capacity, this study uses the perceived crowding approach. Perceptions of crowding are examined by asking visitors to respond to a series of questions (including Heberlein & Vaske's 9-point scale) related to the social conditions experienced. The sample is segregated into homogenous to explore the influence of specialization and culture on perceptions of crowding.

2.1.5 Normative Definitions of Crowding

A great deal of research on crowding in parks and outdoor recreation has focused on normative judgements of crowding. Norms are generally defined as standards that individuals use for evaluating activities, conditions, impacts and behaviours as acceptable or unacceptable (Kim & Shelby, 2005; Lewis, Lime, & Anderson, 1996; Manning, Lime, Freimund, & Pitt, 1996; Shelby, 1981; Vaske, Donnelly, & Shelby, 1993). Norms are typically elicited by asking stakeholders (e.g., park visitors) to indicate the range or maximum level of an indicator (e.g., number of people encountered while snorkeling) at which the recreation experience becomes unpleasant, unsatisfying, undesirable, or unacceptable (Hall & Roggenbuck, 2002; Hall & Shelby, 1996). The individual's response is his or her personal norm, and a group's social norm can be described by aggregating personal norms (Hall & Shelby, 1996; McDonald, 1996; Shelby, 1981).

Indicators and Standards of Quality

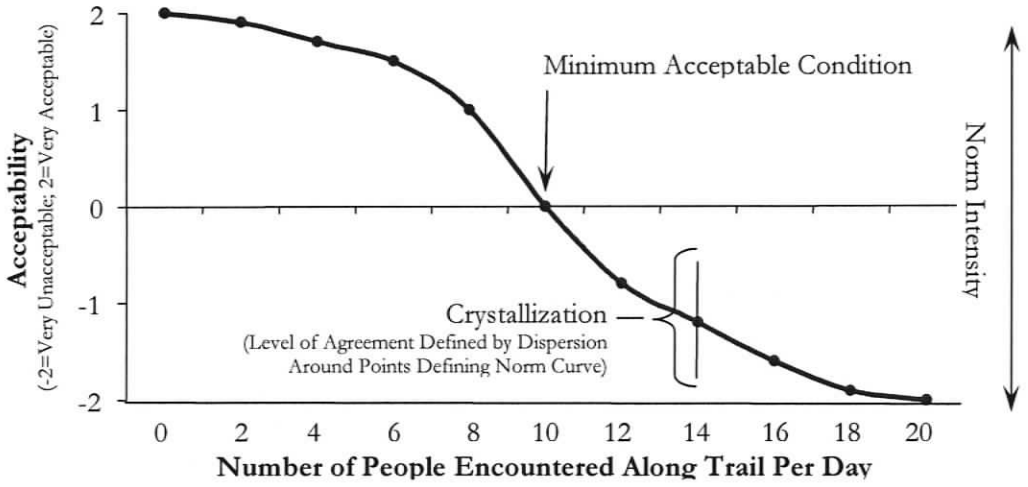
If personal norms are shared widely, managers can consider using these norms as standards or indicators of quality to help manage crowding in parks and outdoor recreation. Indicators of quality are specific, measurable ecological, physical, social, or managerial variables that reflect the essence of management objectives (i.e., they identify what conditions will be monitored), and define the quality of settings and the visitor experience (Manning, 2001; Manning, Lawson, Newman, Laven, & Valliere, 2002; Manning, Valliere, & Wang, 1999). Standards of quality define the minimum acceptable condition of indicator variables, or the social carrying capacity (Laven, Manning, & Krymkowski, 2005; Manning, 2001; Stankey &

McCool, 1984; Whittaker & Shelby, 2002). Indicator variables are monitored over time, and if standards of quality are violated (or in danger of being violated), management action is required (Manning, 2001; Manning & Lawson, 2002; Manning et al., 1999; Newman, Marion, & Cahill, 2001).

The Normative Approach to Setting Standards of Quality

To set standards for an indicator, managers need to understand the point(s) at which experiences or conditions deteriorate (Hall & Roggenbuck, 2002; Smyth, Watzin, & Manning, 2007). The normative approach is often used to formulate visitor-based standards of quality and it has been applied to a wide range of outdoor recreation activities (e.g., rafting, kayaking, motor boating, climbing, sight seeing, wildlife viewing, hunting, fishing, snorkeling) and wilderness management attributes (e.g., ecological impacts, crowding, management practices). The Return Potential Model developed by Jackson (1965) is the conceptual framework used most often for the understanding and application of norms (evaluative standards) in outdoor recreation settings. This approach describes norms or evaluative standards using a graphic device called a "return potential curve", or a "social norm curve" to assess crowding or other indicators managers want to monitor (Figure 2.1). The horizontal axis represents the indicator with intensity of use or impacts increasing from left to right. The vertical axis represents the responses of those sampled. Respondents are asked to evaluate a range of use levels and related impacts using a response scale that has included terminology specifying a variety of evaluative dimensions, including preference, desirability, pleasantness, ideal, tolerance, acceptability, and satisfaction (see Manning et al. 1999, and Needham, 1999 for a detailed list of alternative evaluative dimensions). "Level of acceptability" is the most common dimension utilized (Needham, 1999).

FIGURE 2.1 Hypothetical Social Norm Curve



Source: Needham, Rollins, & Vaske, 2005

An analysis of the shape of Jackson's (1965) curve reveals a number of structural characteristics of norms, including the range of tolerable contacts, norm intensity, and norm crystallization (Patterson & Hammitt, 1990; Vaske, Shelby, Graefe, & Heberlein, 1986). The range of tolerable contacts "represents the number of encounters individual recreationists or members of a group find acceptable" (0-10 encounters per day in Figure 2.1) (Vaske et al., 1986, p.141). Norm intensity is indicated by the height of the return potential curve, both above and below the neutral line (Jackson, 1965). The "norm intensity shows the strength of the respondents' feelings about the importance of a potential indicator of quality. The greater the distance, the more strongly respondents feel about the indicator of quality or the condition being measured" (Manning & Lime, 2000, p.17).

Jackson (1965) defines crystallization as the level of group agreement about the norm. Crystallization can be derived using the standard deviation for each evaluative response - small standard deviations indicate a high degree of consensus about the norm (Patterson & Hammitt, 1990). However, interpretation of standard deviations is problematic because "there are no general guidelines regarding what constitutes an acceptably low standard deviation so as to conclude that there is a sufficient degree of consensus" (Manning, Johnson, & Vande Kamp, 1996, p.129). Standard deviation is commonly used in normative research as a measure of consensus, but there are other measures of variability that can (and some argue ought) to be used, including median and mode. (See Shelby &

Vaske, 1991 and Shelby, Vaske, & Donnelly, 1996 for a more thorough debate surrounding what measure of central tendency should be used to determine consensus.)

The curve can be analyzed for other normative characteristics, including the "optimum or preferred condition", which is the highest point on the curve (0 encounters per day in Figure 2.1), and the "minimum acceptable condition", which is the point where the impact or condition becomes neither acceptable or unacceptable (10 encounters per day in Figure 2.1) (Manning, Lime et al., 1996). The minimum acceptable condition is often designated as the standard of quality or limit of acceptable change (Manning, 1999). Inflection points along the norm curve might also be used to help formulate a standard of quality (Manning, Lime et al., 1996). An inflection point is "a point along the norm curve that falls (or rises) especially steeply" and "may represent thresholds of tolerance (or preference) among the sample population" (Manning, Lime et al., 1996, p.50-51).

In a study of summer alpine recreation, Needham (Needham, 1999) revised and expanded the social norm curve to illustrate other important characteristics. Significant changes to the curve include graphic display of the crystallization (measured by the standard deviation), a "standard of quality window", and an "optimal or preferred standard of quality window". The latter two are defined by the points at which connected standard deviation lines below and above the mean cross the neutral point or line of indifference, and are calculated to "provide managers with a range within which to establish standards" (Needham, 1999, p.245-246). However, as Needham (1999) points out,

> "this approach is difficult to apply in practice simply because this one point may be too precise to monitor, thus it does not provide much leeway for mangers. In addition, this considers the standard as a static measure when in fact, it is dynamic because it can often change due to different social or resource conditions such as weather, type or size of group encountered, noise, and location within an area" (p.246).

Norm measurement approaches

Traditionally, crowding norms have been measured using a numerical approach, whereby respondents are asked to evaluate a range of encounters (e.g., 0, 5, 10, 15) with other groups or individuals per day (Manning, Lime et al., 1996; Manning et al., 1999). To reduce respondent burden, this measurement technique is often shortened using an open-ended

version, where respondents are asked to report the maximum acceptable number of encounters with other groups or individuals per day (Manning et al., 1999).

More recently, visual approaches to normative scenarios have been developed to improve the validity of the results and to reduce respondent burden (Hall & Roggenbuck, 2002; Laven et al., 2005). Computer software is often used to edit and produce a series of photographs that simulate a spectrum of visitor use and/or impact conditions. For example, respondents are shown a series of photographs of wilderness campsites that illustrate a range of ecological impacts; respondents are asked to evaluate each photograph in a series (long version), or to select the photograph that illustrates the highest impact level acceptable (Manning et al., 1999). Compared to the numerical approach, photographs can capture more of the elements important to the recreation experience to be valid indicators of overall experience quality (Hall & Roggenbuck, 2002). There are, however, several dimensions of the recreation experience that are difficult or impossible to be captured visually (e.g., the level of noise, the number of hours that pass without seeing anyone else, etc.), and in these circumstances, the normative approach relies on verbal descriptors (Hall & Roggenbuck, 2002; Manning, Lime et al., 1996).

This study used Jackson's (1965) model to examine the attributes of norm intensity and crystallization among coral reef users. Visual imaging technology was used to simulate different levels of use by snorkelers, and visitors were asked to rate the level of acceptability of increasing levels of use depicted in a series of photographs.

2.2 Conceptual Frameworks for Managing Outdoor Recreation

A number of planning frameworks have been developed specifically to deal with the recreation carrying capacity issue in parks and protected areas. Two contemporary planning frameworks that have received great support and use among land management agencies are the Recreation Opportunity Spectrum (ROS) and Limits of Acceptable Change (LAC).

2.2.1 The Recreation Opportunity Spectrum (ROS)

The recreation opportunity spectrum, or ROS, is a planning and management tool for inventorying and describing recreational opportunities in a variety of settings (Ormsby et al., 2004). The ROS framework explicitly recognizes that experiences derived from recreation are related to the settings in which they occur, and that settings are a function of three

factors: environmental, social, and managerial (Heywood, Christensen, & Stankey, 1991; Manning, 1985b). Thus, an opportunity includes qualities provided by nature (e.g., landscape, topography, scenery), qualities associated with recreational use (levels and types of use), and conditions provided by management (infrastructure, regulations, etc.) (Clark & Stankey, 1979). By describing ranges of these factors, the ROS illustrates the potential diversity of recreation opportunities from the more rural and natural to the more urban and less natural, with different settings along the spectrum accommodating primitive, low density, to developed, high density settings (Ahn, Lee, & Shafer, 2002; Manning, 1985b). In terrestrial environments, for example, Driver, Brown, Stankey, & Gregoire (1987) divided the spectrum of opportunities into 6 land management classes or recreational opportunity spectrum classes, with different forms of recreation experiences falling within each class (Table 2.1). The 6 ROS use classes defined by Driver et al. (1987) are frequently referenced, but many different land (or water) management classes can be defined for a park or protected area. For example, in a small, remote park, 2 opportunity classes might be sufficient to meet a majority of the public's preferences.

The planner does not attempt to inventory experiences directly, but instead applies 6 indicator criteria to the setting where the experience takes place: access, other non-recreational uses, on-site management, social interaction, acceptability of visitor impacts, and acceptable level of regimentation (Clark & Stankey, 1979). Opportunity classes are defined by the range of conditions within each factor:

- *Access* – several elements can be used to describe access, including difficulty of access (very easy to very difficult), access system (roads, trails, etc.), and means of conveyance (motorized/non-motorized vehicles, vehicles on/off road, etc.). Sites that are difficult to access are typically remote from the sights and sounds of humans, and provide opportunities to experience lesser amounts of social interaction.

- *Non-recreational resource uses* – considers the extent to which non-recreational resource uses (e.g., logging, aquaculture) are compatible with various opportunities for outdoor recreation. Planners and managers must consider the lasting effects of a resource activity, as well as short-term effects to determine the impacts on the recreational opportunity.

TABLE 2.1 Recreation Opportunity Use Classes (Driver et al., 1987)

PRIMITIVE – Area is characterized by essentially unmodified natural environment of fairly large size. Concentrations of users is very low and evidence of other area users is minimal. No user facilities for convenience or comfort is provided, and motorized use is prohibited.

SEMI-PRIMITIVE NON-MOTORIZED – Area is characterized by a predominantly unmodified natural environment of moderate to large size. Concentration of users is low, but there is often evidence of other area users. Management is subtle, including minimum restrictions and controls. Some facilities are present for user safety and resource protection. Motorized use is prohibited.

SEMI-PRIMITIVE MOTORIZED – Same as semi-primitive non-motorized noted above with the exception of permitted motorized use.

RUSTIC OR ROADED NATURAL – Area is characterized by predominantly natural environment with moderate evidences of sights and sounds of humans. Such evidences usually harmonize with the natural environment. Concentration of users may be low to moderate with facilities sometimes provided for group activity.

CONCENTRATED OR RURAL – Area is characterized by substantially modified natural environment. Sights and sounds of humans are readily evident, and the concentration of users is often moderate to high. Resource modification and utilization practices carried out to enhance recreation activities and to maintain vegetative cover and soil. Considerable number of facilities designed for use by a large number of people, and facilities for intensified motorized use and parking available.

MODERN URBANIZED OR URBAN – Area is characterized by a substantially urbanized environment, although the background may have natural elements. Sights and sounds of humans on-site are predominant. Large numbers of users can be expected both on-site and in nearby areas. Renewable resource modification and utilization practices carried out to enhance recreation activities. Vegetative cover is often exotic and manicured. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

- *On-site management* – the appropriateness of site management should be considered in light of 4 elements: extent (very extensive to no development), apparentness (obvious changes to no changes), and complexity (very complex to not complex) of the modification, and type and number of facilities (many comforts and conveniences to no facilities).

- *Social interaction* – appropriate levels of interaction vary along a spectrum from frequent inter-party contacts to no inter-party contacts. Generally, in more primitive settings, low levels of interaction are appropriate and expected, while in more modern settings, interaction can rise to very high levels.

- *Acceptability of visitor impacts* – a continuum of impacts can be described from high degree of visitor impact to none. The prevalence of impacts can also range from prevalent over a broad area, to uncommon or none.

- *Acceptable regimentation* - reflects the amount and kind of restrictions placed on people's actions by an administering agency or private landowner. A continuum of controls can be described, ranging from strict, to subtle. Modern opportunities are generally characterized as more highly organized and regulated than are primitive types.

A recreation opportunity setting is the result of a specific combination of these 6 criteria in a particular location, and alternate combinations create different opportunity settings that give recreationists many options from which to choose (Clark & Stankey, 1979).

Clark & Stankey (1979) focused on the situational attributes that comprise a recreational opportunity, but Driver & Brown (1978) suggested that implementing the ROS framework requires more than just defining the characteristics of the setting. According to these authors, implementation of ROS requires the following:

- Define setting characteristics for each setting or class. This requires an understanding of the influence of setting characteristics on visitor experiences.
- Define appropriate activities for each setting or class. This requires an understanding of the relationships between activities and impacts.
- Define the experience. This requires an understanding of visitor expectations.
- Develop management plans to reflect and preserve the opportunities.

The relationship among the environmental, social, and managerial settings was originally conceptualized as a linear one. For example, primitive recreation opportunities were typically defined by "natural" resource conditions, low-density social conditions, and undeveloped managerial conditions, while urban recreation opportunities were defined by "unnatural" resource conditions, high-density social conditions, and developed managerial conditions. Through a more liberal interpretation of the relationships between recreation setting conditions, Manning (1985b) expanded the opportunity spectrum to enable the framework to meet its objective of diversity more fully. He suggests that the relationship among the three setting factors is a non-linear one, with a variety of combinations possible (i.e., any environmental condition can be paired with any social condition, any managerial condition can be paired with any environmental condition, and any social condition can be paired with any managerial condition).

For marine environments, Orams (1999) divided recreation opportunities into five categories or classes (easily accessible, accessible, less accessible, semi-remote and remote)

according to distance from shore, since this factor strongly influences the activities undertaken, the experiences available, and the type of environment in which activities occur. Orams (1999) uses three characteristics to distinguish between the five marine opportunity classes: (1) experience (social interaction/contact with other visitors, degree of services and support); (2) environment (number/visibility of human influences and structures, quality of natural environment); and (3) location (beaches/intertidal areas, intertidal to 100 m offshore, 100 m offshore to one km offshore, isolated coasts 1-50 kms offshore, uninhabited coastal areas more than 50 kms offshore). However, other characteristics can be used to distinguish between marine opportunity classes. In the Great Barrier Reef Marine Park, for example, each reef, bay, and coastal area within the Whitsunday Planning Area has been assigned a "setting" ranging from low use (protected setting) to high use developed setting (Table 2.2) (GBRMPA, 1999). Group size and vessel length - not distance from shore, are the main factors used to determine opportunity classes.

As a planning tool, the ROS has the advantage of being a highly flexible approach that is easily incorporated into management plans (Ormsby et al., 2004). The ROS provides for sensitive areas to be identified and protected, and other areas more capable of withstanding heavier levels of use to be used for more intense forms of recreation. Despite these advantages, the ROS concept is lacking in several respects. First, it fails to address how the experiences of users are facilitated by managerial and physical setting attributes (Needham, 1999), which may help explain why research findings suggest that recreationists do not necessarily report experiential changes as they pass through different ROS settings (Ormsby et al., 2004). ROS also assumes that people choose a recreational site according to a particular experience they wish to gain, and that they have sufficient knowledge and experience to do so (Ormsby et al., 2004).

For this study, a site-by-site, tour operator-by-tour operator approach to data collection is used to reveal differences that may exist among sites regarding social and managerial conditions. This information is useful for segmenting the area based on the ROS framework. In addition, this study makes progress towards developing an understanding of the influence of setting characteristics on visitor experiences.

TABLE 2.2 Setting Descriptions for Whitsundays Plan of Management in the Great Barrier Reef Marine Park (GBRMPA, 1999)

Setting 1: DEVELOPED

Immediately adjacent to urban areas and resorts. These areas are the access points to the Planning Area and a focus for intensive tourism and recreation. These areas are heavily used by a wide range of craft, and contain permanent facilities (e.g., marinas, jetties, ramps).

Group size (including crew): NO LIMIT
Vessel length: UP TO 70 METRES

Setting 2: HIGH USE

A natural setting that may have high levels of visitation. These areas are easily accessed and appropriate facilities (e.g., pontoons, moorings, markers) may be required to manage impacts and assist in visitor interpretation of the area. These areas are regularly visited by larger vessels and aircraft.

Group size (including crew): NO LIMIT
Vessel length: UP TO 35 METRES

Setting 3: MODERATE USE

A natural setting that may have moderate levels of visitation, with appropriate moorings and management facilities to manage impacts. These areas are occasionally visited by larger vessels and aircraft.

Group size (including crew): UP TO 40 PEOPLE
Vessel length: UP TO 35 METRES

Setting 4: NATURAL

A natural setting with low levels of visitation. These areas are generally free from facilities, larger vessels and aircraft.

Group size (including crew): UP TO 15 PEOPLE
Vessel length: UP TO 35 METRES (unless limited by site)

Setting 5: PROTECTED

A protected natural setting, for areas of outstanding or unique conservation value and areas of special management concern. Operation in these areas will be limited and managed according to individual site plans.

Group size (including crew): LIMITED BY SITE
Vessel length: LIMITED BY SITE

2.2.2 The Limits of Acceptable Change (LAC) Framework

The limits of acceptable change (LAC) planning framework moves away from the carrying capacity concept by addressing desired conditions rather than a capacity number (Lucas & Stankey, 1985; Stankey, Cole, Lucas, Peterson, & Frissell, 1985). The LAC process requires managers to identify where, and to what extent, varying degrees of change to an area's social and biophysical characteristics are appropriate and acceptable, and then requires managers to determine the management actions most appropriate for enhancing, maintaining or restoring those characteristics (Eagles & McCool, 2002; Eagles, McCool, & Haynes, 2002; Ormsby et al., 2004; Stankey et al., 1985). The LAC process consists of four major components:

1. identification of the acceptability of biophysical and social impacts,
2. an analysis of the relationship between existing conditions and those judged acceptable,
3. identification of management actions necessary to achieve these conditions, and
4. a program of monitoring and evaluation of management effectiveness.

These four components may be broken down into nine interrelated steps to facilitate application (Figure 2.2). A summary of the LAC process is provided in Table 2.3; a more thorough discussion of the framework can be found in Stankey et al. (1985).

In general, the first five steps in the model are intended to guide managers through a process of identifying relationships between existing and desired or 'acceptable' conditions, while the final four steps deal with implementing standards where they are appropriate, and then monitoring the specified conditions to determine when and if change becomes unacceptable (Ormsby et al., 2004). Given the importance of step three to the LAC process, indicators are discussed in more detail below.

FIGURE 2.2 The Limits of Acceptable Change (LAC) Planning Framework (Stankey et al., 1985)

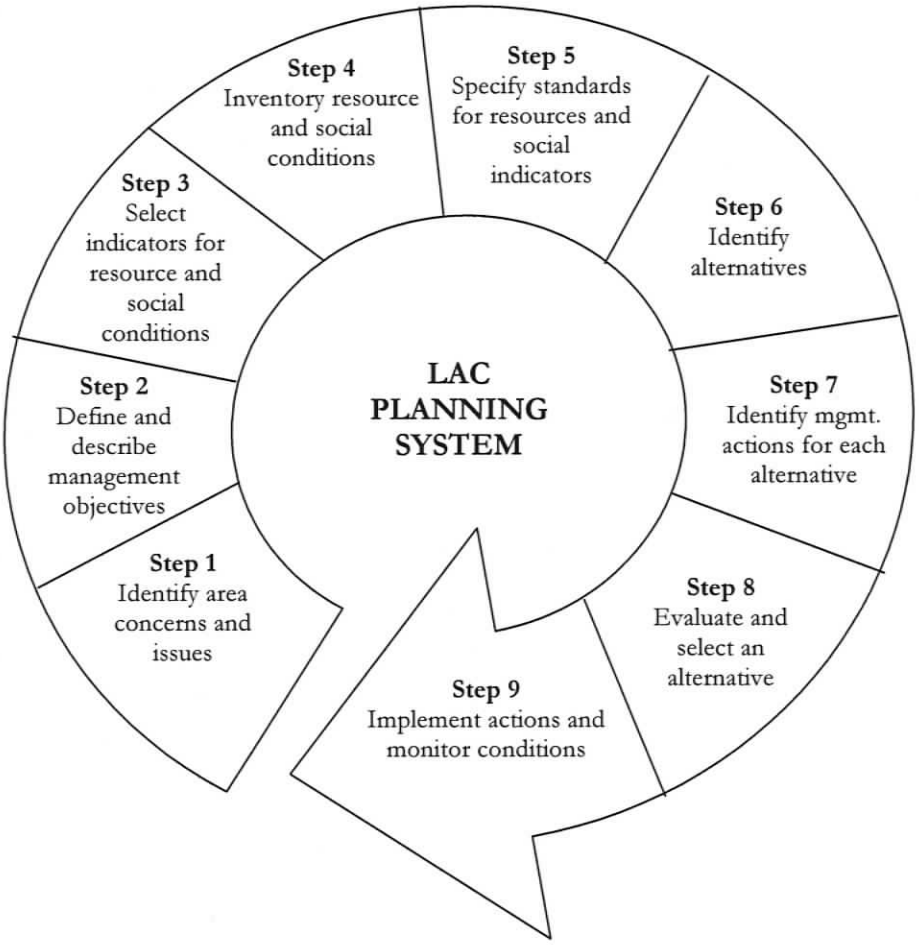


TABLE 2.3 Summary of the Limits of Acceptable Change (LAC) Process (Stankey et al., 1985)

Steps		Description	Purpose
1	Identify special values, issues and concerns attributed to the area.	Citizens and managers identify: • Special features or qualities that require attention, • Existing management problems and concerns, • Issues the public considers important in the area's management, • What role the area plays in a regional and national context.	Encourages a better understanding of the natural resource base, a general concept of how the resource could be managed, and a focus on the principal management issues.
2	Define and describe wilderness recreation opportunity classes.	Opportunity classes describe subdivisions or zones of wilderness where different resource, social, and managerial conditions will be maintained. • Define the number of classes that will be managed, • Develop general descriptions of the kinds of resource, social, and managerial conditions appropriate to each.	Developing classes (or zones) provides a way of defining a range of diverse conditions within the protected area.
3	Select indicators of resource and social conditions.	Indicators are specific elements of the resource and social setting selected to represent the conditions deemed appropriate and acceptable in each opportunity class. Bundles of indicators are used to monitor the overall condition of an area. • Select a few indicators as indicative measures of overall health, • Use economic, social, environmental, political indicators, • Ensure indicators are easy to measure, relate to conditions in opportunity classes, and reflect changes in recreational use.	Indicators are essential to LAC because their condition as a group reflects the overall condition of the opportunity class and guides the inventory.
4	Inventory existing resource and social conditions.	• Use chosen indicators to guide the inventory of resource and social conditions, • Use inventory data to provide a better understanding of area constraints and opportunities, • Map inventories to establish status (location and condition) of indicators. By placing the inventory as step 3, rather than the first step as is often done, planners avoid unnecessary data collection and ensure that the data collected is useful.	Inventory data are mapped so both the condition and location of the indicators are known. The inventory provides a measure of the indicators' existing condition throughout the area, as well as a data base from which managers can formulate the standards for each indicator in each opportunity class. Helps managers establish realistic standards, and is helpful later to evaluate the consequences of alternatives.

TABLE 2.3 ***Continued***

Steps		Description	Purpose
5	Specify standards for resource and social conditions in each opportunity class.	• Identify the range of conditions for each indicator considered desirable or acceptable for each opportunity class, • Define conditions in measurable terms, to represent the maximum permissible conditions allowed (limits), • Ensure conditions are attainable and realistic.	Provides the basis for establishing a distinctive and diverse range of protected area settings, serving to define the "limits of acceptable change". Standards play a critical role of indicating when restoration or enhancement might be needed.
6	Identify alternative opportunity class allocations.	This stage identifies alternative allocations of opportunities. • Identify different types/location/timing of alternatives, using steps 1 and 4 to explore how well the different opportunity classes meet the various interests and values.	Provides alternative ways of managing the area to best meet the needs, interests, and concerns.
7	Identify management actions for each alternative.	• Analyse broad costs and benefits of each alternative, • Identify the kinds of management actions needed to achieve the desired conditions (direct or indirect).	This step involves an analysis of the costs and benefits of each alternative. Provides a measure of what it will take to move the area from its existing condition to that desired.
8	Evaluation and selection of a preferred alternative.	• Review costs vs. benefits of alternatives with managers, stakeholders and public, • Examine the responsiveness of each alternative to the issues, • Explicitly state the factors considered, and their weight in decision-making, • Select a preferred alternative.	Builds consensus and selects the best alternative.
9	Implement actions and monitor conditions.	• Develop implementation plan with actions, costs, timetable, and responsibilities, • Develop a monitoring programme, focusing on the indicators developed in step 3, • Compare indicator conditions with standards to evaluate the success of actions. If conditions do not correspond with standards the intensity of the management effort might need to be increased or new actions implemented.	Ensures timely implementation and adjustment of management strategies. Monitoring ensures that effectiveness of implementation is known. If monitoring shows problems, actions can be taken.

The LAC process has been applied to recreation management issues in various wilderness settings, including backcountry campsites (Cole, 1995), summer alpine ski areas (Needham, 1999) and coral reefs (Roman, 2004; Roman, Dearden, & Rollins, in press; Shafer & Inglis, 2000). The framework has also been applied to systems outside wilderness and to issues other than recreation (e.g., Ahn et al., 2002; Cole, 1995; Moore & Polley, 2007), demonstrating the system's utility as a general management tool. For recreation management, the LAC concept is useful in that it produces a strategic and tactical plan for an area based on defined limits of acceptable change for each opportunity class, with indicators of change that can be used to monitor ecological and social conditions (Nilsen & Tayler, 1997). Other strengths/positive outcomes of the LAC process include:

- enhanced monitoring of wilderness conditions and effectiveness of management actions;
- increased attention to zoning as means of protecting pristine qualities;
- increased trackability and explicitness of protected area decision making;
- enhanced visibility of the costs of wilderness management;
- encouraged innovative approaches to citizen participation in wilderness decision making;
- improved capacity of government agencies to manage wilderness (McCool & Cole, 1998).

The LAC approach is considered an effective one to deal with questions of recreation management in protected areas, however, the LAC concept is complex, and the process may challenge the most competent and experienced wilderness planners (McCool & Cole, 1998). This criticism is discounted by some researchers who argue that "LAC is no more complicated than other land management and planning systems…LAC is the simplest available approach for effectively dealing with the complexity of the real world" (McCool & Cole, 1998, p.75). LAC is also criticized for its focus on issues and concerns. Identification of issues/concerns guide subsequent data collection and analysis, but where there are no current issues or concerns identified, strategic and tactical direction may not be provided on management topics (Nilsen & Tayler, 1997). In addition, several barriers and problems have been encountered with implementation, including:

- the difficulty in identifying good indicators;
- inadequate commitment to good planning and management;
- compartmentalization of functions (i.e., management agencies are typically organized along functional lines, with few internal incentives for integrative solutions);

- lack of attention to experiential knowledge;
- agencies often lack "political will" to implement actions (McCool & Cole, 1998); and
- agencies often lack the experience required to involve stakeholders in the process.

Although these barriers present considerable challenges, it should be emphasized that they are not unique to LAC.

Step Three of the LAC Framework: Indicator Selection

The selection of indicators of biophysical, social, and managerial conditions is an essential part of the LAC framework. Since it is managerially unfeasible and unnecessary to measure the condition of, and change in, every biophysical, managerial, or social feature within a protected area setting, LAC calls for the identification and monitoring of a few indicators selected as measures of the overall health of natural resources and quality of the visitor experience. Biophysical indicators measure the condition of the natural environments and monitor changes that arise directly or indirectly from visitor use. Social indicators are those indicators that measure impacts on park visitors that are caused by interactions with other visitors, park employees, or tour operators (Hof et al., 1994). Visitor experiences are also influenced by the managerial characteristics (services) of the protected area. Managerial indicators measure the impacts on park visitors that are caused by, for example, park rules and regulations and human-made facilities.

Thoughtfully selected indicators can provide valuable information about the condition of the recreation settings, and the effectiveness of the management actions being implemented (Smyth et al., 2007). The usefulness of a set of indicators depends on defining acceptable levels or standards for each indicator so that the monitoring data collected can be interpreted, and appropriate management action taken (Smyth et al., 2007; Stankey et al., 1985). Standards should reflect management goals, scientific understanding, and social values, and should be stringent enough to be meaningful, but not so stringent that they cannot be attained (Smyth et al., 2007; Stankey et al., 1985).

The LAC framework calls for the selection of "a few" indicators that singly, or in combination, *best* reflect the quality of the wilderness condition or wilderness experiences (Roggenbuck, Williams, & Watson, 1993). According to Belnap (1998), Merigliano (1990), and Roggenbuck et al. (1993), good indicators are:

- specific and quantifiable,
- significant (i.e., people care about the impact, or the impact is important to the ecology of the area),
- directly correlated with human activities,
- can be measured simply and reliably,
- repeatable with different personnel,
- integrative (i.e., one indicator reflects several impacts),
- time bounded,
- attainable,
- output oriented,
- cost effective, and
- sensitive to change (i.e., impacts can be seen while still relatively slight.

Managers can use a number of sources to define indicator standards including legal and policy mandates, historical precedents, and previous experience, but since an important objective of visitor management is the provision of quality experiences, visitor preferences for wilderness conditions should also be an important source of information (Hollenhorst & Gardner, 1994; Roggenbuck et al., 1993). Managers can survey visitors to evaluate customer satisfaction with outdoor recreation settings and experiences, and identify park management issues perceived by visitors to be important.

Application of the LAC Framework to Coral Reef Environments: Conditions Influencing Coral Reef Visitors

Extensive lists of items used as indicators of the condition of natural and social resources have been developed from years of research in terrestrial environments, but only recently have studies been undertaken to determine such indicators in marine settings (Shafer, Inglis, Johnson, & Marshall, 1998). In a coral reef environment, the broad classes of conditions will be much the same as those of terrestrial environments, i.e., the experience of the visitor and the state of the resource will be determined by the physical, natural, managerial, and social conditions. However, visitors to the marine environment are likely to find themselves in an alien and unfamiliar setting (corals, fish, waves, currents), where human perceptual systems are severely restricted: the visitors' perceptual field in constrained by masks and by the clarity of the water column; auditory, olfactory, and tactile information is restricted or nonexistent, and; visual information is acquired from an unfamiliar horizontal orientation (Fenton, Young, & Johnson, 1998). Consequently, visitors will likely perceive the physical, natural,

managerial, and social conditions in marine settings quite differently from the conditions on land. The conditions influencing users' experiences in coral reef environments are discussed in greater detail below, and are summarized in Table 2.4.

Physical conditions

The importance of physical conditions related to weather and climate (e.g., air temperature, water temperature, underwater visibility, wind speed) on visitors' experiences tend to play a small role in studies of recreation, probably because weather cannot come under the control of managers (Shafer et al., 1998). Marine-based tourism differs slightly, however, in that tour operators can decide whether or not to travel to reef sites under certain weather conditions, and operators can advise customers about the wind speeds and surface conditions at sea. According to Shafer et al. (1998), "In marine environments, weather conditions may have a higher degree of influence on recreation and tourism experiences than in terrestrial environments. This may be particularly true on day-trips comprised largely of people with little experience of travelling on the open ocean" (p.15). The physical conditions, therefore, may have a considerable influence on visitors' enjoyment of the tourism experience. For example, winds and currents affect visibility in the water, impacting how much people see during their visit, while air and water temperatures influence the comfort of visitors.

Natural conditions

In terrestrial settings, visitors have high shared agreement that encounters with wildlife are very important influences on wilderness experiences (Roggenbuck et al., 1993; Shafer et al., 1995). During a SCUBA dive or snorkeling trip, visitors may easily see 50 different species over a small area and a short period of time. There are few nature-based experiences that provide visitors with an opportunity to see so many different corals, fish, marine mammals, and other animals (e.g., echinoderms and molluscs) in a relatively small area or over a short period of time (Shafer et al., 1998).

People visit coral reefs for the opportunity to view and/or interact with fish and other marine life. Corals are a dominant visual feature of reefs, and the variety of coral species typically found give form, texture, and colour to the underwater landscape, and provide habitat for many other animals that live on the reef (Shafer et al., 1998). Individual aspects of corals (size, morphology, colour) may be perceived by visitors in different ways,

TABLE 2.4 Features That Influence a Reef Experience (Bennett, 2002; Moscardo, 1999; Saltzer, 2002; Shafer et al., 1998)

Condition Items	
Physical Conditions	**Managerial Conditions**
Clarity (visibility) of the ocean water	Helpfulness of the staff
Temperature of the air	Information provided by the staff
Depth of the water	Friendliness of the staff
Warm water	Appearance of the staff
Sea conditions during the trip from/ to shore	Safety procedures
Currents in the water around reef	Food services
Amount of wind	Commitment to the environment
Natural Conditions	**Social Conditions**
Size of the coral	Number of people on the boat
Abundance of coral	Number of people snorkeling
Variety of coral	Number of people on the pontoon
Variety of fish	Number of human-made objects in the water
Abundance of fish	Number of motorized boats
Behaviour of the fish	Number of non-motorized boats
Size of the fish	Amount of noise
Number of animals other than coral or fish	Behaviour of other visitors
Clear, unpolluted dive / snorkel sites	
Undamaged dive / snorkel sites	
Above water scenery	
Unique underwater formations	
Opportunity to view turtles	
Opportunity to view sharks	
Signs of Use (e.g., litter, broken coral)	

and may have different levels of influence on visitors' marine experience, although little is known about peoples' ability to perceive different species of coral (Shafer et al., 1998).

A better understanding of the relative influence of marine wildlife on visitors' reef experiences is needed, but research undertaken by Bennett (2002), Moscardo (1999), Saltzer (2002), and Shafer et al. (1998) suggests that natural conditions may have the greatest influence on visitor experiences. In a study of visitor experiences and perceived conditions on day trips to the Great Barrier Reef, Shafer et al. (1998) asked park visitors to rate the influence of 24 social, biophysical, and managerial conditions on tourism experiences. Their results indicate that conditions related to coral and fish had the greatest influence on the experiences of most visitors. Similarly, Bennett (2002) surveyed SCUBA divers in Phuket Thailand, and found that the natural conditions were the most highly valued aspects of the dive experience: over 90% of divers surveyed rated the variety and amount of marine life as important or extremely important, and 31% of divers rated this condition as the "most

important" feature of the dive trip. In a study conducted by Moscardo (1999) of the relative contributions of a series of factors on visitors' overall satisfaction, visitors to the Great Barrier Reef reported that aspects of the natural environment, including the coral, fish and other marine wildlife, were the most common things reported by people as the 'best' features of their experience. Results summarized in a study by Saltzer (2002) report similar findings: the factor that had the greatest impact on reef visitors' overall satisfaction with their reef experiences was how satisfied visitors were with the fish, coral, and other marine life.

Managerial conditions

Since managerial conditions can hold significant importance for park visitors' enjoyment, and since the success of a tour operator and/or park agency is dependent upon the quality of the participants' experiences, park providers must identify what services their clients value, and how satisfied clients are with the delivery of those services. Aspects of the managerial environment include hospitality services, transportation services, interpretation services, emergency services, environmental codes of conduct, and regulations concerning the spatial and temporal use of marine resources. Shafer & Inglis (2000) found that the services provided by operator staff had a high positive influence on users. Likewise, Bennett (2002) found that divers rated several services as important/very important to the enjoyment of the dive trip, including safety procedures and interpretation.

Social conditions

A majority of the research on the influence of social conditions on visitors' experiences has taken place in the terrestrial realm, and results generally indicate that both encounters with others and the behaviour of others are important influences on visitor experiences (Roggenbuck et al., 1993). For example, research has shown that noise (unwanted sound) in natural environments can have a significantly negative impact on recreational experiences by interrupting people's feelings of solitude and tranquillity (Kariel, 1990). Noise will be considered annoying and will detract from preferred experiences (such as the enjoyment of nature) when sounds encountered are loud, unpredictable, uncontrollable, and considered inappropriate for a given area (Shafer et al., 1998). Similarly, large numbers of people in a natural setting are often judged as intrusive and found to degrade users' perceptions of the natural beauty of an environment (Shafer et al., 1998). The influence of social conditions on recreational experiences in marine environments is not well understood, but research results

reported by Randall (2003), Inglis et al. (1999), and Shafer et al. (1998) suggest that visitors' experiences are similarly influenced by social conditions in marine settings. The number of other people or human-made structures in the water, the distances between them, the types of boats or activities they support, and the behaviour of the people on a boat or participating in activities are all social conditions which may influence user experiences (and marine life) (Shafer et al., 2000; Shafer & Inglis, 1998).

In this study, the LAC framework is used as a guide to examine and inform the process of developing park management interventions that will help deliver satisfactory snorkeling experiences, while maintaining the quality of the natural environment. It is beyond the scope of this study to complete all nine stages of the LAC process; rather, this study establishes a foundation for full application of the limits of acceptable change framework to recreational use of Koh Chang's coral reefs. This study is primarily concerned with steps 1, 3, 4, 5, and 6.

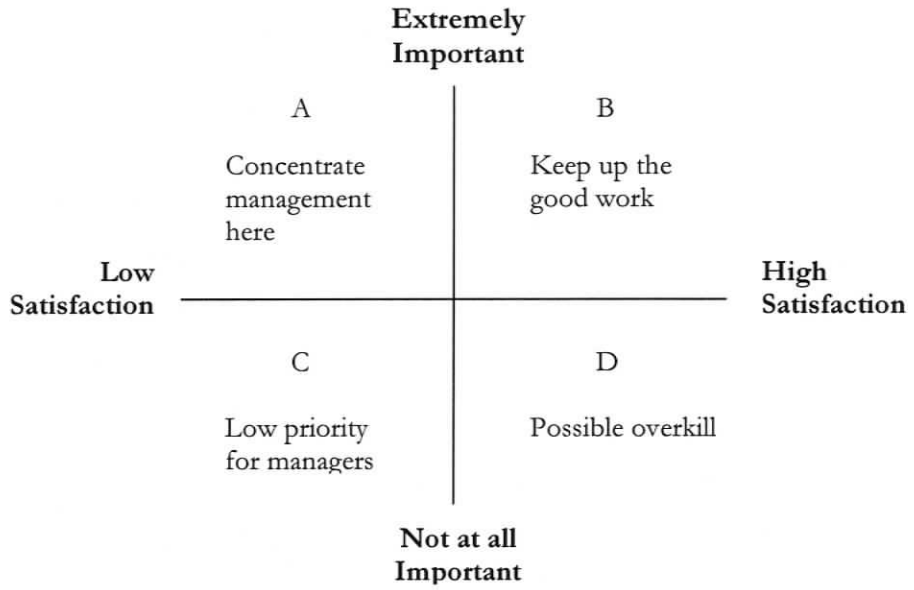
2.2.3 The Importance/Performance Analysis Framework: A Tool for Identifying the "Best" Indicators

Two major limitations encountered with implementation of the LAC framework relate to a lack of knowledge about the importance or influence of resource and social indicators, and difficulties in comparing the conditions or performance of indicators (Hollenhorst & Gardner, 1994; Ormsby et al., 2004; Roggenbuck et al., 1993). These challenges can be overcome with the use of the Importance-Performance (I-P) analysis framework (Martilla & James, 1977), which allows managers to directly compare the importance of indicators in the quality of visitor experiences, and the performance of these indicates relative to visitor standards (Hollenhorst & Gardner, 1994; Vaske, Beaman, Stanley, & Grenier, 1996). In the I-P framework, customers' importance (a perceived worth of the attributes of the experience) and performance (a perceived condition of the attributes of the experience) ratings attained from survey instrument Likert scales are plotted on a four quadrant grid to highlight where management actions should concentrate (Martilla & James, 1977). All points fall into one of four quadrants (Figure 2.3):

A. Concentrate management here: high importance but poor performance
B. Keep up the good work: high importance and excellent performance
C. Low priority for managers: low importance and poor performance
D. Possible overkill: low importance but excellent performance

Attributes that fall within the "concentrate management here" quadrant can be used as indicators of setting conditions that mangers should be concerned about, thereby simplifying the task of identifying the best indicators for application of the LAC decision-making process.

FIGURE 2.3 Importance-Performance Matrix (Martilla & James, 1977)



The I-P approach typically uses four quadrants, but other researchers (e.g., see Bennett, 2002; Randall, 2003) have modified the traditional I-P matrix by combining quadrants B and D, and re-labelling the new quadrant "area of satisfaction". The modification is based, in part, on Duke & Persia's (1996) argument that "possible overkill" can be considered a strength, since extra performance often yields customer satisfaction. Bennett (2002) also suggested that by eliminating the "possible overkill" quadrant, resource and dive industry managers might be encouraged to avoid slipping into complacency, and treat favourable satisfaction ratings as a stimulus to maintain that aspect of the environment, rather than ignoring it.

The location of the grid crosshairs have a significant impact on the interpretation of the findings, and therefore, considerable thought should be given to where the crosshairs are placed (Evans & Chon, 1989; Hudson & Shepard, 1998). Crosshairs can be set using a "scale-centred", "data-centred", or "target-centred" approach. The scale-centred approach

sets the crosshairs in the centre of the scale used. For example, when a 5-point scale is used to measure importance and performance, the crosshairs are set at the point where importance equals three and performance equals three. Using the data-centred quadrants approach, the cross point is set at the mean (or median) importance and mean (or median) performance rating. Target-driven approaches reflect management's goals to either maintain or increase performance standards.

The approach used to place the crosshairs is a matter of judgment, but should consider management's goals for the area (or service) in question (Hudson & Shepard, 1998). The movement of the crosshairs can provide additional analysis and more insightful interpretation, and allows for flexibility in setting standards. For example, an agency with limited resources might only want an indication of the very top priorities and would adjust the importance crosshair accordingly, or the agency may desire a strict quality of service and move the performance crosshair higher on the grid. Martilla & James (1977) stress that the value of the I-P analysis framework lies in identifying relative measures, rather than absolute measures. For example, attributes that appear on the bottom half of the grid are not necessarily irrelevant to everyone in all situations, instead they are less important than other attributes.

I-P analysis has been applied to a number of park and recreation contexts including evaluations of protected areas (Hammitt, Bixler, & Noe, 1996; Mengak, Dottavio, & O'Leary, 1986; Tonge & Moore, 2006; Wade & Eagles, 2003), wilderness conditions (Hollenhorst & Gardner, 1994), and marine-based activities including kayaking (Randall, 2003), SCUBA diving (Bennett, 2002), and snorkeling (Roman, 2004). Popularity of the I-P analysis in a range of tourism and recreation settings indicates that it is a useful management tool, although the framework has been criticized by several authors. The most commonly cited issue with the I-P analysis framework is related to the approach used to infer priorities, although some authors (e.g., Hudson & Shepard, 1998) view flexibility in the placement of the crosshairs as an advantage. The somewhat arbitrary placement of the crosshairs is an inherent limitation of the I-P analysis framework, and so a clear rationale for placement of the gridlines should be developed and communicated. The advantages and disadvantages of the I-P framework are summarized in Table 2.5, along with the modifications and extensions that have been applied to deal with some of the framework's problems.

TABLE 2.5 Advantages, Disadvantages, and Modifications of the I-P Analysis Framework (Bacon, 2003; Bruyere, Rodriguez, & Vaske, 2002; Duke & Persia, 1996; Evans & Chon, 1989; Hudson & Shepard, 1998; Martilla & James, 1977; Oh, 2001; Tarrant & Smith, 2002; Tyrrell & Okrant, 2004; Vaske, Beaman et al., 1996)

Advantages

- It is a low cost, time efficient, easily applied and understood technique.
- Provides an effective and efficient method for collecting and interpreting visitor information and prevents problems associated with making decisions based solely on managers' perceptions.
- It is relatively straightforward for managers to interpret data to make decisions.
- It can help increase managers' confidence in allocating limited resources and establishing minimum standards for setting conditions.

Disadvantages

- Study results and interpretations can be dramatically different dependent upon whether the actual or scale means are used in constructing the IPA grid.
- Borderline attributes fail to offer clear direction for action because they are treated in the same way as attributes falling neatly within a respective quadrant.
- It has an inability to determine if expressed importance is based on a positive or negative attitude about an attribute; a feature or condition can be considered important based on either favourable or unfavourable reasons. The framework traditionally assumes that expressed importance is based on a favourable evaluation, but this may not always be the case.
- It is impractical and/or difficult to always perform exactly at the importance level of the attribute in order to prevent possible overkill or to reduce needs for additional resource allocation to the attribute.
- There is an absence of guidelines for developing a set of attributes to be used.
- IPA without appropriate segmentation of respondents can actually result in undesirable outcomes related to user displacement and sub-optimal resource allocation.

Modifications

- Add a "gray zone" or a "zone of tolerance" to the middle of the matrix to classify those points that fall near the middle of both classifications. Any features falling within the zone of the tolerance would not be considered different from each other, or not interpreted.
- Calculate and include a measure of standard error (SE) for both the importance and the performance values. The outcome is the creation of a confidence interval with the mean value in the centre and two SE bars. Significant and non-significant differences for attributes falling adjacent to the axes can be distinguished by whether or not the cross-points overlay one or both of the I-P axes. If the cross-points of an attribute fall fully in one quadrant, it can be segmented according to the I-P management objectives with confidence, i.e., the mean value on the I-P graph is a true reflection of the needs and preferences of the user population.
- Derive the set of attributes used in the I-P analysis framework using results from previous research in the same or related areas, managerial judgment, and various qualitative research techniques (e.g., focus groups, informal personal interviews) to identify potentially important factors which might otherwise be missed.
- Optimize resource allocation by segmenting visitors into sub-groups.

In this study, the I-P analysis framework is used to provide an initial step toward determining minimum acceptable standards by identifying indicators of setting conditions that park managers and tour operators should be concerned about (i.e., attributes that fall in the 'concentrate here' quadrant). To enhance utility and to achieve useful and accurate results, segmentation on the basis of specialization and culture will be integrated into the I-P analysis. Results from this study can be used to improve visitor experiences and manage recreational use of coral reefs within Koh Chang MNP.

2.3 The Negative Impacts of Tourism and Recreation on Coral Reefs

The impacts of marine tourism can be broadly categorized as ecological, social, and cultural. According to Harriott (2002), the major types of marine tourism impacts include:

- coastal tourism development (population pressures, construction activities);
- island-based tourism infrastructure (marinas, sewage discharge, construction)
- marine-based tourism infrastructure (pontoons, moorings);
- boat-induced damage (anchoring, ship grounding, litter, waste discharge);
- water based activities (diving, snorkeling, reef walking, fishing);
- wildlife interactions (seabirds, turtle-watching, whale-watching, fish feeding)

These impacts are summarized in Table 2.6, along with strategies available to manage and mitigate the impacts. The environmental impacts of water-based activities (SCUBA diving, snorkeling, fishing), boating (anchoring, grounding, pollution), and wildlife interactions (fish feeding) are discussed in greater detail in section 2.3.1, and the social impacts of use are discussed briefly in section 2.3.2. This review will help frame the discussion of results reported in Chapter 6.

TABLE 2.6 Summary of Environmental and Social Impacts of Tourism and Recreation on Coral Reefs (Harriott, 2002)

Activity	Impacts	Management and mitigation
	COASTAL TOURISM DEVELOPMENT	
Population pressures	• increased pressure on services such as sewage, transport, electricity • impacts on social values and amenity	• regional planning, taking into account cumulative impacts
Construction of tourism developments	• effects on catchment water quality	• environmental impact assessment • best-practice construction techniques • monitoring
	TOURISM INFRASTRUCTURE (ISLAND-BASED)	
Marina/ harbour development	• local, on affected reefal area • water quality (antifoulants) • introduced pests • impacts on social values and amenity	• environmental impact assessment • engineering design • reactive monitoring • water quality monitoring
Sewage discharge	• depends on treatment level • elevated nutrients and turbidity • freshwater input	• requirements for discharge levels • water quality monitoring • tertiary treatment • land irrigation
Construction	• vegetation damage • loss of wildlife habitat • sediment runoff	• environmental impact assessment • best-practice construction • water quality monitoring
Tourism activities	• focus for motorized and non-motorized vessels and marine activities	• as discussed below
	TOURISM INFRASTRUCTURE (MARINE-BASED)	
Pontoons	• shading of benthos • dragging of moorings • focus for tourist activities	• permit required • appropriate design • careful selection of location • transplant susceptible biota away from site
Moorings	• local damage to benthos • reduce impacts from anchors	• encouraged to reduce anchor damage • appropriate design • liability and safety issues
	BOAT-INDUCED DAMAGE	
Anchoring	• local coral damage • cumulative impacts	• installation of private and public moorings • codes of practice in other areas • anchor over sand • education program
Ship groundings	• damage to reef structure • local benthos damaged • anti-fouling paint on reef • risk of oil or chemical spill	• education of private and public charter users

TABLE 2.6 *Continued*

Activity	Impacts	Management and mitigation
	BOAT-INDUCED DAMAGE	
Litter	• potential harm to wildlife • aesthetics	• education program • penalties
Waste discharge	• local nutrient enhancement • potential water pollution	• education program • penalties • storage tanks in boats
Vessel strike / disturbance to wildlife	• injury • death • disruption to social bonds	• education program • penalties • speed limits
	WATER-BASED ACTIVITIES	
SCUBA diving	• local damage to fragile corals	• education program • industry code-of-practice • dive briefings • site selection for inexperienced divers
Snorkeling	• local damage to fragile corals	• education program • industry code-of-practice • provision of resting buoys and flotation • briefings
Reef walking	• coral breakage	• education program • industry code-of-practice • walking trails to focus damage
Fishing	• declines in fish diversity and abundance • damage to reef substrate from deployment of gear	• zoning requirements • industry code-of-practice
	WIDLIFE INTERACTIONS	
Fish feeding	• focus of fish aggregations • wrong diet • disease and enhanced capture risk • fish dependency • human danger	• education program • legislation • guidelines • briefings • permit conditions

2.3.1 The Environmental Impacts of Use

SCUBA Diving and Snorkeling

SCUBA diving is generally considered a non-consumptive, non-destructive activity that can yield significant local economic benefits but in reality, divers can cause significant ecological damage to coral communities (Allison, 1996; Harriott, 2002; Harriott, Davis, & Banks, 1997;

Hawkins et al., 1999; Kay & Liddle, 1989; Roberts & Harriott, 1994; Rogers, McLain, & Zullo, 1988; Rouphael & Inglis, 1997, 2001; Tilmant & Schmahl, 1981; Tratalos & Austin, 2001; Walters & Samways, 2001). Divers damage reefs (usually accidentally) by touching, kicking, trampling, holding, kneeling, or standing on benthic organisms (Davis & Tisdell, 1995; Hawkins & Roberts, 1992). Re-suspension of sediment (from fin kicks) may also stress reef organisms by smothering them. Signs of coral reef damage include broken coral fragments and dead, re-attached and abraded corals (Barker & Roberts, 2004). Other, less direct ecological impacts associated with SCUBA diving and snorkeling include: pollution from wastewater discharge and boat fuel; harassment and feeding of marine animals; sediment input by terrigenous runoff; recreational fishing (e.g., spear fishing); and litter.

Snorkeling has been less studied than SCUBA diving, but since most tourists stay on the surface of the water when they snorkel, they are less likely to impact the reef (Harriott, 2002). However, snorkelers can damage reefs, most often when they kick or stand on coral colonies. Allison (1996) measured coral breakage by snorkelers on a Maldivian resort reef, and found a positive correlation between the distribution of broken corals with snorkeling activity, with breakage rates highest at sites with easy access and abundant breakable coral colonies. On the most impacted section of the reef, the author estimated breakage over a one month period at 17% of susceptible coral cover, and 7% of total coral cover. These findings suggest that snorkelers can break a substantial amount of coral in a short period of time.

Recent studies focusing on the ecological effects of recreation on coral reef settings have focused on the relationship between use intensity and damage to coral reef communities. Only a few attempts have been made to estimate the carrying capacity of popular dive and snorkeling sites in coral reef settings, and a majority of these studies have focused on determining the carrying capacity for SCUBA divers. Diver carrying capacity is typically expressed as a maximum number of dives per site per year, and is a measure of the number of dives a site can sustainably support without becoming degraded (Jameson, Ammar, Saadalla, Mostafa, & Riegl, 1999; Zakai & Chadwick-Furman, 2002). When diving rates are below carrying capacity for a given reef site, coral damage is minimal, but above carrying capacity, coral damage may increase greatly (Dixon, Scura, & Hof, 1993; Zakai & Chadwick-Furman, 2002). Detailed studies of recreational carrying capacity in coral reef settings have been conducted by Hawkins & Roberts (1992; 1993; 1997), Dixon et al.

(1993), and Zakai & Chadwick-Furman (2002). Research findings from these studies suggest that SCUBA divers and snorkelers can damage coral reef communities, but that the relationship between level of use and damage is not linear. Damage can rapidly accumulate at new sites, but once a certain level of use has been reached, the impact appears to stabilize (Dixon et al., 1993; Hawkins & Roberts, 1994). Other significant findings from studies on the relationship between diver and snorkeler density/behaviour and impact include:

- massive forms of coral are better able to withstand mechanical stresses than branched colonies,
- controlled contacts include nearly all hand, body and knee contacts, whereas uncontrolled or accidental contacts are most often caused by fins and other equipment,
- there is little evidence that severe biological degradation or loss of biological diversity results from recreational SCUBA diving (although no long-term monitoring studies have been undertaken), and
- significant amenity value losses from diver- and snorkeler-induced damaged (reducing aesthetic quality) may occur at some threshold level of use.

Results from coral reef carrying capacity studies also suggest that threshold levels cannot be transferred easily from one site to another, since recreational capacities depend on a combination of factors that vary from site to site. The carrying capacity of coral reefs for SCUBA diving and snorkeling depends on:

- the size and shape of the reef – large reefs can accommodate more people than smaller reefs;
- the composition of coral communities – the extent of damage to corals in heavily used reefs depends on the fragility of coral colonies and the percentage cover by living corals. For example, massive forms of coral, for example, are better able to withstand mechanical stresses than delicate branched or leafy colonies;
- variation in technical competence or the level of experience of divers and snorkelers. - beginners frequently tread on corals to rest or adjust equipment, and they also blunder against and damage reef organisms more often than more experienced people;
- the level of environmental awareness and training of the divers and snorkelers involved,
- level of instruction provided before and during the trip;
- diver and snorkeler behaviour - individuals may vary greatly in behaviour and in the amount of damage that they cause
- the activities pursued underwater;

- the presence of other anthropogenic stressors that degrade the reef, such as particulate pollution.

Other factors identified as having an influence on how tourist and recreational use impact the environment include: amount of use, distribution of use, time of use, type of use, user knowledge of minimal impact behaviours, and design of the infrastructure to support use (Ormsby et al., 2004). In addition, the activities and practices of tour operators can influence what visitors do, and thus their impacts, and so an understanding of the environmental impacts also requires some understanding of tour operator practices (Ormsby et al., 2004).

Coral reef carrying capacity studies also suggest that capacities are not fixed. Management interventions can increase the carrying capacity of popular dive and snorkeling sites, but such measures require money and legal authority (Dixon et al., 1993). Examples of effective management interventions include: diver education (e.g., Medio, Ormond, & Pearson, 1997), regulation of underwater photography (e.g., Barker & Roberts, 2004), concentrating use (e.g., Plathong, Inglis, & Huber, 2000), and rotating and/or closing dive sites (e.g., Riegl & Riegl, 1996; Rouphael & Inglis, 1997).

Fishing

Commercial and recreational fishing can adversely affect reef fish populations and the reefs themselves. Large fish like groupers and trigger fish are often selectively harvested to meet demand in local seafood restaurants, and bright colourful fish are collected for the live aquarium trade (Burke, Selig, & Spalding, 2006; Lunn & Dearden, 2006; Rudd & Tupper, 2002). Excessive fishing can deplete stocks and lead to local extinctions, and the equipment or technique used to fish (e.g, traps, hand-held spears) can smash or abrade corals.

Boat-induced Damage

Incidences of severe anchor damage to coral reefs have been documented in and out of protected areas around the globe (Allen, 1992). Anchoring can cause significant localized damage by dropping anchor directly on reefs, or as a result of movement of the anchor chain across the substrate (Allen, 1992). When a ship dropped its anchor on Spotts Reef in the Grand Cayman Islands, for example, the damage was extensive:

> "The anchor alone crushed all coral formations within 3 metres of it...the day was calm, but as the anchor chain swayed slowly with the ship, it crushed, snapped, or twisted any coral in its path. Near the anchor, the path of destruction was only 1 or 2 metres wide, but approximately 70 metres from the anchor the path was 50 metres wide...the chain tore 8-metre-wide coral heads from their bases and sent them tumbling down the fore-reef....Clouds of pulverized coral billowed into the water, column...Many corals that were not completely crushed had all their living tissue scraped off. The anchor and chain totally destroyed a section of reef that measured 2100 square metres" (Allen, 1992, p. 332).

Inexperienced boat handlers grounding on reefs can also cause considerable physical damage to shallow areas, particularly at low tide (Harriott, 2004; Rogers et al., 1988; Salm & Clark, 1989). Boats improperly tied up can also get pushed into shallow areas by sudden winds, and scrape or break corals near the surface. Speeding vessels can also kill, injure, and/or disturb marine wildlife, and people.

Other boating impacts relate to the release of sullage and waste water, and littering. Oil and sewage pollutants have been demonstrated to have a number of effects on coral reefs including interfering with physiological – particularly reproductive - processes, aborting larval development, making areas unsuitable for recruitment or settlement of new individuals, and smothering or changing the texture of the habitat (Salm & Clark, 1989). Plastic particles and cigarettes can kill fish and birds who ingest them, and bags can wrap around corals and suffocate the tissues underneath (Rogers et al., 1988). Recreation research suggests that the amount of litter can also detract considerably from visitors' enjoyment of nature-based experiences (Green et al., 1999; Manning, 1986; Noe, Hammitt, & Bixler, 1997; Roggenbuck et al., 1993).

Feeding Fish

Fish feeding is widely practiced, yet very little is known about the potential for changes in the distribution and behaviour of marine fish brought about by regular feedings. There are a variety of impacts that can occur as a result of feeding fish, including alteration in the composition of fish communities, habituation and dependency, aggression, and changes in the health and viability of provisioned animals. In a study of the effects of fish feeding by snorkelers on the density and size distribution of fishes in a Mediterranean marine protected area, Milazzo, Badalmenti, Fernandez, & Chemello (2005) found that fish feeding influenced

the fish assemblages within the park, and significant spatio-temporal changes occurred. "It is very likely that aggregations of fishes that evolve as a result of fish feeding by the public may have negative effects on local populations of fishes and invertebrates that make up their prey" (Milazzo et al., 2005, p.1213). At *Stingray City* in the Cayman Islands, local people have noticed major behavioral changes in the stingray population due to constant food provisioning: "On days when divers cannot visit the site the rays exhibit clear signs of hunger, suggesting that they may not be obtaining food in their usual way" (Shackley, 1998, p.334).

There is also some concern expressed by biologists about what some fish are fed. While there are few long-term empirical studies that prove there are significant negative health consequences of feeding wildlife (Orams, 2002), hot dogs, bread, rice, peas, potato chips, liquid cheese, and spoiled fish – all of which have been used to attract fish to snorkel and dive sites - are not natural food sources for marine animals. The Great Barrier Marine Park Authority claims that fish fed inappropriate food can result in an increase in fat deposits in the liver, which can be fatal (Orams, 2002).

2.3.2 The Social Impacts of Recreational Use

While a significant amount of research has been dedicated towards establishing relationships between intensity of recreational use and amount and rates of damage to coral communities, very few studies have explored issues related to social carrying capacity in tropical marine settings. Inglis et al. (1999) studied perceptions of crowding among coral reef users in the Great Barrier Reef Marine Park, and results showed that most respondents had measurable preferences for the number of others that they found acceptable in coral reef settings: respondents indicated a preference for a maximum of 14 snorkelers from an above-water perspective, and six snorkelers from a below-water perspective. In a study of snorkelers in Koh Chang, Thailand, Roman (2004) found that visitors' perceptions of crowding were strongly correlated with the number of snorkelers, with a majority of visitors feeling crowded when exposed to 40-65 snorkelers. Roman (2004) recommended setting a social LAC standard of less than 35 snorkelers in a zone designated for *ecotourism*. (These studies are reviewed in greater detail in the next section.)

The social impacts of use are generally not well understood, but limited research does suggest that indicators of thresholds for social carrying capacities in marine settings

might be similar to those reported for terrestrial environments (Randall, 2003). For example, perceptions of crowding in terrestrial settings are a function of: the number of other recreationists, the behaviour of other recreationists, and the characteristics and motivations of recreationists. More research is needed to better understand how people perceive use levels and a lack of solitude/privacy in marine environments, particularly since recreation thresholds are determined by both the state of the environment and social conditions. The importance of the social conditions in setting recreation threshold levels has been largely under-emphasized, even though an over-emphasis placed on environmental conditions can constrain the ability of park managers to address both conservation and recreation needs.

To manage the use of coral reefs in a manner that maintains both the integrity of the natural environment and the recreation experience of visitors, this study seeks to develop an understanding the environmental and social impacts of use by investigating:

- tour operators' perceptions of the impact of various activities on the reef environment,
- tour operators' support for a range of management strategies available to manage use of the coral reefs,
- visitors' knowledge of coral reef ecosystems and minimal impact behaviours,
- visitors' observations of high impact behaviours,
- visitors' perceptions of the impact of snorkeling on the reef environment,
- visitors perceptions of crowding and encounter norms, and
- the actual behaviours of tour operators and snorkelers.

2.4 Social Science Studies in Tropical Marine Environments: A Review of Related Research

The broad objective of this study was to establish a baseline understanding of the snorkeling industry in Koh Chang, Thailand, and to recommend a suite of management actions that will sustain economic benefits while still yielding the benefits of protecting aesthetic and biological values. The research task was to develop an awareness of the snorkeling tour providers; the visitors; the physical, natural, managerial, and social conditions present during reef experiences, and; visitors' evaluations of those conditions. The last section of this chapter is devoted to briefly summarizing studies that are similar to this one in intent, research design, setting, and recreation activity. The objective is not to review *every* study that has relevancy to this one, but to provide a general indication of what is known about tourist

and recreational use of coral reefs. Where appropriate, key findings and conclusions from these studies will be compared to results from the present study in the chapters that follow.

2.4.1 Crowding Norms in Reef Environments

While a significant amount of research has been dedicated towards understanding crowding norms in terrestrial settings, very few studies have been concerned with encounter norms in tropical marine settings. Inglis et al. (1999) took a first step towards closing this research gap with a study of coral reef users in the Great Barrier Reef Marine Park. The authors were interested in determining how perceptions of crowding in marine environments are affected by: 1) prior experience in marine settings, 2) the presence of human-made structures (e.g., flotation buoys), and 3) the locations of encounters with other snorkelers (i.e., whether the encounters occurred in or above the water).

Visual imaging technology was used to construct photographs of different numbers of snorkelers in above- and below-water settings. In the above-water view, the density of snorkelers in the images was varied over nine levels (0, 7, 14, 22, 30, 37, 45, 53, 60), and the presence of a single line flotation of buoys was also varied to explore how the presence of safety features altered respondents' ratings of the acceptability of the setting and the presence of others. In the below-water view, the density of snorkelers in the images was varied over eight levels (0, 3, 6,9, 12, 15, 18, 21). The slides were projected on a screen in random order, and the acceptability of each of the 22 scenes was rated by four respondent groups representing differing degrees of familiarity with snorkeling, marine environments, coral reefs, and the Great Barrier Reef.

Results from this study reveal a number of interesting insights into crowding norms in marine settings. First, ratings of crowding acceptability generally decreased as the number of snorkelers depicted in the images increased, a finding that is consistent with the crowding literature. On average, most respondents found between zero and 22 snorkelers acceptable in the above-water images and fewer than six snorkelers acceptable in the below-water scenes. Second, experienced recreationists favoured the total absence of people over all other settings, suggesting that feelings of solitude are an important aspect of the snorkeling experience for specialized snorkelers. In contrast, less experienced snorkelers were more likely to rate the absence of others as unacceptable. Opportunities for solitude may not be important for novice snorkelers, and, as the authors suggest, this may be based on concerns

for safety in the marine environment. Third, the presence of human-made structures influenced the way more experienced snorkelers expressed their personal norms for crowding. Novice snorkelers were more tolerant of the presence of human-made structures than were specialists. This finding suggests that on-site infrastructure has a negative influence on specialized snorkelers' experiences, a finding that is consistent with the wildlife tourism model developed by Duffus & Dearden (1990). Fourth, respondents generally appeared willing to tolerate a larger density of people in the underwater scene than in the above-water scene. The authors suggest that "the restricted field of view underwater and the presence of other snorkelers nearby can obscure other people, so that more snorkelers may be present that the observer is aware of" (Inglis et al., 2000, p.378). The underwater world adds a degree of complexity to the study of crowding in marine settings that is obviously not of concern in terrestrial-based recreation research. Lastly, most respondents had measurable preferences for the number of others that they found acceptable in coral reef settings, and how these preferences are expressed depends, in part, upon prior experience with recreation in marine environments. The different thresholds for social carrying capacities expressed by experienced and novice snorkelers points to the importance of separating use geographically to provide for distinct marine settings that appeal to multiple user groups, a finding that is consistent with the recreation literature.

2.4.2 Application of ROS and/or LAC Concepts to Reef Settings

Explicitly or otherwise, several authors have applied aspects of the ROS and/or LAC planning frameworks to help formulate management recommendations for recreation activities in reef settings, including Bennett (2002), Dearden et al. (2006), Musa (2002), Roman (2004), Roman et al. (in press), Saltzer (2002), Shafer et al. (1998), and Shafer & Inglis (2000). These studies, reviewed briefly below, have greatly enhanced understanding of the experiential and environmental conditions in coral reef settings that contribute to visitors' satisfaction, as well as the characteristics of visitors (e.g., specialization) that influence their motivations and satisfactions. Information of this sort is critical for application of the ROS and LAC planning frameworks.

Bennett (2002) examined how visitor experiences are impacted by the rapid growth of dive tourism in Phuket, Thailand. Personal interviews were conducted to obtain information on

the size, growth, and supply of dive opportunities in Phuket; self-administered pre- and post-dive questionnaires were used to gather data on divers' motivations, expectations, satisfactions, and perceptions of diver impact on reef ecosystems. Surveys were completed on day, and live-aboard dive trips, and differences between the two data sets were explored. Divers were also segmented on the basis of specialization using two specialization indices; the 'diver specialization index' considered the amount and type of diving experience that each individual had, and the 'ecotourist specialization index' considered the divers' environmental attitudes and the importance of various conservation-related initiatives and features. Visitor survey results showed that:

- the dive trip features most valued by divers relate to the marine environment: divers rated the variety and amount of marine life, the presence of clear, unpolluted and undamaged dive sites, good underwater visibility, and the opportunity to view large animals (e.g., whale sharks, manta rays) among the most important dive trip features.

- overall, divers were generally satisfied with their Phuket dive experience; however, the degree of satisfaction varied among dive trip features. Divers were generally satisfied with the service features provided, but features related to the quality and condition of the marine environment were less satisfying.

- divers are not a homogenous group, and the degree of diver satisfaction varied accordingly. Variability was explained in part by the recreation specialization concept. Specialized divers were less satisfied with the Phuket dive experience than were unspecialized divers. Specialized ecotourists were more satisfied than unspecialized ecotourists, a finding that contradicts previous studies that suggest more specialized ecotourists require a higher level of resource quality to be satisfied.

- after completing a dive, divers were less concerned about the negative impacts of diving on the reef, and were also less convinced that diving has positive impacts. Almost 30% of divers surveyed witnessed another diver causing damage to the reef. Divers who personally viewed reef damage were more likely than other divers to express willingness to become involved in marine conservation efforts.

Bennett's (2002) study has added to the recreation literature by enhancing understanding of the features of the marine environment and the recreation experience that are valued by divers. The study has also contributed to our limited understanding of the recreation specialization theory as it is applied to marine-based activities. This type of information is

useful for the application of the LAC and ROS planning frameworks to manage growth of the Phuket dive tourism industry in a manner that protects the values that divers seek. Research results also provide a strong incentive for marine conservation initiatives in Phuket and at dive tourism destinations around the world (Bennett 2002).

Reporting on the research conducted by Bennett (2002), Dearden et al. (2006) linked diver specialization to Duffus & Dearden's (1990) wildlife tourism model.[2] A diver specialization index was designed based on three categories: past diving experience, investment in diving, and centrality to life. ANOVA was used to test for significant differences among high, medium, and low specialization groups regarding motivations for diving, satisfaction with dive trip features, and overall satisfaction. Results of the analysis showed that high specialized divers placed greater importance on the characteristics of the dive itself rather than the trip (e.g., good photo opportunities, the presence of whale-sharks, other sharks and manta rays), while less specialized divers put more emphasis on non-dive characteristics (e.g., good weather, warm water, good underwater visibility, easy dive conditions, good above water scenery, the opportunity to see sea turtles). Satisfaction levels also differed significantly among specialization groups in terms of overall satisfaction with the dive experience, satisfactions compared with motivations, and satisfactions compared with specific trip characteristics. Overall, as specialization increased, satisfaction levels decreased.

The authors suggest that higher dissatisfaction levels with the Phuket dive experience amongst more specialized divers may be symptomatic of the tourism industry's evolution towards maturation and, possibly, decline. As the industry matures, services and facilities are increasingly oriented towards the generalist rather than the specialist market, and ecosystems may become stressed as the number of visitors and facilities to support them increase. Over time, dive specialists may be replaced by generalists, leading to reduced opportunities to sustain a broad-based dive industry that will act as an incentive-driven mechanism for reef conservation.

To meet the needs of both generalists and specialists, the authors emphasized the importance of ensuring that a complete range of opportunity settings for diving was maintained around Phuket. They envisaged a "dive opportunity spectrum" (DOS) to represent three settings (Figure 2.4). Each LAC level represents a different ROS setting. By

[2] Refer to section 2.1.4 for a brief description of Duffus & Dearden's (1990) wildlife tourism model.

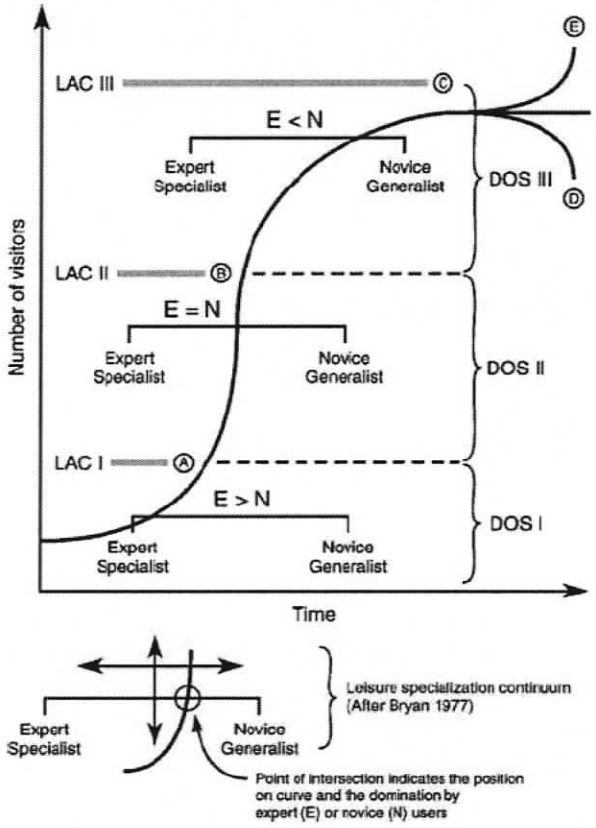
maintaining a diverse range of diving opportunities, several advantages could materialize for the Phuket diving industry, including:

- increased revenues – since specialized divers stay for longer and spend more, the specialized market is a higher yielding market;

- reputation – specialized divers set the reputation and standards for diving. If a destination loses its more specialized markets, its reputation as a dive centre will be jeopardized.

- more attractive reefs - more specialized divers generally have less impact on the environment than novice divers, and so the reefs will be maintained in better condition if the specialist market is maintained.

FIGURE 2.4 Application of Duffus & Dearden's (1990) Wildlife Tourism Model to Divers in Phuket, Thailand (Dearden et al., 2006)



DOS 1 – the industry caters to specialists. Dive sites are zoned to protect the best diving experiences available in the area. They are characterized by the most attractive reefs, the lowest density of divers, and strict management interventions to maintain these conditions.

DOS II – the does not cater to specialists or generalists. Less pristine dive sites are zoned for higher diver densities and less restrictive management.

DOS III – the industry caters to generalists. Dive sites are easily accessed with minimal management intervention. These sites could be used for diver training.

In a study of divers in Sipadan, Malaysia, Musa (2002) identified a diver profile, examined overall diver satisfaction and the determinants of their satisfaction, and ascertained the impact of tourism development on the island. Data were collected using a self-completed questionnaire. Twenty-nine variables relating to SCUBA diving satisfaction were identified, covering a variety of aspects of the dive environment and experience such as natural beauty, activities, services, and facilities. A series of open-ended questions were included to elicit a broader response.

Survey results showed that the majority of respondents were experienced or "hardcore" divers; only 31% were novices. An overwhelming majority of divers (97.8%) rated their experiences overall as 'satisfied' to 'extremely satisfied' (response categories ranged from very good, good, neutral, poor, to very poor). Only 2.2% of divers rated their experience as 'neutral' to 'extremely dissatisfied'. This dissatisfaction was mainly attributed to poor underwater visibility, crowding, and over-development on the island. No significant correlation was found between satisfaction and educational achievement, nationality, number of countries that divers have dived in before, diving certification, or age.

Divers rated most individual satisfaction items positively. Using mean scores as a basis of comparison, the author grouped the attributes into three categories: attributes to be maintained and enhanced, attributes that have room for improvement, and attributes requiring urgent action. Attributes that were considered to be central determinants of diver satisfaction include:

- abundance and variety of marine life,
- general staff and the services of dive masters,
- ease of access, and
- social aspects (good diving buddies, meeting people and making friends with staff or other divers)

Areas identified as requiring some improvement included accommodation, ground transportation, rental equipment, tourist information, and interpretive facilities. One attribute of the dive experience – crowding, was identified as requiring immediate attention. Over 90% of the negative qualitative responses were related crowding and over-development.

The impacts of tourism development as perceived by divers were grouped into two categories: physical impacts and social impacts. Crowding was the most worrying social

impact as perceived by divers. No significant correlation was found between the perception of crowding and either nationality or satisfaction. Noise was considered the second most serious social impact. Underwater visibility was identified as a physical impact of concern to divers. Pollution arising from sewage disposal or the use of fertilizers was identified as a possible cause of poor visibility. Divers also expressed concern about the underwater pollution (e.g., debris such as cans and plastic bags, and traces of oil in the water). Responses to open-ended responses suggest that many divers were also concerned with the physical impact on the land itself, including garbage disposal, noise, and foul odours.

In a study of snorkelers in Koh Chang Marine National Park, Thailand, Roman (2004) conducted coral reef and visitor surveys to inform the development of a multiple-use zoning plan to manage conflict between tourism and conservation. The coral reef survey assessed differences among 14 sites for four criteria - trampling vulnerability, coral life form diversity, coral reef sizes, and suitability for restoring degraded branching *Acropora* spp. corals. The visitor survey was administered to respondents taking part in organized snorkeling tours to assess visitor satisfaction, differences in perceptions between subgroups of people, and LAC for social and biophysical indicators of high-quality snorkeling experiences. The results were analyzed using an importance-performance action grid.

Coral reef survey results revealed differences in coral morphological diversity among reefs at the regional scale, with reefs in the southern region of the park more diverse than reefs in the northern or central regions. Reef sites were grouped according to their vulnerability to trampling by snorkelers, and three main clusters were identified:

- Cluster 1 – deeper reefs
- Cluster 2 – an abundance of vulnerable hard corals (>30% cover), a significant amount of abiotic substrate (>25%), and a significant amount of less vulnerable cover types (>10% types)
- Cluster 3 – high dead coral cover (>50%), relatively low amounts of abiotic substrate (<15%), low amounts of zoanthids and anemones (<5% cover).

Visitor survey results showed that perceptions of coral conditions were strongly influenced by actual field conditions. Snorkelers in the "Central" region were unsatisfied with the corals they encountered (high coral mortality and low coral diversity), while most visitors were highly satisfied with coral conditions in the "Southern" section of the park (low

coral mortality and high coral diversity). Intermediate satisfaction scores were provided for coral conditions in the "Northern" section of the marine park (relatively low coral mortality and intermediate coral diversity). High coral mortality detracted from visitor satisfaction, and low coral mortality enhanced visitor satisfaction. Coral diversity also influenced visitor experiences, with higher diversity resulting in higher satisfaction with the 'variety of coral shapes'.

The three most important biophysical features for visitors were 'clear water', 'fish', and 'coral', although most visitors attached a relatively high degree of importance to the full range of biophysical conditions included in the survey. The majority of respondents were either "somewhat satisfied" or "very satisfied" with the natural conditions encountered. When visitors were segmented into three groups based on level of experience (novice, intermediate, and experienced), results indicated that intermediate/ experienced snorkelers were less satisfied overall than were novice snorkelers, although specialization did not influence levels of satisfaction with the 'number of other people' or 'coral'. Novice snorkelers were more likely than intermediate/experienced snorkelers to recommend snorkeling to other Koh Chang visitors.

When mean importance and satisfaction scores were integrated using Importance-Performance analysis, features related to coral (coral, variety of coral colours, variety of coral shapes) were identified as "major areas of concern". A majority of visitors rated coral, and variety of coral colours as "extremely important", but less than half of the respondents were "very satisfied" with these conditions. Features related to fish (fish, large number of fish, variety of fish types) were identified as "minor areas of concern", and clarity of water was also identified as a "minor area of concern". Natural features considered to have a "low priority" for management attention included 'sandy beaches', 'uninhabited islands', 'rocky coastlines', and 'underwater rock formations'. None of the natural features fell into the "keep up the good work" quadrant.

Snorkelers experienced a number of 'problems' during their trip, including: garbage on the beaches, garbage in the ocean, fishing gear on the seafloor, not enough interpretive information provided, too many other snorkelers, and dead or unhealthy coral. Increased coral mortality caused a significant decrease in visitor satisfaction.

Visitor perceptions of crowding were strongly correlated with the number of other snorkelers. A majority of visitors exposed to 40-65 snorkelers felt crowded, while visitors

exposed to sites containing 1-15 snorkelers or 20-35 snorkelers did not feel crowded at all. Visitors exposed to very high densities of people (>65 snorkelers) felt less crowded than those exposed to 40-65 snorkelers, suggesting that crowded sites were occupied by visitors who tolerated higher densities of users. When visitors were segmented into groups on the basis of country of residence, the analysis showed that foreign visitors were more sensitive to the number of other snorkelers and the number of boats than were Thai visitors. Foreign visitors were less likely to return to Koh Chang for snorkeling, and less likely to recommend snorkeling to other visitors.

Results of the coral reef and visitor survey were used to prescribe marine park zones to different areas of the park based on biodiversity value and vulnerability to snorkeler trampling. For example, tourism zones permitting the highest level of tourism activity were designated at sites with low vulnerability to visitor impacts, while ecotourism zone designations were recommended at more vulnerable sites to meet conservation objectives. Roman's (2004) study is one of the first to systematically integrate ecological and social carrying capacities to manage visitor use. Research of this nature deserves much more attention.

Saltzer (2002) sought to describe and understand the nature of Great Barrier Reef (GBR) tourism to assist in the development of more sustainable tourism, and to determine the relative importance of a number of factors in visitors' satisfaction with their GBR experience. The reef operations surveyed included a variety of sizes and types of boats, and lengths and purposes of the trip. Passengers on reef operations in North and Far North Queensland coastal regions were surveyed on large and small day trip boats, island trips, overnight cruises, diving trips, and bareboat cruises.

Visitors were generally very satisfied with their overall reef experience. Features of the reef experience with the lowest satisfaction ratings were marine life other than fish and coral, and information about the reef. Saltzer (2002) found that the factors that have the greatest impact on reef visitors' overall satisfaction with their reef experiences were:

- the fish, coral, and marine life other than fish and coral;
- the importance of learning about nature, experiencing the beauty of nature, being in a natural place, experiencing an undeveloped environment, and experiencing something new and different; and
- the number of activities undertaken.

Characteristics of the reef trip that were found to be significantly related to overall satisfaction with the reef experience were:

- reef destination,
- activities undertaken, and
- setting characteristics, with lower satisfaction recorded by visitors who felt there were too many/too much or too few of the following features: the number of other people present, the number of other boats, the number of activities available, the number of wildlife encounters, and the amount of information about the reef.

Shafer et al. (1998) examined the range of qualities (or "benefits") that Great Barrier Reef visitors seek, and whether the attainment of these qualities is modified by the natural and social environments experienced on the trips, and by the characteristics of the respondents. The authors collected data from 1,922 day-trip visitors to the GBR using self-administered questionnaires designed to measure different attitudinal, behavioural, and demographic characteristics. Respondents were passengers on one of four tourism operations that visited reef sites. Visitors were asked to rate how much the trip provided them with different benefits as part of their experiences (e.g., exercise, social opportunity, learning opportunity, etc.), and the influence that different physical, biological and social conditions had on their enjoyment of the trip. Demographic information was used to characterize the experience according to different types of visitors.

Survey results revealed 4 main classes of benefits: 1) experiencing nature, 2) relaxing and escaping from normal routines, 3) excitement with family and friends, and 4) being physically active. Experiencing nature generally rated as the most important benefit tied to reef trips, whilst snorkeling interactions and experiencing solitude were moderately important. The most influential items on visitors' enjoyment related to natural features of the environment (aspects of the corals and fishes) and services offered by the staff, respectively. The more neutral, and in some cases negative, influences related to the number of people or human-made structures present at the site and to the physical weather and water conditions. Visitors showed little discrimination among sites with substantially different coral assemblages and settings. The authors concluded that there is a need for a greater understanding by managers of the range of opportunities and experiences that are sought by

visitors so that planning can incorporate measures to both protect and provide for the existing diversity of opportunities.

Shafer & Inglis (2000) used the limits of acceptable change (LAC) framework as a conceptual basis for a study of snorkeling at reef sites in the Great Barrier Reef World Heritage Area (GBRWHA). The purpose of the study was to determine if different settings existed among tourism operators traveling to the reef and, if so, to identify specific conditions relating to those settings. Snorkelers traveling with four commercial tourism operators visiting a total of 8 sites in the GBRWHA completed surveys. Questions were related to the influence of social conditions (other people and infrastructure), biological/physical conditions (fishes, corals, and other fauna as well as weather conditions), and managerial (service) conditions on the trip.

A key finding from this study was the notable differences between large (more people and infrastructure) and small (few people and little on-site infrastructure) operations in the benefits visitors received from traveling to the reef and in their perceptions of a quality experience. Respondents on small, roving operations that visit several sites during a single day-trip scored conditions related to coral and fish more positively than passengers on operations that visited a single destination.

Natural features of reef environments – notably assemblages of corals and fishes, and the role of staff on the vessels had the greatest positive influences on the experiences of visitors across all operators. Weather conditions, items related to people on the trip, and infrastructure on site had a higher potential to negatively influence respondents. Natural conditions were the most important influences on enjoyment of the trip, but visitors showed little discrimination among sites with substantially different coral assemblages and settings.

At least two opportunity settings were identified within the reef trips provided by the four tour operations studied. The settings existed de facto, having emerged as a part of the tourism market. Visitor demographics and past use suggest that different types of people are using these settings. Low-density, minimal infrastructure settings provided by small operators appears to be more desirable for repeat visitors, while vessels traveling to pontoon sites with more infrastructure may be more desirable for first-time visitors.

The authors suggest that since features of the natural environment had the most positive influence on visitors and the influence of other people and infrastructure had the

most negative influence, that these two types of conditions may hold the most promise as LAC indicators of change in day-use coral reef settings.

2.4.3 Summary

A full assessment of the current state of knowledge about tourist and recreational use of coral reef environments would require a more complete review of the recreation research, but nevertheless, this brief review has highlighted some important and interesting information and insights.

- Available information suggests that regardless of the recreation activity, the features most valued by reef visitors relate to the marine environment – the variety and amount of corals and fish, the presence of unpolluted, undamaged sites, etc. Perceived quality of the natural environment has an important influence on visitor satisfaction, as does perceived quality of the reef tour operators (e.g., staff friendliness, information provided, etc.).

- The influence of the number of other users on visitors' enjoyment of the recreation experience is not generalizable across settings and recreation activities. Some reef visitors place a high level of importance on the number of other people, while other reef visitors do not.

- Generally, normative research in coral reef environments has been overlooked. Only one study has used a normative approach to establish standards of quality for the number of other snorkelers and human infrastructure in the water.

- Diving and snorkeling are specialized activities, and more specialized visitors are more sensitive to the quality of the recreation setting. Visitors' level of site and/or activity experience also influences perceptions and awareness of recreation impacts.

- Research into cultural differences in tourism and recreation is much more limited than research on specialization, but available research does suggest some major differences in the way cultural groups perceive use levels.

- With the exception of Bennett's (2002) study, visitors' perceptions of the impacts of human use on coral reef ecosystems has been largely ignored.

- It seems that no research has been conducted on tour operators' perceptions of the quality of the recreation settings and experiences.

This review of applied studies from the recreation literature provides a good foundation for this study, which builds and improves upon previous works by describing and investigating:

- Tour operators' perceptions of the quality of the natural environment and the impacts of human use, and their willingness to support strategies to manage impacts;
- Visitors' environmental awareness and concern, including visitors' knowledge and awareness of high impact behaviours, and visitors' perceptions of the human impacts of use;
- Visitors' perceptions of the social impacts of human use;
- Encounter norms for the number of other snorkelers;
- The physical, natural, managerial, and social settings in Koh Chang, and how visitors evaluate these settings; and
- The influence of specialization and cultural background on visitors' evaluations of the recreation setting and experience.

The results, and their implications for park managers and tour operators, are discussed in Chapters 4, 5, and 6.

CHAPTER 3 Data Collection and Analysis

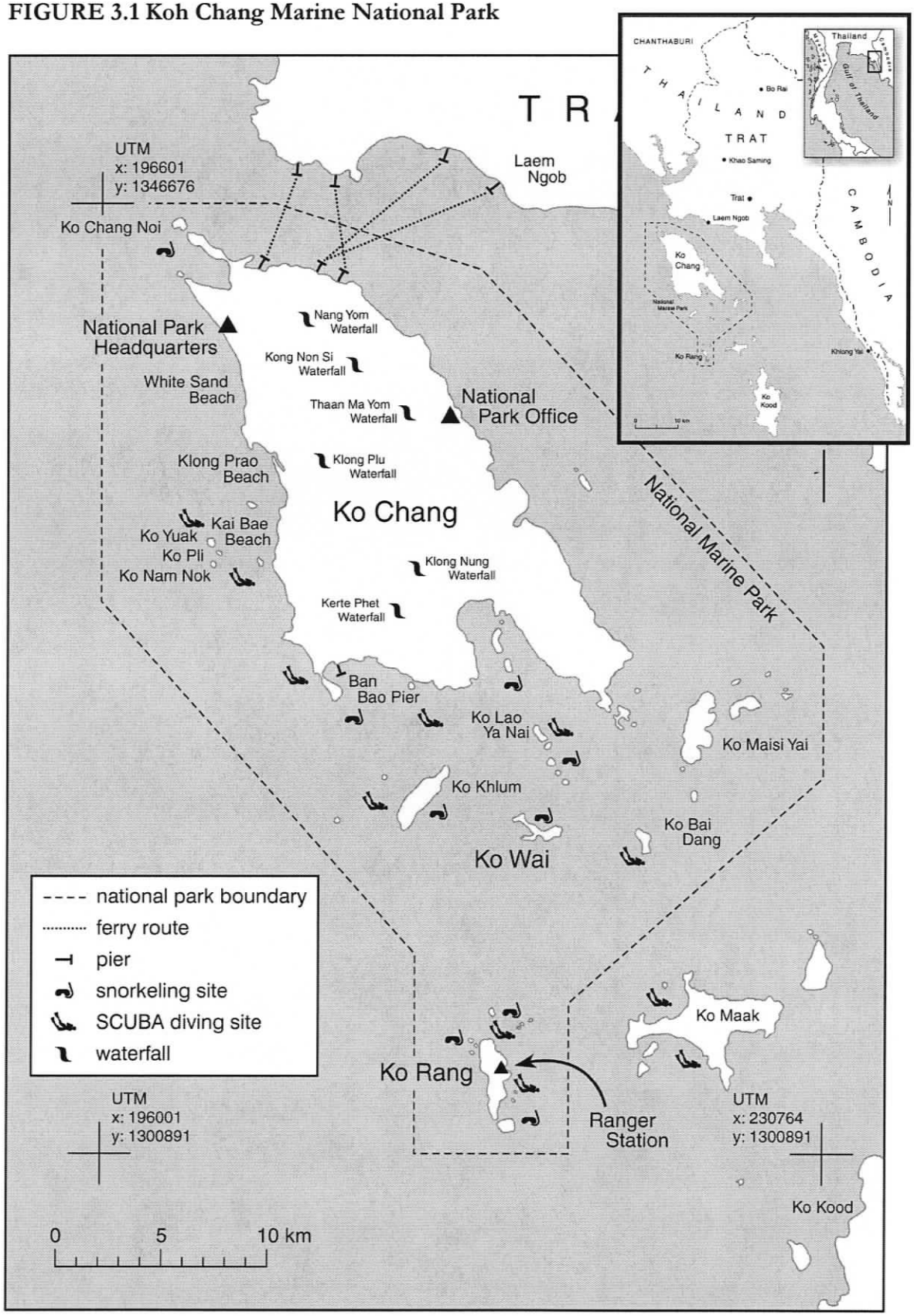
This chapter outlines the study site, survey design, sampling methods, and data collection and analysis techniques used in this study.

3.1 Study Site

The Koh Chang archipelago comprises more than 40 islands scattered off the coast of Trat Province near the Cambodian border (Figure 3.1). The main island, Koh Chang, is the second largest island in Thailand after Phuket, and measures nearly 30 km long and almost 14 km wide. The Marine National Park, gazetted in 1982, covers 650 km^2 of land and sea, including coral reefs that cover an estimated 4.5 km^2 (Arceo & Cheung, 2002). Koh Chang's coral reef communities are rich in marine life with numerous types of hard corals (massive coral, staghorn coral, columna coral), soft corals, sea urchins, giant clams, sea anemone, sea fan, sea star, fish, and green sea turtles. Occasionally, whale sharks are found migrating through the waters around Koh Rang. An estimated 5,000 people reside in the Koh Chang archipelago, and small-scale fisheries remain an important source of market and subsistence income to local residents (Lunn & Dearden, 2006a). Highly sought after species include groupers, shrimp, and crab (Lunn & Dearden, 2006a). Fishers work inside park boundaries, although few operate around reef habitats, and less than 15% participate in the live reef fish industry throughout the year (Lunn & Dearden, 2006b).

Two government agencies located on Koh Chang oversee management of the marine park: the National Park, Wildlife and Plant Conservation Department, and the Sustainable Tourism Development Office. The National Park Office is directly responsible for management of the park's marine resources, including enforcement of park policy and development and execution of research programmes. The Sustainable Tourism Development Office is primarily focused on issues related to terrestrial development, although officials from this department investigate claims of illegal fishing and have a growing interest in the recreational use of the coral reefs. The office is also responsible for coastal development projects, including wastewater discharge, marina development, and pier maintenance and development.

FIGURE 3.1 Koh Chang Marine National Park

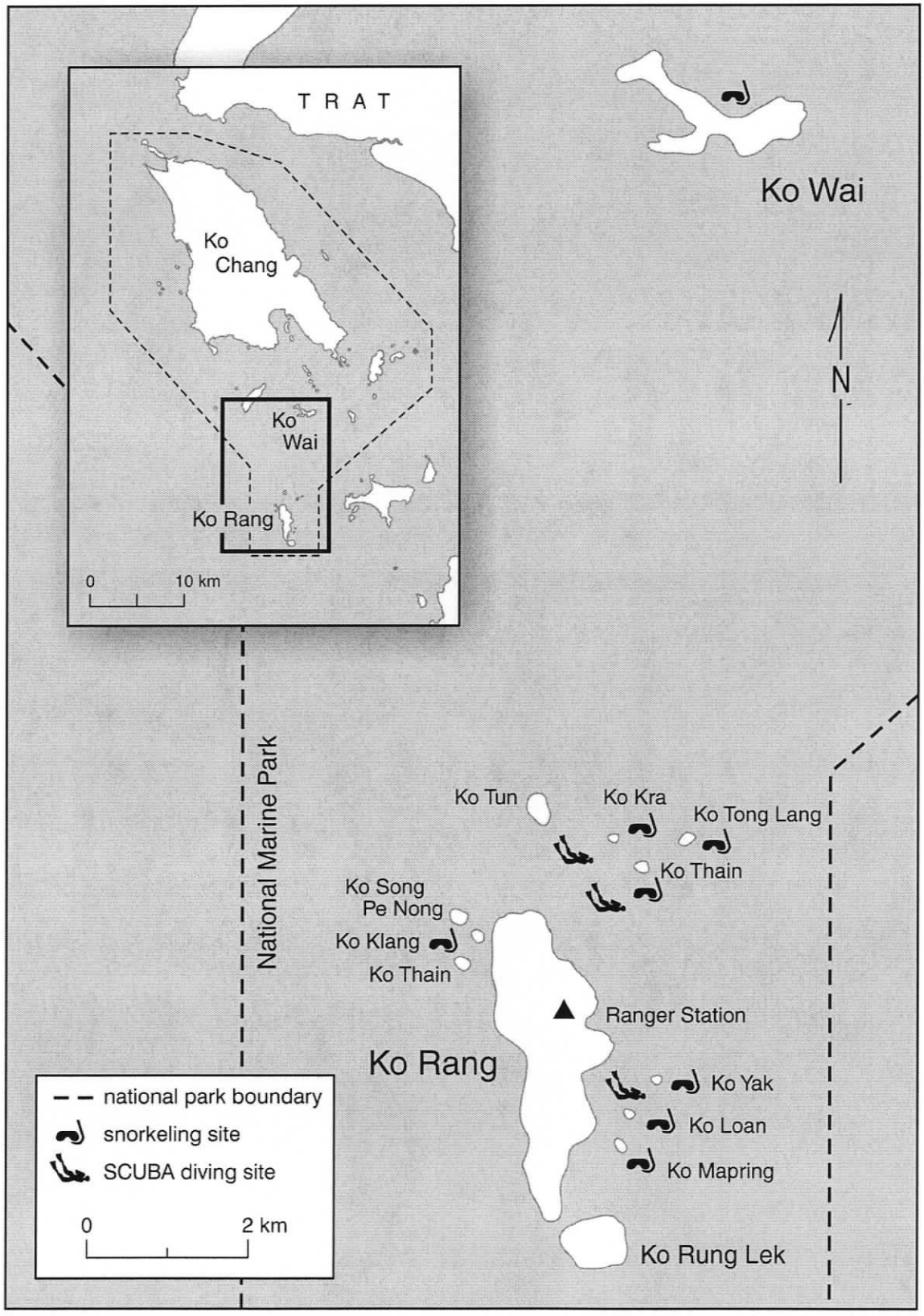


In 2002, an estimated 450,000 tourists visited Koh Chang, up nearly 20 percent over the previous year (TAT, 2002). Official statistics on the number of visitors who participate in coral reef tourism are not available, but Roman (2004) estimated the number of day-trip snorkelers in the marine park at approximately 30,000 per year, and the total number of dives at less than 9,000 per year. Tourism peaks during the dry season, which lasts from October to April.

Snorkeling is the principal maritime activity undertaken in the park's shallow coral reef communities (Figure 3.1). Snorkeling activity is now concentrated in the islands around Koh Rang (Figure 3.2), but snorkeling sites off the northwest side of the main island (Koh Chang Noi, Koh Ma Pring) were once popular (Roman, 2004). Popular snorkeling sites south of Koh Chang include Koh Wai, Koh Tong Lang, Koh Yak Yai, Koh Yak Lek, Koh Ma Pring (SE of Koh Chang), Koh Kra, and Koh Thain (Figure 3.2). Vessel-based and resort-based tourism operations offer snorkeling day trips to these and other islands in the archipelago. There are five high-capacity (50-100 passengers per boat) vessel-based snorkeling companies that offer daily trips, and four low-capacity (<20 passengers per boat) companies that offer day trips upon sufficient demand. The low-capacity snorkeling companies generally cater to private bookings of groups of ten or more. There are also several island-based and mainland resorts within the Marine Park offering snorkeling day trips to guests. These resort-based operations are typically small, use high-speed power boats, and carry between six and 15 passengers. This study focused on high capacity vessel-based tour operators that offered regular, daily trips.

Vessel-based snorkeling tours are sold by representatives at resorts and huts located along the main beaches of Koh Chang (Figure 3.1). With the exception of one snorkeling company that departs offshore from several beaches en route to Koh Rang, all vessel-based snorkeling tours set off from Ban Bao pier on the south-west end of Koh Chang Island. Transportation between visitors' resorts and Ban Bao pier is included in the purchase price, along with food and drinks, and snorkeling equipment (mask, snorkel, life jacket). Trips cost visitors around US$10 for a full day of snorkeling. For an additional fee, tourists can rent fins (100-200 baht or US$2.75-$5.50), and purchase bread (20 baht or US$.55) to feed fish.

FIGURE 3.2 Popular Snorkeling and Diving sites in Koh Chang Marine National Park, Thailand



Trips to reef sites located around Koh Rang take approximately 1½ hours by boat, and operators then provide three to four hours of time on-site before returning. Visitors are taken to three or four different sites determined on a daily basis by company administration. Once at the site, the boat remains tethered to the shore line or a mooring buoy, from which all activities are initiated. All of the sites visited by the operators are fringing reefs with water depths that range from two to 15 m.

3.2 Data Collection

Data were collected between February-April 2005 (dry season) using three primary data collection techniques: 1) participant observation, 2) informal, unstructured interviews, and 3) structured questionnaires. Commonly cited strengths and limitations of these data collection approaches are summarized in Table 3.1. The use of multiple methods, referred to as *triangulation*, is "a concept based on the assumption that any bias inherent in particular data sources, investigator, and method would be neutralized when used in conjunction with other data sources, investigators, and methods" (Creswell, 1994, p.128).

TABLE 3.1 Summary of Strengths and Limitations of Data Collection Techniques Used in This Study (derived from Creswell, 1994; Denzin & Lincoln, 1998; Dillman, 1978)

PARTICIPANT OBSERVATION

Strengths

- the researcher takes on the role of study participants to acquire knowledge and collect rich data
- allows for better access to informants and activities
- enhanced understanding of phenomena investigated
- allows for juxtaposition of what people say they do, and what they are observed to do

Limitations

- observations are susceptible to bias from researcher's subjective interpretations of situations; requires conscious effort at objectivity because method is inherently subjective
- time consuming
- data can be difficult to document; quality of the data relies on the diligence of the researcher

UNSTRUCTURED INTERVIEWS

Strengths

- provide the opportunity for the researcher to probe deeply, to open up new dimensions of a problem, and to secure vivid, accurate, inclusive accounts that are based on personal experience
- control over selection of respondents is high
- high response rates
- flexibility in the types of questions asked (e.g., questions can be complex)

Limitations

- locating respondents can be difficult
- time consuming and expensive
- high refusal rates or resistance
- requires a great deal of skill and experience to conduct a "good" interview
- likelihood of avoiding interviewer bias is low
- quality of the information received is dependent on the cooperation and honesty of the interviewee
- respondents may not wish to share information they view as confidential

TABLE 3.1 *Continued*

STRUCTURED QUESTIONNAIRES

Strengths

- large volumes of data can be collected at a low cost
- low cost allows researchers to base sample size decisions on what is needed to accomplish research objectives
- results are easy to analyze – data can be continuously and directly imported into statistical tools and databases, increasing the speed and accuracy of analysis
- questionnaires are familiar to most people
- reduced bias (uniform question presentation, researcher's own opinions do not influence responses, etc)
- less intrusive
- well-designed studies consistently produce high response rates

Limitations

- well-designed studies require a large time commitment to prepare
- responses cannot be probed, although this can be overcome with extra space for additional comments
- mail-back surveys can take a long to receive

3.2.1 Participant Observation

To gain a better understanding of the visitor experience, the principal investigator accompanied visitors on snorkeling trips. This method allowed for in-field observations of both visitors and tour operators. Tour operators were aware of the researcher's role, but participants were not informed of the researcher's role prior to administration of the survey unless they inquired directly. A majority of observations were made from the boats of three popular, high-capacity tour operators. An observation sheet was used to record information at each snorkeling site, including details about:

- ✓ the weather and snorkeling conditions;
- ✓ the services provided by tour operators (orientation, hospitality, etc);
- ✓ the number of boats at each snorkeling site at three different time intervals (arrival, approx. one-half hour post arrival, approx. one hour post arrival);
- ✓ the number of snorkelers in the water (i.e., use levels) at each snorkeling site at three different time intervals (arrival, approx. one-half hour post arrival, approx. one hour post arrival);
- ✓ the number of tourists on the boat;
- ✓ the number of staff on board the boat;
- ✓ the number of mooring buoys at each snorkeling site;

- ✓ the behaviour of tour operator staff (e.g., touching marine mammals, touching coral, disposing of garbage in the water, fishing at the reef sites, use of mooring buoys, etc.);
- ✓ visitor behaviour (e.g., touching marine mammals, touching coral, disposing of garbage in the water, etc.); and
- ✓ interesting or unusual activity (e.g., illegal activity).

Observations of the behaviour of tour operator staff and visitors were casual in nature, i.e., staff members or visitors were not followed and behavioural observations were not made in a rigorous, systematic fashion. Data obtained through personal observation were analyzed by reviewing and transcribing field notes. On-site observations are summarized in Appendix A.

The collection of this observational data was important because the physical conditions (weather), the services provided, the behaviour of tour operator staff and visitors, and the number of snorkelers, mooring buoys, and boats in the water are all conditions that have an influence upon visitors and their experiences. On-site observations made it possible to assess the relationship between visitors' perceptions of the conditions, with recorded observations of the conditions present.

3.2.2 Unstructured Interviews

To obtain additional information about the marine tourism industry in Koh Chang, non-scheduled, non-structured, non-standardized, informal personal interviews were conducted with government representatives from the National Park Office and the Sustainable Tourism Development Office, as well as members of the local snorkeling and SCUBA diving community, including snorkeling and dive shop owners, managers, and staff. These individuals have witnessed the evolution of the snorkeling and dive industry in Koh Chang, and could attest to the changes and resulting impacts that have occurred over time. Interviewees were selected opportunistically. Nineteen interviews were conducted in total:

- two interviews with representatives from the National Park Office,
- three interviews with members of staff from the Sustainable Tourism Development Office,
- six interviews with snorkeling tour operator owners and staff, and
- eight interviews with dive shop owners and staff.

Interviews were conducted in the presence of a representative from the Sustainable Tourism Development Office, who was well known and respected within the local community. Some of the interviews took place with individuals for whom English was not the first language; in these instances, participants were given an opportunity to provide their comments in writing, which were later translated into English.

3.2.3 Structured Questionnaires

Tour Operator Survey

Survey design

The tour operator questionnaire was prepared following consideration of study objectives, and an assessment of information needs. The booklet-style survey was designed according to the *Dillman Total Design Method*, which has proven to result in improved response rates and response quality (Dillman, 1978). The survey contained three open-ended questions and 17 close-ended questions. The survey included questions designed to measure the size of the operation (capacity, number of staff, revenue), characteristics of product(s) offered (range of activities offered, sites visited, services provided), perceptions of the quality of corals and the variety and abundance of marine life at various snorkeling sites within the park, perceptions of the impact of marine recreation activities on coral reefs in Koh Chang, and support for a range of visitor management strategies.

Sampling

The eight-page, 20 question survey (Appendix B-1) was administered in Thai or English to all owners or managers of vessel-based snorkeling tourism operators located on the main island of Koh Chang between April 17-21, 2005. Data collection was assisted by staff from the Sustainable Tourism Development Office. Surveys were dropped off for completion, and picked up three days later. At the time of research, there were nine vessel-based tour companies offering snorkeling day trips. A 100% sample was attempted; efforts resulted in eight useable questionnaires, or a response rate of 88.8%.

Visitor Survey

Survey design

A self-administered, on-site structured questionnaire was the primary data collection instrument. The questionnaire (Appendix C-1) was prepared following a review of relevant literature (e.g., survey design, marine tourism, outdoor recreation, carrying capacity, crowding, visitor satisfaction, frameworks for managing recreational use of natural spaces, recreation specialization), consideration of study objectives, and an assessment of information needs. The booklet-style survey was designed according to the *Dillman Total Design Method* (Dillman, 1978). A pilot test (n=25) was conducted with visitors snorkeling in the study site to alleviate potential survey administration and design concerns, and as a result, several questions were eliminated or altered to reduce respondent burden.

The questionnaire contained six sections that included a combination of open- and close-ended questions. The first section asked visitors to respond to a series of closed-ended questions regarding their recreation activities and experiences, including past visitation/experience snorkeling in Koh Chang and/or at other reef sites, equipment ownership, and the importance of coral reefs as a tourist attraction. One of the objectives of this study was to examine the influence of reef experience on visitors' evaluations of the snorkeling environment and experience, and these questions support achievement of this objective.

The second section of the questionnaire was designed to provide the data required to meet the third objective of this thesis, which was to identify potential indicators of snorkeling conditions for application of the ROS and LAC concepts. Visitors were asked to use a 5-point Likert scale to indicate the importance of (1= not at all important to 4= extremely important, 5= not sure) and satisfaction with (1=not at all to 5=very satisfied) a range of environmental and managerial/service features. Questions were related to the influence of biological/physical (weather/ snorkeling conditions, fishes, corals), social (other people and infrastructure) and managerial/service (information provided by crew, safety procedures, quality of transportation services, variety, cost) conditions on the trip. Respondents were also asked to rate their overall level of satisfaction with the snorkeling environment and the services offered, and whether or not they would return to Koh Chang for snorkeling, or recommend snorkeling to other tourists. This section also included an

open-ended question that invited respondents to list other environment/setting features that they felt were important to their snorkeling experience in Koh Chang.

Section three focused on visitors' knowledge and the importance of learning. Respondents were presented with a series of 12 quiz items on coral reef ecosystems and asked to indicate if the statement was true, false, of if they didn't know. A 5-point Likert scale was used by the respondents to indicate the importance of (1=not at all important to 4=extremely important, 5=not sure) the opportunity to learn about coral reefs, and to rate the opportunity to learn in Koh Chang MNP (1=very poor to 5=very good). These questions were designed to improve understanding of marine park visitors, and to inform recommendations aimed at improving the visitor experience.

Using a series of closed-ended questions, the fourth section of the questionnaire queried visitors more extensively about their encounter expectations ("How many snorkelers did you expect to see during your snorkeling trip?"), observed use levels ("About how many other snorkelers do you remember seeing on your snorkeling trip?"), perceptions of crowding (Heberlein & Vaske's (1977) 9-point scale), and encounters with the number of other snorkelers, boats, tourists on board the boat, mooring buoys in the water, and staff on board the boat. Variables were developed from a review of relevant literature on outdoor recreation, marine tourism, carrying capacity, crowding, and survey design. This section also used a visual approach to measure crowding norms. Respondents were shown a series of photographs that illustrated increasing levels of use, and were asked to evaluate the acceptability of each photograph using a 5-point Likert scale (1=very unacceptable to 5=very acceptable). Results from this section are used to apply steps one, four, and five of the LAC framework.

Section five of the visitor survey looked at the potential impact of snorkeling on Koh Chang's coral reef ecosystems. Following a review of park regulations and relevant literature on the impacts of tourism and recreation on coral reefs, a list of prohibited (e.g., collecting sea shells, anchoring on the reef) and/or negative (e.g., touching coral, breaking coral, feeding fish) behaviours was compiled (i.e, behaviours that could negatively impact coral reef health). Visitors were asked to select from the list all the behaviours that they observed while snorkeling or traveling to the snorkeling sites. Respondents were also asked to indicate their perceptions of the impact of snorkeling on Koh Chang's reef ecosystems using a 5-point Likert scale (1=very large impact, 4=no impact, 5=not sure), and respondents were also

asked whether or not they would be willing to make an additional monetary contribution towards protection of the marine environment. These questions were designed to improve understanding of the snorkeling industry's negative impacts on coral reefs, and how these impacts might be managed to improve the long-term sustainability of the industry.

The last section of the visitor survey was designed to gather information on visitors' demographic characteristics including gender, country of origin, age, level of education, underwater camera ownership, and SCUBA diving certification. Following this section was an open-ended question that gave visitors a chance to provide additional information about their snorkeling experience at Koh Chang.

Sampling

The 12-page, 38-question survey (Appendix C-1) was administered on trips with a variety of high-capacity vessel-based snorkeling tour operators across different days of the week, for a total of 40 days between February 25 and April 8, 2005. Snorkeling trips were arranged by staff from the Sustainable Tourism Development Office, who explained the objectives and methods of the study. Care was taken to ensure that the full range of opportunities available to snorkelers was represented, however, several factors influenced the companies that were selected for the study, including:

- the Sustainable Tourism Development Office's relationship with the owners of the snorkeling tour companies;
- tour operators' willingness to participate in the study; and
- tour operators' willingness to assist with logistical and feasibility challenges (i.e., transportation between residency and Ban Boa pier, and cost of the snorkeling trip).

Gaining cooperation from the local tour operators was essential for the successful collection of visitor information for this study. Permission to participate in the snorkeling trips and access boat staff and customers was obtained from four of the five high-capacity vessel-based tour companies. One company was later eliminated from the study because the owner was not willing to waive the cost of the snorkeling trip, making it unfeasible to accompany tourists and administer the survey.[1] Among the three remaining tour operators who agreed to participate in the study, every effort was made to evenly rotate snorkeling trips. However,

[1] Snorkeling trips on this boat cost approx. US$21 per trip.

for political reasons, even rotation was not achieved, and consequently, the results may not be representative of the population (Table 3.2).

TABLE 3.2 Number of Trips and Visitor Surveys Completed

Tour Operator	Number of Trips	Number of Surveys Completed
Operator 1	20	318
Operator 2	6	101
Operator 3	13	276
Operator 4*	1	21
Total	**40**	**716**

*Eliminated from further participation in the study.

Survey respondents were passengers on one of the selected tour boats that visited reef sites in the Koh Rang area. Following an explanation of the project and the time commitment required, visitors over the age of 18 were asked (on a voluntary basis) to complete a survey during their return journey from the reefs. The identity of all participants was kept anonymous. The survey instrument was distributed in Thai, English, German, and French to help accommodate the range of international visitors in the sample. Visitors were sampled in a random systematic fashion. Every third visitor was asked to participate in the study; visitors who did not snorkel were excluded from participation. A vast majority of people approached accepted the offer to complete a survey, and sampling efforts resulted in 716 useable questionnaires, with a response rate of over 95% and yielding a margin of error of ±3.7%. Forty trips were taken, but due to inhospitable weather and boating conditions, surveys were distributed on 39 trips. Surveys took approximately 25 minutes to complete, but this was not considered problematic since visitors had little to keep them occupied or distracted on the 1.5 hour journey back to Ban Bao pier. Completed surveys were dated and assigned a chronological number.

3.3 Analysis

Data from the pre-coded surveys were entered for analysis using SPSS/PC + Version 11.0. Data checks were conducted to ensure consistent and accurate data entry. Data from the tour operator survey were analyzed with frequencies and percentages. The sample size for the tour operator survey (n=8) was too small to apply statistical tests (i.e., statistical tests with

small sample sizes would violate many of their assumptions). The visitor survey was analyzed using statistical measures to test associations or differences between variables. Analysis was predominately undertaken using three statistical tests: chi-square, analysis of variance (ANOVA), and independent samples t-test. The chi-squared test was used to compare categorical variables (e.g., "yes/no" response categories) and determine whether significant differences existed between groups. Where interval scales were used for response categories, t-tests were applied to compare the mean scores of two groups, and ANOVA tests were applied to compare the mean scores of three groups. All analysis was conducted with a significance level of p=.05.

Thai, German, and French responses to open-ended and informal interview questions were translated into English by a hired translator. The information derived from the informal interviews and the open-ended questions for both the tour operator and visitor surveys were analysed by grouping common themes together to describe the perceptions and attitudes of survey respondents. Direct quotes that are included to reveal the attitudes and opinions of representatives rely on the accuracy of the translation of survey and interview responses.

3.3.1 Analysis Variables (Visitor Survey)

Independent Variables

The provision of high quality recreation experiences requires that managers consider the variety and type of experiences desired by recreationists. To fully understand and address the needs of recreationists, the heterogeneous mass market may be segmented into relatively homogeneous groups of people with identifiable environmental preferences and recreational participation patterns. For this study, visitors were divided into groups based on 1) the recreation specialization framework, and 2) culture.

Recreation Specialization

Several variables might have been selected to measure respondents' level of recreation specialization, including: number of previous snorkeling trips in Thailand (Q6); number of times respondents snorkeled in the year prior to survey administration (Q8); equipment

ownership (Q10); SCUBA certification (Q38), and self reported level of experience (Q9).[2] However, a single-item measure of specialization - "self reported level of experience" (Q9) - was selected to disaggregate participants into high, medium, and low specialized groups (Table 3.3). Respondents were asked to describe their snorkeling skill level by choosing one of four response categories: "novice", "intermediate", "advanced", or "expert". These four response categories were collapsed into three categories for analysis – "high specialized", "medium specialized", and "low specialized". Respondents who rated their level of experience as "advanced" and "expert" were categorized together into one specialization group, as preliminary analysis showed that the differences between expert and advanced groups were not statistically significant.

"Self reported level of experience" was selected for the specialization analysis for three primary reasons:

1. self reported experience or skill level in an activity is often noted as an important dimension of specialization, and is one of the most frequently used measures of the concept (Needham, 2005),

2. four response categories allow for a greater range of specialization than would be possible using variables that require a yes/no response (e.g., equipment ownership, SCUBA certification), and

3. when preliminary statistical tests were performed to identify which question(s) from the visitor survey might be used to apply the specialization framework, "self reported level of experience" had a powerful influence on the dependent variables, suggesting that this variable was a good 'indicator' of specialization.

[2] Appendix D summarizes results for the independent variables that were not used for the specialization analysis (number of previous snorkeling trips in Thailand, number of times respondents snorkeled in the year prior to survey administration, equipment ownership, SCUBA certification).

TABLE 3.3 Sample Sizes by Segmentation Group

Segmentation variable	Sample size (*n*)	Percentage (%)
Specialization		
Low (Novice)	390	54.9
Medium (Intermediate)	232	32.7
High (Advanced / Expert)	88	12.4
Total	710	100.0
Country of Origin		
Thai	337	48.1
Non-Thai	363	51.9
Total	700	100.0

Culture

Consistent with the study conducted by Vaske et al. (1996), country of origin was used as an indicator of cultural orientation. Visitors were segmented into two groups, "Thai" and "non-Thai" (Table 3.3). Foreign visitors were grouped together into one category ("non-Thai") for two reasons: 1) the sample sizes for each country of origin were too small to derive meaningful analysis (Table 33, Appendix C-2), and 2) this approach has managerial appeal, since it is not practical or feasible for park managers and tour operators to maintain quality experiences for several different cultural groups recreating in a single park.

Dependent Variables

The dependent variables used in the analyses fall into seven categories:

1. importance/ satisfaction,
2. perceptions of crowding,
3. encounter norms,
4. knowledge of coral reef ecosystems,
5. perceptions of environmental impact,
6. observations of tour operator and snorkeler behaviour, and
7. willingness to contribute to marine conservation.

Importance/ Satisfaction

For both importance and satisfaction, respondents were given the same list of attributes covering physical, natural, social, and managerial conditions, and asked to assign a value to each using a 5-point Likert scale. For importance the scale ranged from 1="not at all important", to 4="extremely important", 5= "not sure", but for purposes of analysis, results

were recoded as 1= "not at all important", 3= "not sure", 5= "extremely important". For satisfaction the scale ranged from 1="very unsatisfied", to 5="very satisfied". Questions were related to the influence of biological/physical (weather/snorkeling conditions, fishes, corals), social (other people and infrastructure) and managerial (information provided by crew, safety procedures, quality of transportation services, variety, cost) conditions on the trip. The list of features/attributes was derived, in part, from work by Bennett (2002), Shafer et al. (1998), and Shafer & Inglis (2000), who had previously conducted surveys with day-use visitors in reef environments on trips similar to those studied here. This approach helped ensure that the survey attributes collectively captured the conditions most likely to contribute to a satisfying experience for visitors, as well as being meaningful to tour operators and/or park managers.

The importance-satisfaction analysis was based on Importance-Performance analysis (Martilla & James, 1977), except that satisfaction replaced performance, and the "keep up the good work" and "possible overkill" quadrants were combined and re-labeled "area of satisfaction", after Bennett (2002) and Randall (2003). The I-P grids were created by plotting the mean importance rating of each feature on the vertical axis against the corresponding mean satisfaction rating on the horizontal axis. Mean values were chosen for this study since they were easily derived, a spread in the data was desired, and the majority of researchers who have used I-P analysis have used the mean (e.g., Duke & Persia, 1996; Fletcher, Kaiser, & Groger, 1992; Hammitt et al., 1996; Havitz, Twynam, & DeLorenzo, 1991; Hudson & Shepard, 1998; Mount, 1997; Randall, 2003; Roman, 2004; Tarrant & Smith, 2002; Tonge & Moore, 2006; Wade & Eagles, 2003). A measure of standard deviation (SD) for both the importance and satisfaction values was included to improve the statistical confidence of correctly categorizing an attribute into one of the four I-P quadrants, and to provide additional information for the analysis. A 95% confidence interval was used to set the SD.

Gridlines were placed at values of 3.0 for the importance scale and 4.0 for the satisfaction scale to reflect standards of 'quite important' and 'extremely satisfied'. The importance crosshair was placed at the mean of the scale range to focus on attributes that visitors felt were "quite" or "extremely" important, as it would be a misuse of limited resources to focus management effort on conditions that do not heavily influence visitors' experiences. The performance crosshair was placed at 4.0 to identify features rated below "somewhat" satisfied, and to stress the importance of providing a high standard of quality to

satisfy visitors' expectations. Maintaining high-quality experiences is essential if the snorkeling industry in Koh Chang is to remain competitive with other forms of recreation within, and outside the marine park. High levels of satisfaction with conditions are an essential contributor to positive visitor experiences, an outcome that is central to protected area management.

Perceptions of Crowding

A number of questions were developed to evaluate visitors' perceptions and attitudes towards the social conditions. Visitors' expectations of use levels have been found to influence crowding norms (Ditton et al., 1983; Manning, Valliere, Minteer, Wang, & Jacobi, 2000), and so participants were asked to indicate how many snorkelers they expected to see (compared with how many snorkelers they actually saw). The response categories were: "less than you actually saw", "about as many as you actually saw", "more than you actually saw", and "didn't know what to expect". Since perceived encounters have also been found to influence crowding (Tarrant et al., 1997), visitors were asked to indicate how many other snorkelers they remembered seeing by choosing one of seven response categories that ranged from "0-9 snorkelers" up to "more than 49 snorkelers", and "not sure/can't recall".

Perceptions of crowding were evaluated by asking respondents to report their feelings about the number of other people snorkeling, the number of other tourists on board the boat, and the number of staff on the boat using a 3-point Likert Scale, where 1="too few", 2="too many", and 3="about right". The presence of human-made structures within natural landscapes may influence perceptions of crowding by affecting the perceived naturalness of the setting (Inglis et al., 1999; Manning et al., 1996), and so respondents were also asked to report their feelings about the number of boats and mooring buoys using the same 3-point Likert Scale.

Use level evaluations were also measured using the widely adopted 9-point scale developed by Heberlein & Vaske (1977). The scale ranges from 1= "not at all crowded" to 9= "extremely crowded". Two of the nine scale points label the situation as un-crowded, and the remaining seven points label it as crowded to some degree (slightly crowded, moderately crowded, extremely crowded). Respondents were asked to think about the total number of other snorkelers encountered while snorkeling, and indicate how crowded they felt by circling a number on the scale.

Encounter Norms

Image capture technology (ICT) was used to measure visitors' encounter norms. Visual approaches to normative scenarios have been developed to improve the validity of the results and to reduce respondent burden (Hall & Roggenbuck, 2002; Laven et al., 2005). In this study, photographs of snorkelers were manipulated using image-editing software *Adobe Photoshop Version 5.5*. The "number of snorkelers" indicator was measured with six above-water photographs depicting 0, 7, 15, 23, 33, and 49 snorkelers (Figure 3.3). The number of snorkelers in each photograph was initially modeled after the density of snorkelers depicted in the images used by Inglis et al. (2000); after traveling to the study site, the images were adjusted based on a count taken of snorkelers at Koh Tong Lang, Koh Yak Yai, and Koh Loan during the pilot phase of the study (February 1-4, 2005). The photos were reproduced in black and white, and sized to approximately 2¾" x 1.5". Snorkelers were randomly positioned, but the number of snorkelers in the foreground and background was balanced. The photos were presented in ascending order, with use levels increasing left to right down the page. The order in which photos are presented could potentially bias responses. However, the issue has been explored by Manning et al. (2002) and Needham (2002), and results from both studies suggest that *starting point bias* is not a major concern when measuring recreationists' norms.

Respondents were asked to rate the acceptability of each photograph using a 5-point Likert scale, where 1="very unacceptable" and 5="very acceptable". For purposes of analysis, results were recoded as -2="very unacceptable" to +2=very acceptable. Mean acceptability ratings were used to display the social norms of respondents using Jackson's (1965) original model. The 'number of other snorkelers' indicator is shown on the x-axis with use levels increasing from left to right. The evaluative judgments or acceptability of the use levels is shown on the y-axis, with the most positive response at the top, the most negative response on the bottom, and a neutral category in between. The norm curves are analysed to reveal various structural characteristics including the optimal or preferred condition, the range of tolerable impacts, the minimum acceptable condition, and norm intensity. Crystallization was calculated using standard deviations around mean responses. To incorporate some of Needham's (1999) modifications to the social norm curve model, other measures such as the "lower tolerance respondents" and the "higher tolerance respondents" will be graphically displayed.

FIGURE 3.3 Photographs Depicting "Number of Other Snorkelers" Crowding Indicator Used for Establishing Norms (Q28)

PHOTO A (0 snorkelers)

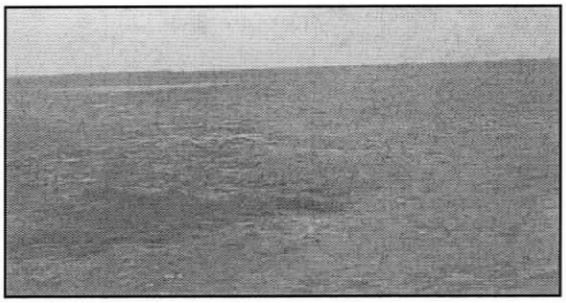


PHOTO B (7 snorkelers)

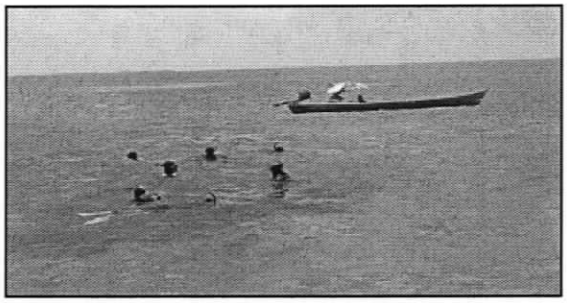


PHOTO C (15 snorkelers)

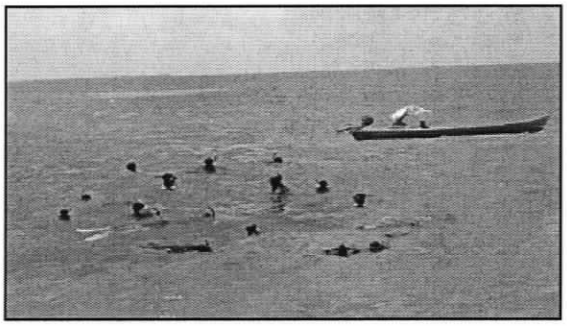


PHOTO D (23 snorkelers)

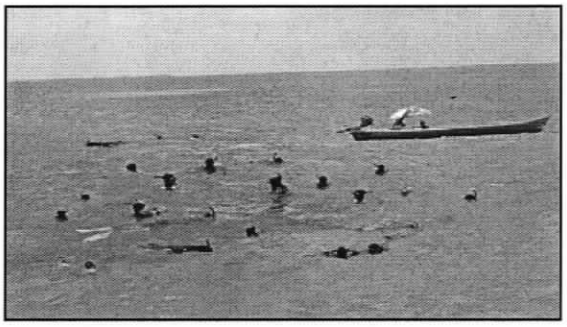


PHOTO E (33 snorkelers)

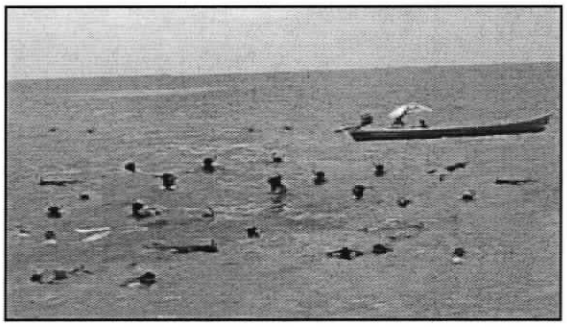
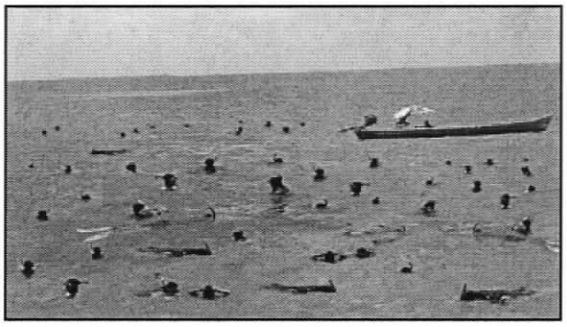


PHOTO F (49 snorkelers)



Knowledge of Coral Reef Ecosystems

To test visitors' knowledge and understanding of coral reef ecosystems and human impacts on the reef environment, visitors were asked read 12 statements and indicate whether they believed each statement to be true or false. Respondents could alternatively select a third response category, "don't know". Six questions sought to provide an indication of visitors' knowledge of reef ecology, and another six sought to assess visitors' grasp of the actual and potential effects of their actions while visiting the reef, as well as the impacts of park and tour operator staff behaviour on coral and other marine animals. The questions were based

on a review of recreation research studies in coral reef settings (e.g., Harriott, 2002; Riegl & Riegl, 1996; Tratalos & Austin, 2001).

Perceptions of Environmental Impact and Observations of Tour Operator and Snorkeler Behaviour

In order to manage the use of coral reefs to ensure environmental conditions that provide enjoyable visitor experiences, it is important to understand the impacts that recreationists perceive their sport to have on the reef environment, and to be aware of the impacts that recreationists actually view during their trips, as these may influence their feelings and enjoyment (Bennett, 2002). Visitors were asked to rate to what degree they believed snorkeling activities impact coral reefs in Koh Chang using a 5-point Likert-scale, where 1= "very large impact", 2= "large impact", 3= "small impact", 4= "no impact", and 5= "not sure". For purposes of analysis, results were re-coded as 4= "very large impact" to 1= "no impact", and 0= "not sure".

To gain a better understanding of the amount of damage to reefs caused by visitors and tour operators in Koh Chang, visitors were provided with a list of 14 behaviours/ situations, and asked to indicate which ones they noticed while snorkeling, or traveling to the snorkeling sites. The list, which was derived from a review of studies of diver and snorkeler damage to reefs, comprised a mix of behaviours that can impact reefs directly in negative ways (e.g., anchoring on the reef, touching or kicking the reef, breaking coral off), or indirectly (e.g., touching/handling marine animals, feeding fish, littering, diving deeper for a closer look, use of hard physical structures such as mooring buoys, sea shell collection).

Willingness to Contribute to Marine Conservation

To assess the snorkeling industry's potential to contribute to reef conservation, visitors were asked whether or not they would be willing to make an additional monetary contribution towards protection and maintenance of the snorkeling environment.

3.4 Limitations of Sampling Methods

This study has a number of sampling limitations, and these should be noted before the research results are discussed. Firstly, data were collected at the end of February through to the beginning of May. The tourist season runs from December to late May, and as a result, representation from snorkelers who visited Koh Chang outside of the data collection period

are excluded from the study. In addition, resort-based, low-capacity tour operators were excluded from the study, and as a consequence, the results may not be representative of the snorkeling population. Furthermore, the visitor survey was administered in English, French, German, and Thai, but respondents who were not proficient in one of these four languages are not represented by this sample. Since sampling methods cannot guarantee with absolute certainty the representativeness of the sample, care should be taken when generalizing the research findings beyond Koh Chang.

CHAPTER 4 Profile of Koh Chang's Snorkeling Industry

One of the objectives of this study was to apply the limits of acceptable change (LAC) and recreation opportunity spectrum (ROS) planning frameworks to guide and inform the process of developing park management interventions that will help deliver satisfactory snorkeling experiences, sustain economic benefits, and maintain the quality of the natural environment. Balanced use of resources for economic, recreational, and ecological values requires an enhanced understanding of the snorkeling industry in Koh Chang, both in terms of the people who visit the park to snorkel, and the tour operators who service them. An enhanced understanding of both the snorkeling environment and the snorkeling experience is also required, since the prevailing physical, natural, managerial, and social conditions influence both the experience of the visitor, and the quality of the natural environment.

To improve understanding of the tourism providers and park visitors, this chapter summarizes descriptive results from tour operator (Part A) and visitor surveys (Part B).[1] For the visitor survey, results are summarized at the aggregate (Part B, Section 4.2), and disaggregate level (Part B, Sections 4.3 and 4.4). Self-reported level of experience was used as an indicator of specialization to categorize visitors into high (n=88), medium (n=232), and low (n=390) specialized snorkelers, and country of origin was used as an indicator of culture to segment the aggregate sample into Thai (n=337), and Non-Thai (n=363) groups.

In Part C of this chapter, data collected from personal, on-site observations of tour operators and visitors are summarized to describe the park's existing opportunity classes. The setting and experience characteristics are also appraised using data collected from non-structured, informal personal interviews with government representatives, and members of the local snorkeling and SCUBA diving community, including snorkeling and dive shop owners, managers, and staff. The data used to define opportunity classes are less than complete (e.g., data on the natural conditions were not collected), but nevertheless, provide an enhanced understanding of the recreation activity and the physical, social, and managerial settings.[2] Knowledge of the range of existing conditions is a critical step to knowing where and what management actions will be needed (Stankey et al., 1985).

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[1] The complete descriptive analysis is included in Appendices B-2 (tour operator survey results) and C-2 (visitor survey results) for reference, including answers to open-ended survey questions.

[2] The complete analysis of personal observations is included as Appendix A.

PART A: TOUR OPERATOR SURVEY

4.1 Tour Operator and Snorkeling Trip Characteristics

4.1.1 Tour Operator Characteristics

Table 4.1 profiles the vessel-based snorkeling tour operations in Koh Chang. A significant portion of the sample is new to the industry with a reported operational history of 1-2 years (25.0%, n=2). Thirty-seven percent (n=3) of the sample has been offering snorkeling tours in Koh Chang for 3-4 years, and 25.0% (n=2) of tour operators have been in the business for more than 10 years. The snorkeling tour operator industry employs, on average, 5.5 full-time employees (FTE); 50.0% (n=4) of the tour operators employ between 1 and 5 FTE, and 50.0% (n=4) employ between 5 and 15 FTE. Seventy-five percent (n=6) of operators do not have any part-time employees (PTE) on staff, while 12.5% (n=1) report 2 PTE, and 12.5% (n=1) report 5 PTE.

TABLE 4.1 Tour Operator Profile

Operator	Years in Business	Staff		Cost of trip (USD)		No. of weeks in operation/ year	Capacity (no. of tourists per boat)	Avg. no. of snorkelers (Daily)
		FTE	PTE	Thai tourist	Foreign tourist			
1	7-10	11.0	0.0	$10.50	$10.50	-	100	41-50
2	3-4	3.0	2.0	$20.25	$20.25	20	56	-
3	3-4	15.0	0.0	$10.50	$10.50	36	225	21-30
4	1-2	2.0	5.0	$11.75	$11.75	16	40	11-20
5	>10	7.0	0.0	$10.50	$10.50	28	20	1-10
6	1-2	1.0	0.0	$7.75	$7.75	14	22	1-10
7	3-4	5.0	0.0	$7.75	$9.15	48	80	11-20
8	>10	6.0	0.0	$20.75	$20.75	30	12	11-20
Mean		6.25	0.87	$12.52	$12.68	36.4	69	14-22
Median	3-4	5.5	0.0	$10.50	$10.50	29.0	48	

On average, snorkeling trips cost Thai tourists 478.3 baht (approx. US$12.50), and foreign tourists 484.6 baht (approx. US$12.68) (Table 4.1). There is a difference in the average price of a snorkeling trip for Thai and foreign tourists because one agent practices differential pricing on the basis of nationality. Operators offer snorkeling tours for a minimum of 14 and maximum of 48 weeks a year; the average is 36.4 weeks in a year. Boat capacity ranges between 12 and 225 tourists; the average capacity is 69 tourists. Thirty-seven

percent of operators (37.5%, n=3) reported taking an average of 11-20 visitors snorkeling on a daily basis, while 12.5% (n=2) reported an average of 41-50 customers daily.

4.1.2 Trip Characteristics

Operators take visitors to a minimum of three islands per snorkeling trip, with 50% of tour operators taking visitors to four islands; 37.5% (n=3) of operators visit three islands, and 12.5% (n=1) of operators visit more than islands islands. The most popular snorkeling sites (sites that at least 50% of the sample reported regular visits to) include Koh Yak Yai, Koh Yak Lek, Koh Tong Lang, Koh Thain, and Koh Wai (refer to Chapter 3, Figure 3.2). Other snorkeling sites visited by tour operators on a regular basis include Koh Kra (37.5%, n=3), Koh Kham (25%, n=2), Koh Yuak (25%, n=2), and Koh Chang Noi, Koh Ma Pring (NW side of Koh Chang), Koh Klum, Koh Ngam, and Koh Rang (12.5%, n=1).

Respondents were asked to indicate whether or not SCUBA diving services were provided on the boat. A majority of respondents did not report offering diving services to visitors, but one tour operator reported taking an average of three to five visitors diving on a daily basis. The same operator reported certifying an average of six visitors on a weekly basis.

Respondents were also asked to indicate the type of information staff are instructed to provide tourists while on a snorkeling trip in Koh Chang. Twelve "types of information" were listed in the questionnaire, and respondents were asked to indicate whether or not the information was provided in Thai and/or English. The results indicate that 100.0% and 62.5% of the sample reported giving staff instructions to provide all of the information types listed in Thai and English, respectively (Table 4.2). Respondents were also given the opportunity to describe other messages communicated to visitors during a snorkeling trip. Comments included:

> "Telling the name of beaches as we pass by."
>
> "Telling the name of mountains and altitude."
>
> "Big boats cannot stop close to the island – anchors are needed. Small boats can stop near the island – they give buoys for stopping."
>
> "Garbage needs to be disposed of properly or taken back to hotels. There are trash cans provided on the boat."
>
> "We will explain everything to the tourists!"

TABLE 4.2 Types of Information Boat Staff Are Instructed to Provide Tourists (Q12, Tour Operator Survey)

	Thai Language		English Language	
Types of information	**(%)**	***(n)***	**(%)**	***(n)***
Safety procedures on board the boat	100.0	(8)	62.5	(5)
The names of the islands tourists will see en route to the snorkeling sites	100.0	(8)	62.5	(5)
The names of the islands tourists will visit	100.0	(8)	62.5	(5)
The length of time the boat will stop at each site	100.0	(8)	62.5	(5)
Safety procedures while snorkeling	100.0	(8)	62.5	(5)
Proper use of snorkeling equipment	100.0	(8)	62.5	(5)
The variety of corals tourists can see while snorkeling	100.0	(8)	62.5	(5)
The variety of fish tourists can see while snorkeling	100.0	(8)	62.5	(5)
The danger of stepping on rocks	100.0	(8)	62.5	(5)
The danger of standing on coral	100.0	(8)	62.5	(5)
The danger of touching/stepping on sea urchins	100.0	(8)	62.5	(5)
Marine Protected Area restrictions (e.g., collection of sea shells)	100.0	(8)	62.5	(5)

4.1.3 Perceptions of the Natural Conditions

Tour operators were asked to rate 1) the quality of the coral and 2) the variety and abundance of marine life for a variety of snorkeling sites in Koh Chang using a 5-point Likert scale, where 1= "very poor", 4= "very good", and 5= "not sure". The snorkeling sites were selected based on personal observations of snorkeling activity and discussions with park staff and tour operators. Figures 4.1 and 4.2 summarize the results. At least 50% of the tour operators rated the coral reefs of Koh Wai, Koh Tong Lang, Koh Kra, Koh Yak Yai, and Koh Yak Lek as "very good" or "good". The same proportion of respondents rated the variety/abundance of marine life as "very good" or "good" for Koh Wai, Ko Thong Lang, Koh Kra, Koh Yak Yai, Koh Yak Lek, Koh Yuak, Koh Lao Ya, and Koh Kham. Less than 30% of the sample rated the coral reefs and abundance/variety of marine life at Koh Man Nok, Koh Chang Noi, Koh Ma Pring (NW of Koh Chang) and Koh Ma Pring (SE of Koh Rang) as "very good" or "good". The abundance/variety of marine life was rated more favourably (i.e., rated as "very good" or "good" by at least 62.5% of tour operators) than the quality of coral for Koh Kham, Koh Lao Ya, and Koh Yuak; the quality of coral at these sites was rated "very good" or "good" by only 28.6% of operators.

FIGURE 4.1 Tour Operators' Perceptions of the Quality of the Coral Reefs (Q14 Tour Operator Survey) (Missing cases excluded; *n*=8)

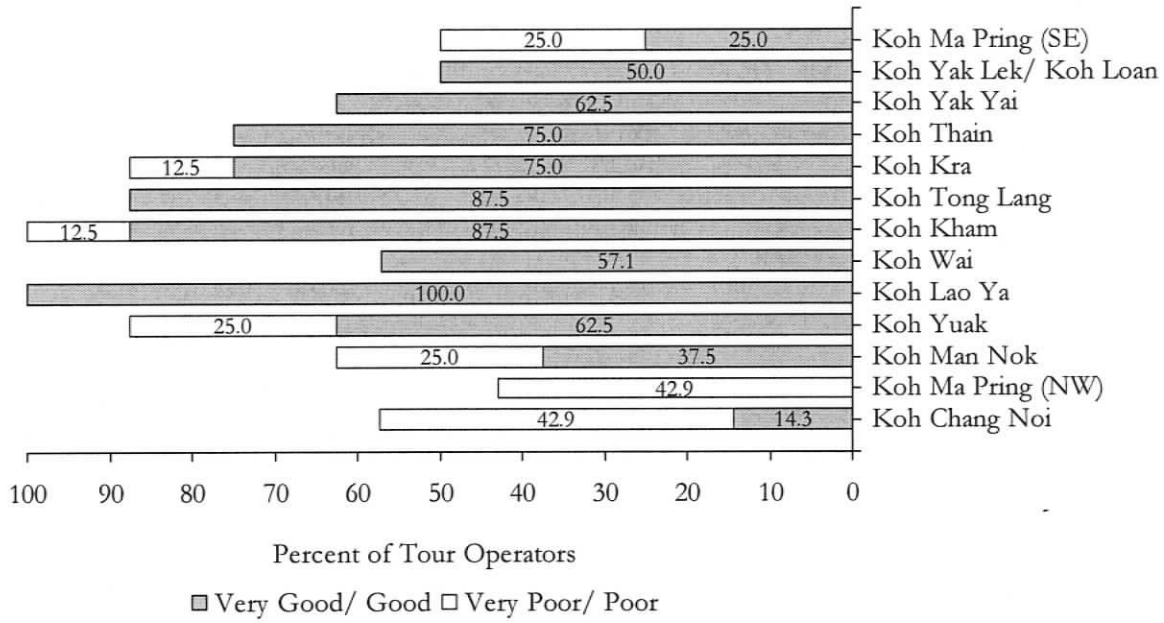
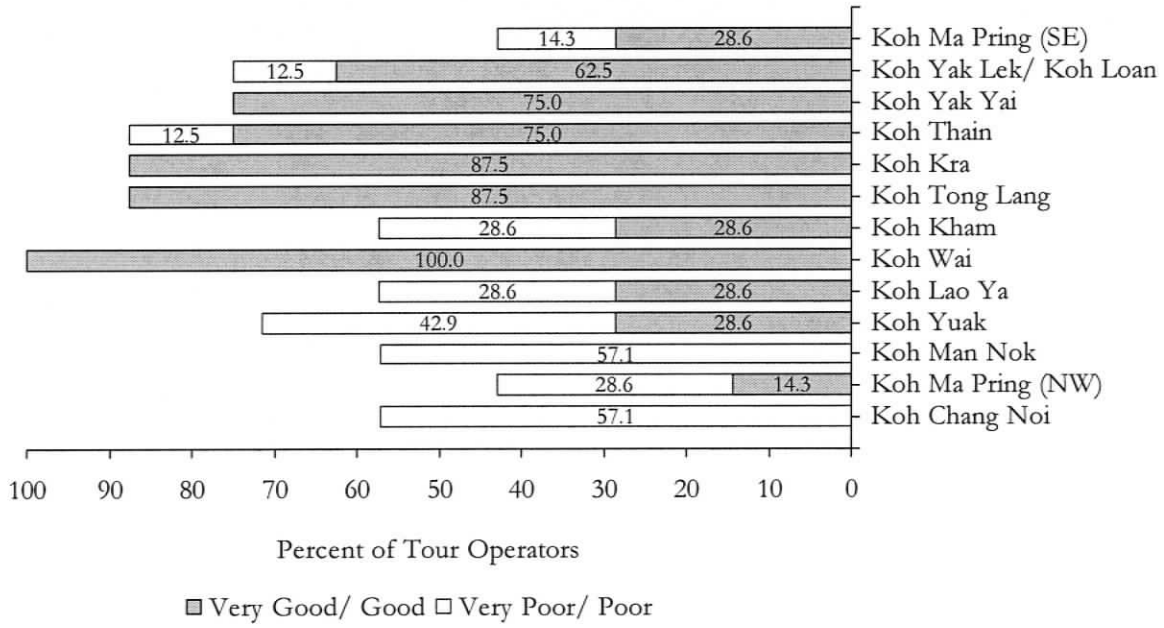


FIGURE 4.2 Tour Operators' Perceptions of the Variety and Abundance of Marine Life (Q15 Tour Operator Survey) (Missing cases excluded; *n*=8)



A significant portion of the sample was unable to rate the quality of the coral and/or the variety and abundance of marine life for the sites listed. For example, 57.1% of the sample was "not sure" about the quality of coral or the variety/abundance of marine life at Koh Ma Pring (NW of Koh Chang), and 42.9% of the sample responded "not sure" when asked to rate the quality of coral at Koh Chang Noi, Koh Man Nok, Koh Lao Ya, and Koh Kham, while 50% of the sample was "not sure" about the variety/abundance of marine life at Koh Yak Lek and Koh Ma Pring (SE of Koh Rang).

PART B: VISITOR SURVEY

4.2 Who Are the Snorkelers?

This section summarizes descriptive results from the first section of the visitor survey (Questions 1-11), as well as the last two sections (Questions 29-38). A selection of visitors' responses to open ended questions is also included.

4.2.1 Demographic Characteristics

The total sample contains a slightly greater proportion of females (n=405, 57.4%) than males (n=300, 42.6%) (Table 4.3). Over forty percent of respondents (n=310, 43.6%) are between the ages of 25 and 35, but a significant portion of visitors (n=220, 31.0%) are between 18 and 25 years of age (Table 4.3). Twenty-five percent (n=334) of the sample is over the age of 36 (Table 4.3). Respondents listed 31 countries of origin (Table 4.3), but most visitors came from three countries: Thailand (n=337, 48.1%), Sweden (n=84, 12.0%), and Germany (n=56, 8.0%).

Visitors to Koh Chang MNP are highly educated individuals, with 72% of respondents holding degree or diploma qualifications: 67.7% (n=499) hold college or university degrees, and 5.7% (n=41) have trade or apprenticeship qualifications. Only 2.4% of respondents did not complete high school (Table 4.3).

TABLE 4.3 Respondents' Gender (Q33), **Age Distribution** (Q35), **Country of Origin** (Q34), **and Level of Education** (Q36)

Response	(%)	(*n*)
Gender (Q33)		
Female	57.4	(405)
Male	42.6	(300)
Total	100.0	(705)
Age distribution (Q35)		
18-25 years	31.0	(220)
25-35 years	43.6	(310)
36-45 years	16.1	(114)
46-55 years	6.5	(46)
56-65 years	2.7	(19)
Over 65 years	0.1	(1)
Total	100.0	(710)
Country of origin (Q34)		
Europe	43.3	(303)
Sweden	12.0	(84)
Germany	8.0	(56)
England	5.0	(35)
France	4.0	(28)
Other	10.3	(72)
Australia / New Zealand	3.0	(21)
Canada	2.0	(14)
United States	2.0	(14)
Other	1.7	(12)
Thailand	48.0	(336)
Total	100.0	(700)
Highest level of education completed (Q36)		
Grade / Primary school	2.3	(16)
High school	20.5	(144)
College / University	67.8	(476)
Trade / Apprenticeship	5.8	(41)
Other (e.g., Masters, PhD)	3.6	(25)
Total	100.0	(702)

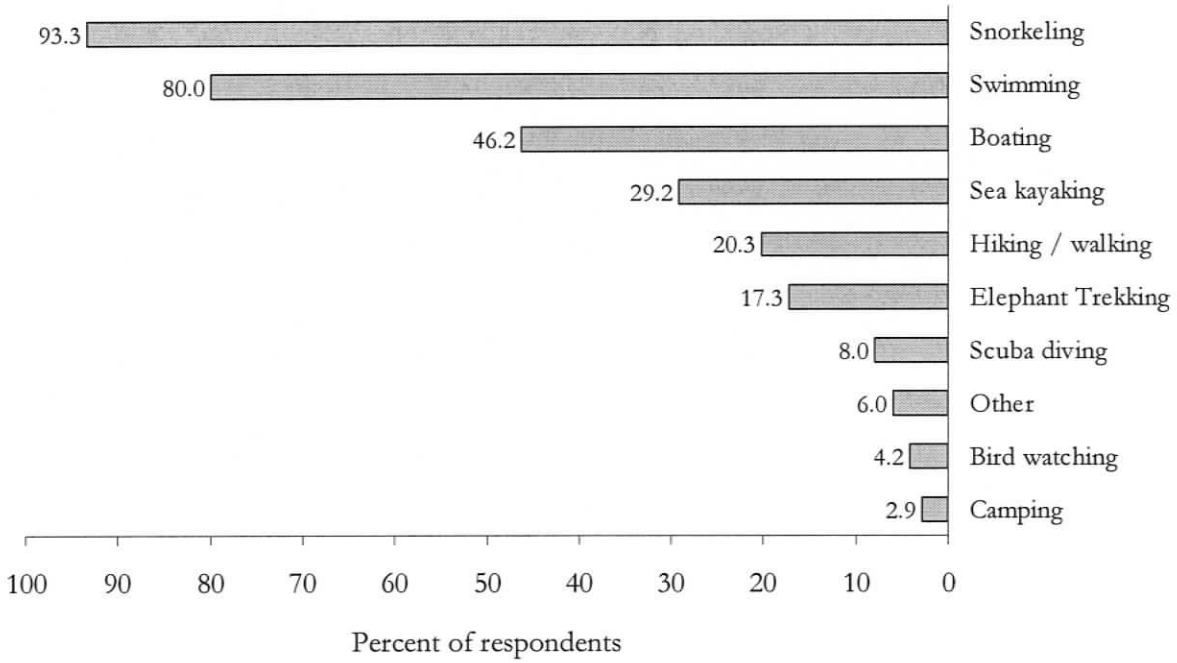
4.2.2 Trip Characteristics

On average, respondents planned to stay 5.8 days (SD 5.14) in Koh Chang; 42.1% of respondents (*n*=301) planned to stay 1-3 days, while 28.0% (*n*=200) planned to stay 4-6 days. While visiting Koh Chang, snorkeling was a planned activity for a majority of the respondents (*n*=436, 60.9%), and for 10.7% of the sample, snorkeling was the

main reason for visiting Koh Chang. Snorkeling was an unplanned activity for 25.7% (n=184) of respondents. While a majority of the sample (n=528, 76.0%) planned to take only one snorkeling trip, 13.2% (n=92) planned to take two trips, and 9.6% (n=67) planned to take three to four snorkeling trips. Most visitors (n=607, 87.9%) planned to spend between US$0-20 to snorkel in Koh Chang, while 7.9% (n=45) and 4.2% (n=29) planned to spend US$21-40 and more than US$40, respectively. On average, respondents planned to spend US$15 to snorkel.

While visiting Koh Chang, visitors participated in a range of terrestrial- and marine-based recreation activities (Figure 4.3). Aside from snorkeling, other popular recreation activities included: swimming (n=573, 80.0%), boating (n=331, 46.2%), sea kayaking (n=209, 29.2%), and hiking/walking (n=145, 20.3%). Less than 10% of the sample (n=57, 8.0%) planned to participate in a SCUBA diving trip.

FIGURE 4.3 Activities Engaged In (Q2) (Missing cases excluded; totals do not equal 100% due to multiple responses)



4.2.3 Respondents' Commitment to the Underwater World

A majority of respondents (n=410, 58.6%) had been snorkeling in Thailand at least once before (Table 4.4). Fifty-three percent (n=366) of the sample had not snorkeled anywhere outside of Thailand. Popular snorkeling destinations for respondents with snorkeling experience outside of Thailand include the Mediterranean, SE Asia, and the Caribbean

TABLE 4.4 Visitors' Snorkeling Experience (Q6, Q7, Q8)

	(%)	(*n*)
Number of trips taken in Thailand (Q6)		
0 trips	41.4	(288)
1-2 trips	36.2	(253)
3-4 trips	10.6	(74)
5-6 trips	4.4	(31)
7-8 trips	1.4	(10)
9-10 trips	3.6	(25)
More than 10	2.4	(17)
Total	100.0	(698)
Previous snorkeling experience (Q7)*		
Have not snorkeled anywhere else	53.4	(366)
Mediterranean	22.3	(160)
Elsewhere in SE Asia	16.4	(112)
Caribbean	14.5	(99)
Australia / New Zealand	13.5	(92)
Indian Ocean	10.0	(69)
Other	18.1	(124)
Red Sea	6.7	(48)
Number of times respondents snorkeled in a coral reef environment in the last year (Q8)		
Zero times	52.4	(371)
1-5 times	39.4	(279)
6-10 times	4.8	(34)
More than 10 times	3.4	(24)
Total	100.0	(708)

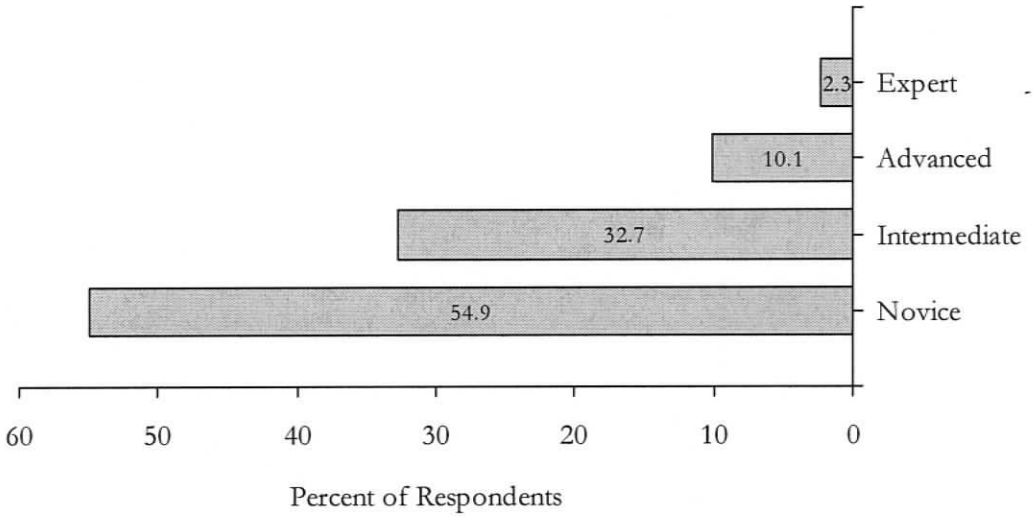
* Totals do not equal 100% due to multiple responses

(Table 4.4). Most respondents (n=371, 52.4%) had not been snorkeling in a coral reef environment recently, although 39.4% (n=279) went snorkeling between one and five times and 8.2% (n=58) went snorkeling more than five times, within a year prior to survey administration (Table 4.4).

Equipment ownership is sometimes used as an indication of commitment to the recreation activity, and so respondents were asked to indicate whether they owned their own snorkeling gear (e.g., mask, snorkel, fins) and underwater camera. Only 31.4% (n=224) of the sample owned their own snorkeling equipment, while 9.9% of the sample (n=70) reported owning an underwater camera. Of those reporting underwater camera ownership, 58.6% (n=41) reported using the camera while snorkeling.

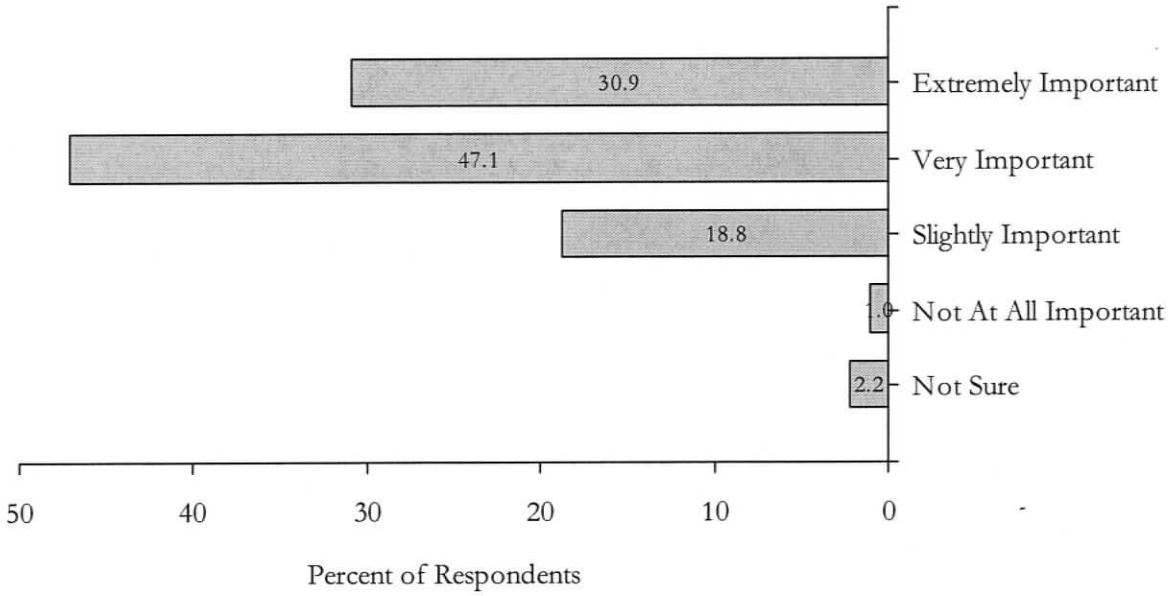
Participants were also asked to describe their level of snorkeling experience. A majority described their level of snorkeling experience as "novice" (n=390, 54.9%) or "intermediate" (n=232, 32.7%), while less than 15% of respondents described their level of snorkeling experience as "advanced" or "expert" (Figure 4.4). When respondents were asked if they were certified SCUBA divers, 11.6% (n=82) of the sample responded "yes". Of those who were certified, 37.7% (n=29) were certified between 2001-2005, and had completed one to two dives (n=17, 32.1%) in the last year.

FIGURE 4.4 Self-Reported Level of Snorkeling Experience (Q9) (Missing cases excluded; n=710)



When visitors were asked to rate the importance of coral reefs as a tourist attraction to them on a scale of 1-5 (where 1= "not at all important", 4= "extremely important", 5= "not sure/undecided"), 78.0% (n=555) of the sample responded "very" or "extremely" important (Figure 4.5).

FIGURE 4.5 The Importance of Coral Reefs as a Tourist Attraction (Q11) (Missing cases excluded; n=712)



4.3 DISAGGREGATE RESULTS – HIGH, MEDIUM, AND LOW SPECIALIZED SNORKELERS

To enhance understanding of the differences among visitors snorkeling in Koh Chang, this section explores the variation in demographic and participation characteristics across three segments of the aggregate sample - high, medium, and low specialized snorkelers.

4.3.1. Demographic Characteristics

Chi-square test results show that a greater percentage of male respondents are categorized as high specialized, while a greater percentage of females are medium, and low specialized snorkelers (Table 4.5). Specialization groups also differ with respect to age distribution – 58.2% and 69.9% of high and medium specialized snorkelers are between the ages of 18 and 35, respectively, while 81.2% of respondents categorized as low specialized snorkelers are between the ages of 18 and 35 (Table 4.5). Chi-square test results also show significant differences between specialization groups and country of origin: 81.7% of foreign visitors are high specialized snorkelers, compared with only 18.3% of Thai visitors (Table 4.5). There are no statistically significant differences between specialization groups and visitors' level of education (Π^2=12.83, df=8, p=.118). In summary, results show that compared with low

specialized snorkelers, a significantly greater percentage of high and medium specialized snorkelers are:

- male,
- over the age of 35, and
- Non-Thai.

TABLE 4.5 Demographic Characteristics of High, Medium, and Low Specialized Groups (Missing cases excluded)

	Response by Specialization (%)					
	HIGH	MEDIUM	LOW	χ^2	*df*	Sig*
Gender						
Female	43.5	54.5	62.3	11.40	2	**.003***
Male	56.5	45.8	37.7			
Age distribution						
18-25 years	24.5	30.2	32.9			
25-35 years	33.7	39.7	48.3	35.04	6	**.000***
36-45 years	18.6	20.1	13.1			
Over 45 years	23.2	10.0	5.7			
Country of origin						
Thailand	18.3	36.0	61.5	70.21	2	**.000***
Other	81.7	64.0	38.5			
Highest level of education completed						
Grade / Primary school	3.5	1.8	2.1			
High school	17.6	21.2	20.5			
College/ University	61.2	68.1	69.6	12.83	8	.118
Trade / Apprenticeship	10.6	7.1	4.2			
Other (e.g., Masters, PhD)	7.1	1.8	3.6			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

4.3.2 Participation Characteristics

Chi-square tests were used to examine differences between high, medium, and low specialized snorkelers' participation characteristics. The results, summarized in Table 4.6, indicate that compared with low specialized snorkelers, a significantly greater percentage of high and medium specialized snorkelers:

- have more prior experience snorkeling in Thailand,
- have more prior experience snorkeling outside of Thailand,
- have snorkeled more times in the year prior to survey administration,
- own their own snorkeling equipment and underwater camera, and
- are certified SCUBA divers.

TABLE 4.6 Participation Characteristics of High, Medium, and Low Specialized Groups (Missing cases excluded)

	Response by Specialization (%)					
	HIGH	MEDIUM	LOW	χ^2	*df*	Sig*
"Snorkeling in Koh Chang..."						
Is the main reason for my visit	10.7	7.0	13.6			
Is a planned activity	67.9	65.9	59.3	8.05	4	.090
Is an unplanned activity	21.4	27.1	27.0			
"How many previous snorkeling trips have you taken in Thailand?"						
Zero	26.2	31.6	50.1			
1-5 trip	14.3	20.2	23.9	51.81	4	**.000***
More than 5 trips	59.5	48.2	26.0			
"Have you snorkeled anywhere outside of Thailand?"						
Yes	85.1	62.9	27.8	128.65	2	**.000***
No	14.9	37.1	72.2			
"How many times have you snorkelled in the last year?"						
Zero	21.8	34.1	69.9			
1-5	47.1	54.3	29.0	160.70	4	**.000***
More than 5	31.0	11.6	1.0			
"Do you own your own snorkeling equipment?"						
Yes	70.5	48.7	12.6	158.39	2	**.000***
No	29.5	51.3	87.4			
"Do you own an underwater camera?"						
Yes	22.1	11.4	6.2	21.14	2	**.000***
No	77.9	88.6	93.8			
"Are you a certified SCUBA diver?"						
Yes	45.3	16.2	1.3	141.16	2	**.000***
No	54.7	83.8	98.7			

*Significant at $p < 0.05$ (2-tailed test)

A one-way ANOVA test was used to examine differences between high, medium, and low specialized snorkelers' mean evaluations of the importance of coral reefs as a tourist attraction. The results, summarized in Table 4.7, show that as specialization increases, the importance of reefs as a tourist attraction increases.

TABLE 4.7 The Importance of Snorkeling as a Tourist Attraction: A Comparison of High, Medium, and Low Specialized Snorkelers (Missing cases excluded)

	HIGH		MEDIUM		LOW				
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**F**	***df***	**Sig***
Importance of reefs as a tourist attraction[a]	4.2	0.75	3.9	1.06	3.8	1.12	8.19	2	**.000***
							Bonferroni comparisons		
							H-M	**M-L**	**L-H**
						p value	.075	.099	**.000***

[a] Recoded response categories ranged from 1= "not at all important", 3= "not sure", 5= "extremely important"
*Significant at $p < 0.05$

4.4 DISAGGREGATE RESULTS – THAI AND NON-THAI VISITORS

This section explores the variation in demographic and participation characteristics across Thai and Non-Thai respondents.

4.4.1 Demographic Characteristics

Differences between Thai and Non-Thai visitors' gender distribution, age distribution, and level of education were examined using Chi-square tests. The results, summarized in Table 4.8 and below, show that there are statistically significant differences between the two groups.

Thai snorkelers:

- a greater percentage of females than males (almost twice as many) participated in the activity,
- 38% of the sample is between the ages of 18 and 25, and 13% of the sample is over the age of 35, and
- at least 78% of respondents have completed college or university.

Non-Thai snorkelers:

- a similar percentage of male and female respondents participated in the activity,
- 24% of the sample is between the ages of 18 and 25, and 36% of the sample is over the age of 35, and
- at least 58% of respondents have graduated from college or university.

TABLE 4.8 Demographic Characteristics of Thai and Non-Thai Visitors (Missing cases excluded)

	RESPONSE (%)				
	THAI	NON-THAI	χ^2	*df*	Sig*
Gender					
Female	64.8	51.4	12.75	1	.000*
Male	35.2	48.6			
Age distribution					
18-25 years	38.3	24.5			
25-35 years	48.7	39.1	69.18	3	.000*
36-45 years	12.2	19.3			
Over 45 years	0.9	17.1			
Highest level of education completed					
Grade / Primary school	1.5	2.8			
High school	16.7	24.0			
College/ University	78.5	58.1	44.64	4	.000*
Trade / Apprenticeship	3.0	18.7			
Other (e.g., Masters, PhD)	0.3	6.4			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

4.4.2 Participation Characteristics

Table 4.9 examines the influence of country of origin on respondents' participation characteristics. Chi-square test results show that compared to Thai visitors, a significantly greater percentage of Non-Thai visitors:

- did not plan to snorkel in Koh Chang, and did not visit Koh Chang specifically to snorkel,
- have more prior experience snorkeling in Thailand,
- have more prior experience snorkeling outside of Thailand,
- have snorkeled more times in the year prior to survey administration,
- rate their level of snorkeling experience as "advanced" or "expert",
- own their own snorkeling equipment,
- are certified SCUBA divers.

There were no statistical differences between Thai and Non-Thai visitors with respect to underwater camera ownership.

TABLE 4.9 Participation Characteristics of Thai and Non-Thai Visitors (Missing cases excluded)

	RESPONSE (%)				
	THAI	NON-THAI	χ^2	*df*	Sig*
"Snorkeling in Koh Chang..."					
Is the main reason for my visit	20.7	2.5			
Is a planned activity	64.7	60.3	83.89	2	**.000***
Is an unplanned activity	14.6	37.2			
"How many previous snorkeling trips have you taken in Thailand?"					
Zero	35.6	47.7			
1-5 trip	23.4	19.2	10.4	2	**.006**
More than 5 trips	41.0	33.1			
"Have you snorkeled anywhere outside of Thailand?"					
Yes	6.4	93.6	364.40	1	**.000***
No	80.1	19.9			
"How many times have you snorkelled in the last year?"					
Zero	57.1	48.7			
1-5	39.0	38.4	21.57	2	**.000***
More than 5	3.3	12.8			
"How would you rate your level of snorkeling experience?"					
Novice	71.3	41.4			
Intermediate	24.3	40.0	72.47	3	**.000***
Advanced	4.5	14.7			
Expert	0.0	3.9			
"Do you own your own snorkeling equipment?"					
Yes	15.2	45.6	74.97	1	**.000***
No	84.8	54.4			
"Do you own an underwater camera?"					
Yes	7.7	11.6	3.00	1	.083
No	92.3	88.4			
"Are you a certified SCUBA diver?"					
Yes	1.8	19.6	56.43	1	**.000***
No	98.2	80.4			

* Significant at $p < 0.05$ (2-tailed test)

A t-test was used to examine differences between Thai and Non-Thai visitors' evaluations of the importance of coral reefs as a tourist attraction, and results show that Thai snorkelers rate the importance of reefs higher than Non-Thais (Table 4.10).

TABLE 4.10 The Importance of Snorkeling as a Tourist Attraction: A Comparison of Thai and Non-Thai Visitors (Missing cases excluded)

	THAI		NON-THAI				
	Mean	**SD**	**Mean**	**SD**	**t**	***df***	**Sig***
Importance of reefs as a tourist attraction[a]	4.1	0.98	3.7	1.13	4.88	691	**.000***

[a] Recoded response categories ranged from 1= "not at all important", 3= "not sure", 5= "extremely important"
*Significant at $p < 0.05$

PART C: Inventory of Existing Opportunity Classes

In this section, an enhanced understanding of the environmental, social, and managerial settings in the snorkeling sites around Koh Rang is developed using data collected from personal, on-site observations of tour operators and visitors. The settings are also appraised using data collected from non-structured, informal personal interviews with government representatives, and members of the local snorkeling and diving community. Results are used to describe elements of:

- the snorkeling environment – weather/sea state, rules and regulations, number/visibility of human influences and structures, impacts of activities on the quality of the natural environment; and
- the snorkeling experience - degree of services and support, social interaction/contact with other visitors.

These characteristics can be used to distinguish between marine opportunity classes that can range from "primitive to modern" (Driver et al. 1987), or "developed to protected" (GBRMPA, 1999).

4.5 Characteristics of the Snorkeling Environment

4.5.1 Physical Conditions

The weather and sea state conditions were highly favourable during data collection (Appendix A). Rainy or overcast conditions were observed only two out of the 40 observation days. On most trips the sea state was 'calm' or 'slight', making the journey comfortable and the snorkeling conditions 'easy. Tour operators took visitors to snorkeling sites regardless of prevailing conditions, although on one occasion operators stopped the tour early because the waves were too high to snorkel and visitors were getting physically ill. Visibility (water clarity) was highly variable over space and time, ranging from 'very poor' to 'fair' to 'very good'.

4.5.2 The Regulatory Environment

Conservation of the park's marine resources is funded primarily by the government, not the users. A small fee (20 baht or ~US$0.55 for Thai visitors, 200 baht or ~US$5.60 for foreign visitors) is collected at the entrance to the National Park's waterfalls located on the main island of Koh Chang (Chapter 3, Figure 3.1), but if tourists elect not to visit these attractions, no park entrance fee is collected. Local businesses, including tour operators, are not required to make a formal, direct financial contribution to marine conservation, and there are no opportunities for tourists to donate money to help conserve natural resources. Indirect financial contributions to conservation initiatives by tourism operators include organized clean-ups of Ban Bao pier, and donation of resources (time, equipment, technical expertise) to install additional mooring buoys and re-introduce giant clams (Tuchai, 2005, pers. comm.).

The regulatory environment with respect to tour operators is relaxed - there are no barriers to market entry imposed by local government, there are no restrictions or regulations on the number of boats, snorkelers or SCUBA divers at reef sites, and there are no regulations on the temporal or spatial recreational use of the marine resources, although the Sustainable Tourism Development Office was considering implementation of a seasonal closure on recreational use of reefs for two months of the year to give reef communities a break (Tuchai, 2005, pers. comm.). Prohibited activities in the marine park include coral and shell collection and commercial and recreational fishing on the reefs (Tuchai, 2005, pers. comm.), but these rules are not actively enforced. Over the observation period, no National

Park staff were observed at the snorkeling sites, despite the close proximity of a ranger station adjacent to popular snorkeling sites (Chapter 3, Figure 3.2). Until the commencement of this research, no representatives from the Sustainable Tourism Development Office had visited the park's coral reefs. Comments made by tour operators support the observation that Koh Chang's regulatory environment is laissez-faire, and park rules are not enforced:

> "Every day I see boats anchor on the reef, snorkelers standing on the reef, boats fishing at snorkel sites, commercial fishing boats, and boats dropping their garbage in the sea. What I never saw is one marine park boat!!!"
>
> "They [park managers] should actually spend some time on the water so that [they] could protect the park!"
>
> "Park staff should take care and control the tour operations by setting-up the rules and regulations for those companies."
>
> "Give us someone to help us protect Koh Chang."
>
> "I have been operating here for four years and I have seen National Park staff only one time".
>
> "The past superintendent was more active – he organized clean-up days and put in mooring buoys."
>
> "The national park doesn't do anything. I offered to help put in mooring buoys but it didn't happen."

Formal regulations to protect coral reefs from over-use and misuse are either absent, or not enforced, but discussions with tour operator staff suggest that the industry has taken informal steps to protect the park's natural resources from overuse. According to one tour operator, 3-4 reefs are seasonally selected for concentrated use to give other reefs a rest, although these unwritten rules are sometimes violated, particularly on holidays and weekends. In addition, SCUBA dive companies and resort-based tour operators generally do not abide by these informal rules.

4.5.3 Human Infrastructure

The only permanent infrastructure at the snorkeling sites is mooring buoys. There are three mooring buoys stationed at Koh Yak Lek, four at Koh Yak Yai, two at Koh Ma Pring, two at Koh Thain, and one at Koh Kra (refer to Chapter 3, Figure 3.2 for a map of the study

area). With the exception of Koh Wai, there are no facilities on land. Accommodation and food services are offered on Koh Wai.

4.5.4 The Natural Environment

Reef surveys of snorkeling sites were not conducted for this study, but an assessment of reef benthos at Koh Tong Lang, Koh Kra, and Koh Thain by Roman (2004) revealed that:

- Koh Tong Lang contains a high proportion of soft coral cover and encrusting coral cover,
- all three sites have high morphological diversity, and
- Koh Kra and Koh Thain are relatively vulnerable to trampling.

Roman's (2004) study sought to identify zones within the park suitable for differing intensities of snorkeling use, and so the parameters studied were limited to coral mortality index, coral morphological diversity, and cover of each life form category. In the absence of more detailed data on general morphology, the percent of live and dead coral, the composition of hard corals, the diversity of marine life, and/ or the amount of visible damage, accurate descriptions of reef environments are impossible to arrive at. However, threats to the quality of the natural environment arising from the behaviour of tourism providers and visitors are easier to identify, and can provide valuable insight into stresses on reef health and aesthetic appeal. Behaviours that were observed regularly that may have negative impacts on the ecological and/or aesthetic values of Koh Chang's reefs include:

- snorkelers (particularly Thais) and boat staff disposing of garbage en route to snorkeling sites and/or at the snorkeling sites (e.g., bottle caps, plastic containers, garbage bags, cigarette butts, etc.);
- snorkelers and boat staff touching coral;
- snorkelers (particularly Thais) and boat staff standing on corals;
- snorkelers kicking corals with their fins;
- snorkelers and boat staff touching and/or handling marine animals (e.g., sea cucumbers, sea urchins, star fish, clams, soft corals, sea anemone);
- boat operators anchoring on top of coral reefs or securing boats to coral boulders with rope;
- snorkelers and boat staff feeding fish bread, rice, seafood, watermelon, banana peels, pineapple;
- tourists collecting dead coral and sea shells from the beach;

- human waste deposited directly over the reefs at snorkeling sites (boats were not equipped with holding tanks and tourists were not instructed to avoid using the washroom facilities when the boat was stopped);
- spear and hook-and-line fishing.

Photographs taken in the field (Figure 4.6, A-D) and comments made by industry representatives and visitors support personal observations of tour operator and visitor behaviour:

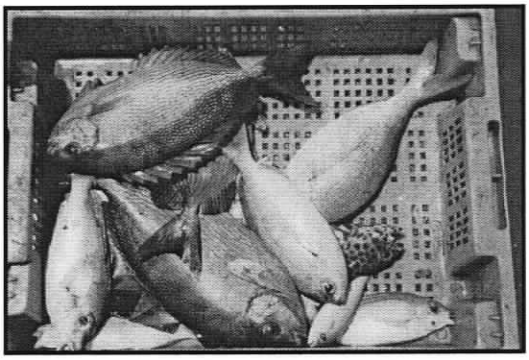
> "Park staff should control the garbage throwing into the sea for each trip. Should be one park staff with the tour to control this with the tourists and enforce the law with all the tour operators who do not follow."
>
> "Do not allow smoking on boats, this should be a smoke-free area because there were foreign tourists smoking and throwing their cigarettes into the sea."
>
> "I think the staff on the boat should educate their passengers better when it comes to conservation of the reefs. Both staff and passengers were standing on the coral and some people were breaking bits off. The boat staff should make it their responsibility that this doesn't happen."
>
> "I saw some people standing on the coral reefs and break it/destroy it. So sad. The boat should also stop far from the snorkeling sites. Some boats also tie the boats to the corals."
>
> "Surprised to see boat crew fishing from back of boat."

Compared with Non-Thais, Thai snorkelers were more frequently observed participating in potentially high-impact behaviours such as standing or sitting on coral boulders, feeding fish, touching and handling coral and other marine animals, and fishing. Recreational fishing on the reefs is illegal, but it was a common activity for staff and tourists on at least two tour boats (Fig 4.6-B). Fish caught on these boats were cooked and served to tourists. Commercial fishing on reefs is also prohibited, but illegal fishing is allegedly a problem (Tuchai, 2005, pers. comm.).

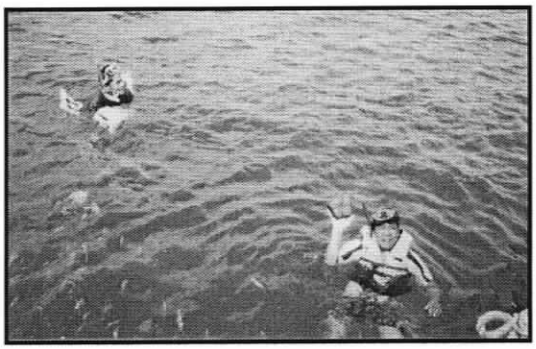
FIGURE 4.6 Photographs of Behaviours Observed in the Field

A. Visitors feeding fish

B. Fish caught at Koh Yak Yai



C. Visitor handling a sea star



D. Boat tethered to coral

4.6 Characteristics of the Snorkeling Experience

4.6.1 Services Offered

Tour operators did not differ significantly with respect to price point, the range of services offered, length of snorkeling trip offered, the size and type of boat, and snorkeling sites visited. Among the three tour operators who agreed to participate in the study through snorkeling trips, a full day of snorkeling cost between 400-450 baht (approx. $US11.25 - $US12.60), including transportation between resorts on Koh Chang Island and Ban Bao pier, equipment rental (snorkel and mask), food, and non-alcoholic beverages. At Ban Bao pier, visitors boarded old fishing boats converted into passenger boats that carried between 75-100 passengers. With few exceptions, all three tour operators consistently visited Koh Tong Lang, Koh Yak Lek, Koh Lon, and Koh Ma Pring (refer to Chapter 3, Figure 3.2). Tour operators occasionally took visitors to Koh Kra and Koh Thain. Tour operators descended on the same site at the same time, regardless of the number of boats/tourists already using the site, and tour operators typically visited the same sites in the same order. Two of the tour companies spent more time at Koh Ma Pring (approx. 1½ hours), where visitors could swim

to nearby Koh Rang Island to relax on a white sand beach, while the other tour company traveled north-northeast to Koh Wai, where visitors snorkeled and relaxed on the beach for approximately 45 minutes.

Eight of the nine tour operations were owned and staffed by Thais. Three tour operators had at least one staff member on board the boat who could speak some English. On these boats, foreign tourists received safety and interpretive messages, including:

- safety procedures on board the boat (e.g., location of life jackets, and identification of lifeguards and first aid kits),
- the names of snorkeling sites and/or names of islands en route to snorkeling sites,
- the length of time the boat will stop at each site,
- safety procedures while snorkeling (e.g., the location of strong currents), and
- the danger of touching/stepping on rocks, corals and sea urchins.

Foreign tourists generally did not receive any instructions on how to use the snorkeling equipment, unless specifically requested. Information on the variety of corals or marine life was generally not provided verbally or in print. One tour company posted a notice of permitted and prohibited activities on the reefs, but the notice was torn, faded, and difficult to read.

Foreign tourists on boats without English-speaking staff on board received very little instruction or interpretive information. Tourists were occasionally told the names of snorkeling sites, the length of time the boat will stop at each site, and to avoid stepping on rocks and sea urchins, but the delivery of this information was inconsistent. Several tourists were injured by stepping on sea urchins and grazing or stepping on coral and sharp rocks.

Thai visitors received more information than foreign visitors, particularly instruction on how to use the snorkeling equipment. Boat staff often accompanied Thais while they snorkeled, and pointed out interesting features of the marine environment. Personal observations about interpretive services provided on the tour boats are supported by comments from visitors:

> "No instructions on the boats, no sign for tourists indicating which animals are dangerous or what we shouldn't do to avoid harming the marine life."

> "It would have been good to know whereabouts we were actually snorkeling. Maybe a map could be provided with the islands contained within the National park and the

sites we go to. Tourists were constantly standing on coral - they should be informed of the dangers of this."

"Boat crew should provide more information about the coral and what to do and what not to do. Make it an educational trip as well."

"The tour operators should give information to tourists who have never been to Koh Chang, such as how to protect themselves from dangerous animals (sea urchins). Tourists should be advised about what tools they can use to protect themselves...wearing shoes that can save them from sharp stones. Tourists should be advised on how to use masks."

"There should be a presentation during the trip...where we are going, history of the islands, species of coral/fish, some dos and don'ts during snorkeling."

"More information on history and instructions on snorkeling techniques so the tourists will not do anything that will harm the ecosystem and environment. More information on safety and fist aid techniques if any emergency should occur on the boat."

"Teaching the Thai tourists before they come to the island, from my experience seeing the Thai people destroy their own nature is very sad. Its our own country but we have foreigners complain and protect the environment instead. All boats should provide instruction in both Thai and English."

"Obviously I thought it was fantastic, and for all my snorkeling experience I am aware of the need for preservation, but what about the locals? As our boat operator did not speak English, I was unaware of any guidance given, if at all, to help preserve and protect this beautiful environment!"

"Officers take care of only some groups of people. It's better to think that everyone has knowledge equal to zero. The boat staff should explain the dos and don'ts that tourists should know."

4.6.2 Use Levels and Social Interactions

Snorkeling experiences are also influenced by the social setting, which is defined by the amount, type, and location of visitor use, as well as the behaviour of visitors and tour operators.

Use levels

The minimum and maximum number of snorkelers and boats recorded over the observation period is illustrated in Figures 4.7 and 4.8. Observations of the number of snorkelers and boats were taken at each site visited on a snorkeling trip; the numbers reported here represent the lowest and highest numbers of snorkelers and boats observed for the day. Use levels (i.e., number of boats, number of snorkelers in the water) varied widely over space and time (Figure 4.9, A-C). The mean observed number of snorkelers ranged from a low of 17 to a high of 90, while the mean observed number of boats ranged from two to seven. Visitors' evaluations of use levels are examined in detail in Chapter 6.

FIGURE 4.7 Minimum and Maximum Number of Snorkelers Counted Over 39-Day Observation Period

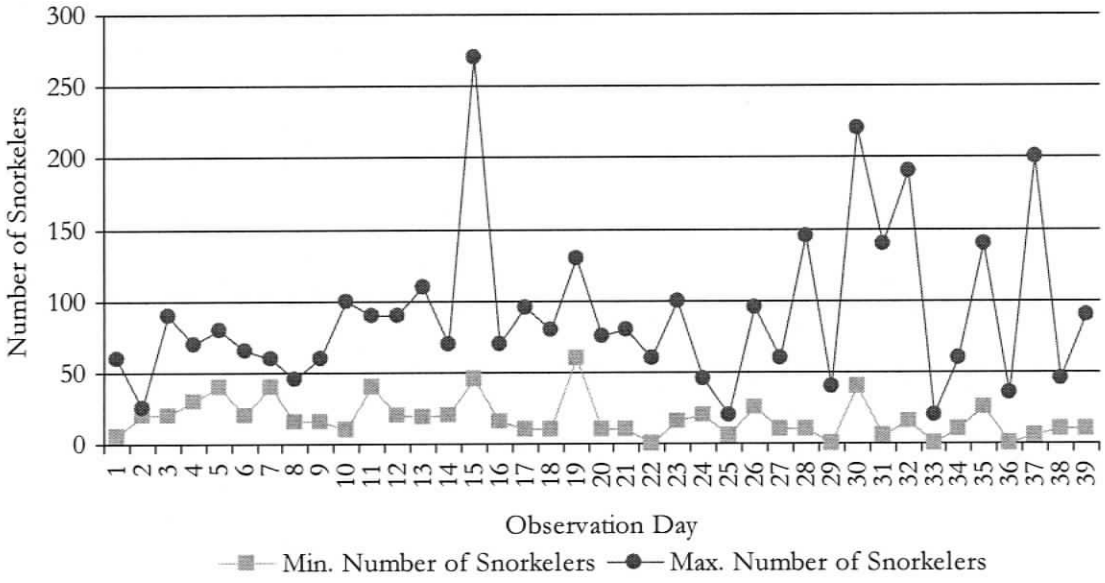


FIGURE 4.8 Minimum and Maximum Number of Boats Counted Over 39-Day Observation Period

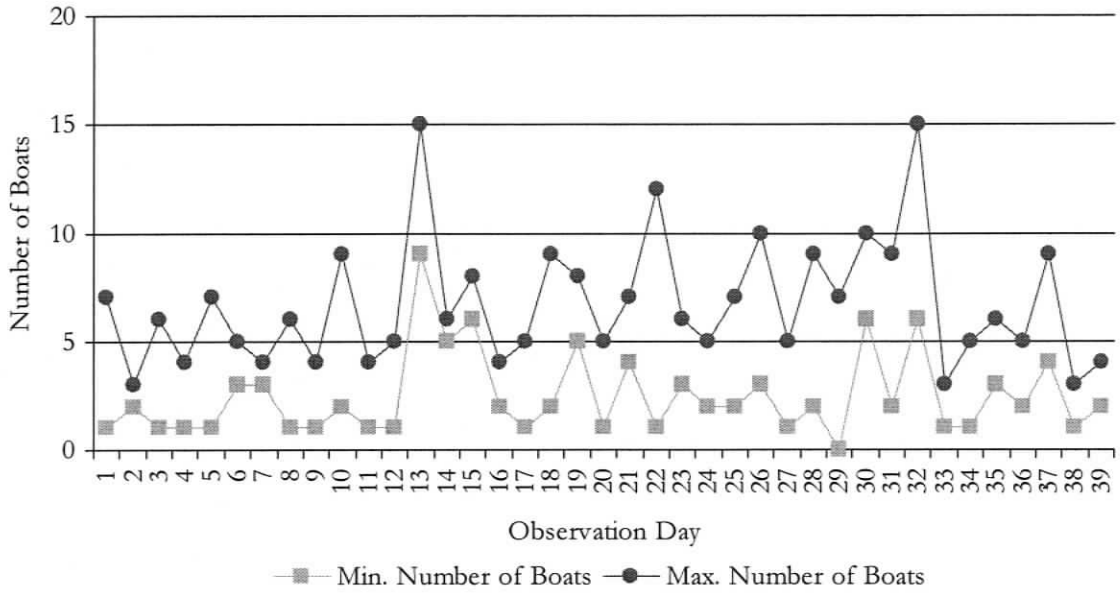
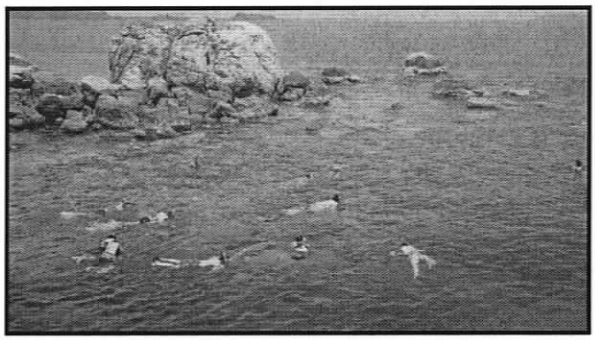
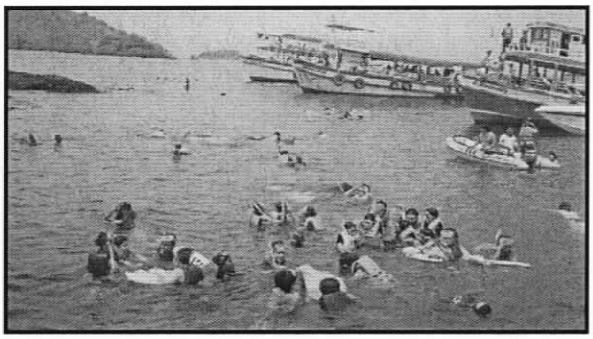


FIGURE 4.9 Photographs of Actual Use Levels Observed in the Field

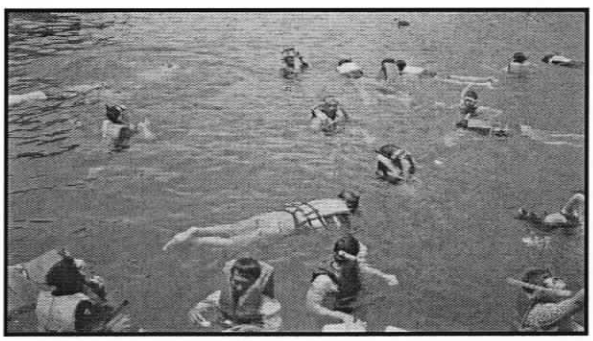
A. A quiet day at Koh Yak Lek



B. A busy day at Koh Yak Yai



C. High density of Thai snorkelers



D. High density of tourists on board

The estimated number of visitors snorkeling at reef sites visited by tour operators who participated in the study is summarized in Table 4.11. These numbers should be interpreted with caution, as the averages may be over-inflated for some sites due to peak periods of visitation. The total number of visitors snorkeling in Koh Chang on an annual basis can not be accurately calculated by adding up the estimated number of annual visits per site; since tour operators typically visit three sites in the Koh Rang area in one day, some visitors would be triple counted. The total estimated number of snorkelers (90,013) could be divided by three to account for the fact that tourists typically snorkel at three of the six sites in the Koh Rang area per visit. This would place the estimated number of snorkelers visiting Koh Rang on an annual basis at 30,004.

TABLE 4.11 Estimates of the Total Number of Visitors Snorkeling in Koh Rang

	Average Max. Number of Snorkelers Observed				
Coral Reef Site	**Weekday**	**Weekend**	**Estimated Avg. No. of Snorkelers / Week**	**Estimated Number of Visits / Year[a]**	**Reef Area[d] (ha)**
Koh Tong Lang	72	100	558	20,323	2.6[e]
Koh Lon/ Yak Yai	34	28	228	8,281	n/a
Koh Yak Lek	54	82	432	15,740	n/a
Koh Ma Pring	26	20	172	6,266	n/a
Koh Thain	78	45	478	17,381[b]	1.6
Koh Kra	45	190	605	22,022[b]	5.1
TOTAL				**90,013[c]**	

[a] Calculation is based on a season that runs for 36.4 weeks, the mean number of weeks vessel-based tourism operators reported being in operation (refer to Table 4.1)

[b] These numbers are grossly inflated. Koh Thain and Koh Kra were unofficially "closed" to snorkelers, and tour operators visited these sites only when Koh Tong Lang, Koh Lon/Yak Yai, or Koh Yak Lek were considered "too busy" by the boat captain. Koh Kra, for example, was visited only once on the weekend over the observation period, and so the figure used to estimate the average number of snorkelers on a weekly basis is atypically high. Similarly, Koh Thain was only visited 7 out of the 39 observation days, and use levels were unusually high (ranging from 20-220), over-inflating the annual estimate of visitors.

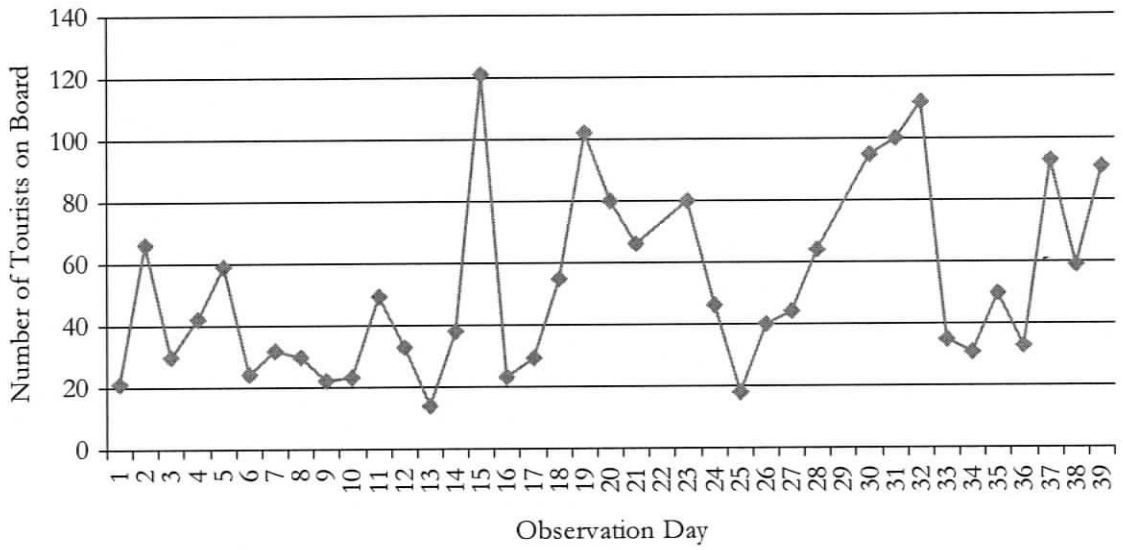
[c] This estimate is inflated. Tour operators generally visit three sites in one day; by adding up the total for each site, some visitors are triple counted.

[d] Source: Roman, 2004

[e] Snorkeling activity is concentrated on the north side of the reef. Boats and snorkelers do not utilize the south side due to strong currents that run between Koh Tong Lang and Koh Kra.

Figure 4.10 illustrates the number of tourists on board the boat from which field observations were taken. The number of tourists observed on board ranged from 14 to 121, with a mean of 53. On at least four occasions, the number of tourists on board exceeded the number of seats available, raising concerns about visitor safety.

FIGURE 4.10 Number of Tourists Observed On Board the Boat



Type of Visitor Use and Behaviour

The snorkeling experience is also influenced by the type of visitor use, as well as noise and gregarious behaviour. Coral reefs in the study area are used for a range of different recreation activities, including snorkeling, diving, kayaking, boating, and fishing. Snorkeling, diving, and fishing activities were concentrated directly on the reefs, and since these activities were not partitioned in the available space, overlap and conflict was not uncommon. Snorkelers only occasionally competed with kayakers for space, but often competed with other snorkelers, particularly at Koh Tong Lang where movement was restricted to the north side of the reef. On busy days, encounters with Thai snorkelers - who characteristically swam in human chains of 5-10 and spent a considerable amount of time in a vertical position floating and socializing - were particularly difficult to avoid.

Noise and gregarious behaviour were not unusual. Boat staff were often observed speeding around snorkelers in a dingy outfitted with a motor, while shouting at visitors and

staff through a loud speaker. In addition, boat staff consistently played music over loud speakers, and boat motors were left running. The sound of music and motors could be heard while underwater.

4.7 Summary and Discussion of Major Findings

This chapter sought to improve understanding of the tourism providers, the visitors, and the characteristics of the snorkeling setting and experience (i.e., the physical, natural, managerial, and social conditions). Key research findings are summarized and discussed below.

Snorkeling activity is concentrated in the Koh Rang area. Only one operator still offers snorkeling tours at reefs located on the western side of Koh Chang island.

Roman (2004) conducted research in Koh Chang Marine National Park in 2002, and reported that Koh Yuak, in the central area of the park (Chapter 3, Figure 3.1), was the most popular snorkeling site, receiving in excess of 170 visitors on weekends. Koh Chang Noi and Koh Ma Pring (NW of Koh Chang) were also identified as popular snorkeling sites, receiving up to 90 visitors on a busy day (Roman, 2004). Results from this study suggest that snorkeling activity around sites located adjacent to Koh Chang island has declined since 2002, while activity in the Koh Rang area has intensified. Tour operator survey results indicate that over 50% of operators regularly visit Koh Yak Yai, Koh Yak Lek, Koh Tong Lang, Koh Thain, and Koh Wai, while only 25% visit Koh Yuak, and only 12.5% visit Koh Chang Noi and Koh Ma Pring (NW side of Koh Chang). More research is needed to determine why a shift in the concentration of snorkeling activity has occurred, but one possible explanation is the poor quality of the reefs that surround Koh Chang island:

- 25% of tour operators rated the quality of the coral at Koh Yuak as "very poor", and 43% rated the variety and abundance of marine life as "very poor",
- 43% of tour operators rated the quality of coral at Koh Ma Pring (NW of Koh Chang island) as "very poor", and 29% rated the variety and abundance of marine life as "very poor",
- 43% of tour operators rated the quality of coral at Koh Chang Noi as "very poor", and 57% rated the variety and abundance of marine life as "very poor".

According to Thailand's Department of Fisheries (1999), the reefs that surround the main island of Koh Chang are generally in poor condition due to natural conditions of high freshwater runoff, as well as pollution, bleaching, fishing, and tourism. However, these reefs

are easily accessed from popular beaches on the main island, which may explain why tour operators took visitors snorkeling to these sites despite their poor quality. Reefs in the Koh Rang area are in better condition (Department of Fisheries, 1999), but since tour operators are required to invest significantly more time and money to access these reefs, tours to these sites may have taken longer to get established. For example, ground transportation must be arranged to shuttle customers between resorts on the main island and Ban Bao pier, and the costs of providing this service are likely significant (e.g., acquisition and maintenance/repair of vehicles, insurance, gas, additional staff, etc.). Results from this study suggest that as the snorkeling industry matures, access to remote reefs improves. In addition, there may be some evidence of "recreational succession" (Orams, 1999), where tour operators that have seen environmental deterioration have moved into new, unexploited areas.

There is excess capacity in the industry.

Data from the tour operator survey reveal that there is excess capacity in the industry. Boats can accommodate an average of 69 tourists, while the average number of visitors on board per day ranges between 14 and 22. Clearly, there are enough snorkel tour operators running day trips to reefs in the Koh Rang area to meet demand. Park managers might want to consider regulating the start up of new companies to discourage the exploitation of new reef sites, to prevent growth in the number of boats traveling to reef sites, and/or to protect the interests of established tourism providers.

Snorkeling is an important marine tourism activity in the park.

The natural marine resources of the park are evidently an important source of employment and income for many Thais who live on the main island. Tour operators running high-capacity tour vessels employ at least 50 people on a full-time basis, and seven on a part-time basis. All of the vessels are owned and operated by Thais, and with the exception of one dive instructor, all full-time and part-time staff are Thais.

Data from the tour operator survey indicate that between 28,500 and 44,850 visitors snorkel in the Koh Rang area on an annual basis. The total number of snorkelers visiting the marine park's coral reefs may be significantly higher, since resort-based tour operators did not participate in the study. Roman (2004) estimated the annual number of snorkeling trips in Koh Chang at 30,000, based on data collected in 2002. If the estimate of the number of

snorkelers is closer to 44,850 annually, the industry has grown by almost 50% in only three years.

The total annual direct value of snorkeling to the local economy is estimated at US$357,300 – US$561,500. This estimate is *very* conservative, as it does not take into consideration direct revenues earned from resort-based tourism operators and equipment rental or purchase, and indirect revenues associated with snorkeling such as accommodation, food and beverage, transportation, entertainment and souvenirs, and other goods and services. Spin-off effects are likely considerable. For example, Bennett (2002) estimated that divers in Phuket directly contributed US$52,789,727 to Thailand's economy, and an additional US$101,568,106 in spin-off effects.

Coral reefs are also important to tourists. Seventy-one percent of snorkelers surveyed stated that snorkeling was a planned activity on their trip or their main reason for traveling to Koh Chang, and 78% of respondents rated the importance of coral reefs as a tourist attraction as "very" or "extremely" important.

The characteristics of snorkelers in Koh Chang are similar to those of reef visitors in other parts of the world.

Survey respondents came from 31 countries on four continents, indicating that Koh Chang has the capacity to attract visitors from around the world. The sample was almost evenly split between international (52%) and domestic (48%) tourists; international visitors were mainly from European destinations. Similar results were reported by Roman (2004) - respondents came from 24 countries, and 49.5% of visitors were Thai. Other reef sites around the world also attract a significant number of international visitors (e.g., see Bennett, 2002; Moscardo, 1996; Ormsby & Shafer, 2000; Saltzer, 2002; Shafer et al. 1998; Tratalos & Austin, 2001).

A slightly higher percentage of females (57%) than males (43%) went snorkeling. Inglis et al. (1999) also reported slightly higher percentages of female snorkelers than males across recreation sub-groups (locals, tourists, novices). In Roman's (2004) and Shafer et al.'s (1998) studies of snorkelers, males and females were evenly represented (49% and 51%, respectively). This is in contrast to data published on SCUBA divers, where males typically dominate the sport (Professional Association of Dive Instructors, PADI, 2000). For

example, males represented 81% of divers surveyed in the Medes Islands in Spain (Mundet & Ribera, 2001), and 64% of divers surveyed in Phuket, Thailand (Bennett, 2002).

Previous research studies found that while individuals of all age groups snorkeled, individuals between 18 and 35 years of age were more likely than others to participate in the activity (Roman, 2004; Saltzer, 2002; Shafer et al., 1998). The age distribution of snorkelers reported here is consistent with findings from previous studies – 75% of respondents are between the ages of 18 and 35.

Results show that snorkelers in Koh Chang are highly educated individuals, as 65% hold a college or university degree. This statistic is higher than that which was reported by Shafer et al. (1998), where half of the sample held a university or technical degree.

Overall, comparison of data collected in this study with information available on the characteristics of snorkelers surveyed in Koh Chang (Roman, 2004) and the Great Barrier Reef (Inglis et al., 1999; Saltzer, 2002; Shafer et al., 1998) suggest that visitors surveyed for this study are typical snorkelers. However, this study also highlighted significant differences between sub-groups of visitors within the sample. Post hoc test results revealed that high and medium specialized snorkelers were more likely than low specialized snorkelers to be male, over the age of 35, and from a country other than Thailand. Test results also revealed that compared with Non-Thai snorkelers, a greater percentage of Thai snorkelers were female, under the age of 35, and college or university graduates.

A majority of visitors have some prior reef experience.

Survey results indicate that:

- 59% of visitors have been snorkeling in Thailand at least once before,
- 47% have snorkeled in other destinations throughout the world,
- 47% went snorkeling at least once before in the year prior to survey administration, and
- 12% were certified SCUBA divers.

These findings suggest that many visitors to Koh Chang have knowledge of how to use snorkeling equipment, and have had some exposure to coral reef environments. These statistics are similar to those reported by Roman (2004), where 73% of respondents snorkeled at a coral reef before, 50% had been snorkeling at least once in the year prior to survey administration, 33% had taken a snorkeling trip in Koh Chang at least once before,

and 20% had been SCUBA diving. Prior experience can influence visitor expectations, a topic that is explored in greater detail in Chapter 6.

There are significant differences among high, medium, and low specialized visitors' participation characteristics.

Results indicate that high, medium, and low specialized snorkelers demonstrate significant differences in terms of behaviour (e.g., prior experience and familiarity), and attitudes and values towards the importance of coral reefs as a tourist attraction. Compared with low specialized snorkelers, high and medium specialized snorkelers are more experienced, participate in the activity more frequently, demonstrate a greater financial commitment to the activity (e.g., equipment ownership and SCUBA certification), and place a higher value on coral reefs as a tourist attraction.

These findings support the recreation specialization framework. Bryan (1977) hypothesized that groups of visitors are arranged along a continuum of commitment or intensity of involvement in the sport. In this study, when visitors are categorized into high, medium, and low specialized groups on the basis of self-reported skill level, this hypothesis is upheld – high specialized snorkelers have more past experience (e.g., number of previous trips), and are more committed to the sport (e.g., equipment ownership, recent experience, SCUBA certification), suggesting that self-reported skill level may be a good indicator of specialization. In the next 2 chapters, recreation specialization will be used to examine variation in visitors' satisfaction with setting attributes, knowledge and awareness, perceptions of impact, and willingness to pay.

There are significant differences between Thai and Non-Thai visitors' participation characteristics.

Visitors with different cultural backgrounds have significantly different participation characteristics. Compared with Non-Thai visitors, Thai visitors are less familiar with snorkeling, marine environments, and coral reefs, and they invest less money in the activity and the setting.

For a significantly greater percentage of Thai visitors, snorkeling was the main reason for visiting Koh Chang, suggesting that for some Thais, the opportunity to snorkel has an influence on destination choice. However, on average, Thai visitors rate the importance of coral reefs as a tourist attraction lower than Non-Thai visitors, possibly indicating that Thai

visitors are more interested in the activity rather than the setting. The influence of culture on visitors' satisfaction with the snorkeling environment and experience, knowledge and awareness, perceptions of impact, and willingness to pay are explored in greater detail in chapters 6 and 7.

The activities and behaviours of reef users may be damaging the reef. Reefs are used for multiple, and conflicting purposes.

Regularly observed behaviours that may have negative impacts on the quality of the natural environment include anchoring on top of reefs, littering, touching/kicking corals, handling marine life, and fish feeding. High levels of damaged coral may be unavoidable if use levels are heavy and concentrated (Barker & Roberts, 2004), and so park managers should seek to either limit the types or amount of use, and/or the behaviour of visitors to ensure that the tourism industry operates in an ecologically sustainable manner. Comments made by dive and snorkel tour operator staff suggest that negative impacts on the quality of the natural environment are already evident, and some individuals are exasperated by the government's apparent lack of interest in protecting the reefs from misuse and over-use.

Prohibited activities such as recreational and commercial fishing regularly occur at the same sites where visitors are snorkeling and diving. Snorkelers and divers are seeking an abundance of fish, which anglers are seeking to remove. The two activities are clearly at cross purposes, and management action to minimise conflict and protect reef resources is urgently needed.

Vessel-based tour operators provide a single, uniform type of snorkeling experience that can be characterized as natural or undeveloped with low levels of regimentation and moderate to high levels of use.

With the exception of the presence of mooring buoys for resource protection at a few of the snorkeling sites, islands in the Koh Rang area are essentially unmodified. Land-based facilities for the comfort or convenience of boat-based tourists are not provided, and residential and/or commercial use of the islands is very limited. The snorkeling sites are easily accessed by boat, although travel time (approximately 1½ hours from the mainland to the first snorkeling site) is considerable. Although the area is unmodified, noise (e.g., loud music and the sound of boat motors could be heard underwater) and evidence of other users

(e.g., litter, broken/damaged coral) was prominent and may detract from the "natural" feel of the snorkeling experience.

The nature, extent, and level of control over recreational use is also an important factor characterizing different recreation opportunities. In general, a continuum of controls can be described, ranging from subtle techniques such as site design and providing visitors with information, to fairly heavy-handed measures that are authoritarian and perhaps accompanied by legal sanctions (Clark & Stankey, 1979). Specific techniques for regimenting recreationists' activities include regulations, rules, site design, and laws. In Koh Chang Marine National Park, the level of regimentation and on-site management is low. All coral reef sites in the area are easily, and frequently accessed by fishers, divers, and/or snorkelers. There are very few rules in place to manage tour operators or visitors, and existing rules and regulations are rarely enforced. The type of activity, the number of users or group sizes, and vessel lengths, for example, are not controlled, and as a result, impacts of use on biological and social values are not managed. Use of some reef sites (e.g., Koh Kra, Koh Thain) by snorkeling companies may be restricted on a seasonal basis, but there is no permanent protection afforded to any of the reef sites.

The services provided also influence the snorkeling experience. On-site observations of tour operator staff indicate that visitors receive very little instructive or interpretive information, particularly foreigners. These observations do not support results reported by tour operators (Table 4.2), a majority of whom state that they provide safety and interpretive information to tourists in both English and Thai. However, few boats have English-speaking staff on board, and interpretive materials (brochures, posters, maps, etc.) are generally unavailable. Environmental education does not appear to be a priority for tour managers or park personnel in Koh Chang, but environmental interpretation is a common component of nature-based tourism (Orams, 1995), and can be an effective visitor management strategy that helps to encourage visitors to adopt more appropriate behaviour in order to sustain tourist use of natural resources (Kuo, 2002). In addition, research has shown that tourists *want* to be educated. For example, in a study of divers in Phuket, Thailand, the provision of diver education received the highest level of endorsement as a positive impact of diving (Bennett, 2002; Dearden et al. 2007). Similarly, a survey of tourists participating in swim-with-dolphin tours in New Zealand clearly indicated that visitors would like to receive more

information, particularly about the wider marine environment (Luck, 2003). The provision of interpretive information is revisited in the next two chapters.

The appropriate amount of social interaction is an important characteristic of different recreational opportunities. In more "primitive" settings, low levels of interaction are appropriate and expected, while in more "modern" settings, interaction can rise to very high levels. Both natural variations (e.g., reef depth, coral morphology, oceanic currents) or management actions (e.g., ease of access, timing of access) can greatly influence the actual level of contact among people. The number of people in an area, how they are distributed in space and time, and the probability of interaction between parties are important elements in determining the appropriate social carrying capacities at different points along the opportunity spectrum (Clark & Stankey, 1979). In Koh Chang, the number of users varied considerably over space and time, with peak periods of activity generally observed on weekends and holidays. The number of snorkelers observed at Koh Tong Lang and Koh Yak Lek was typically moderate-to-high, while the number of snorkelers observed at Koh Yak Yai, Koh Ma Pring, Koh Tang, and Koh Kra was typically low, with infrequent spikes in visitation. Physical characteristics of the snorkeling sites served to concentrate use in small areas, particularly at Koh Tong Lang and Koh Yak Lek where movement was restricted by reef depth and strong ocean currents. Visitor characteristics also served to concentrate use in patches, as Thai visitors prefer to snorkel in tight groups. Opportunities to experience isolation were uncertain and unpredictable; visitors might experience solitude or privacy by chance, not choice. The impact of the social conditions on visitors' snorkeling experiences is explored in greater detail in Chapter 6.

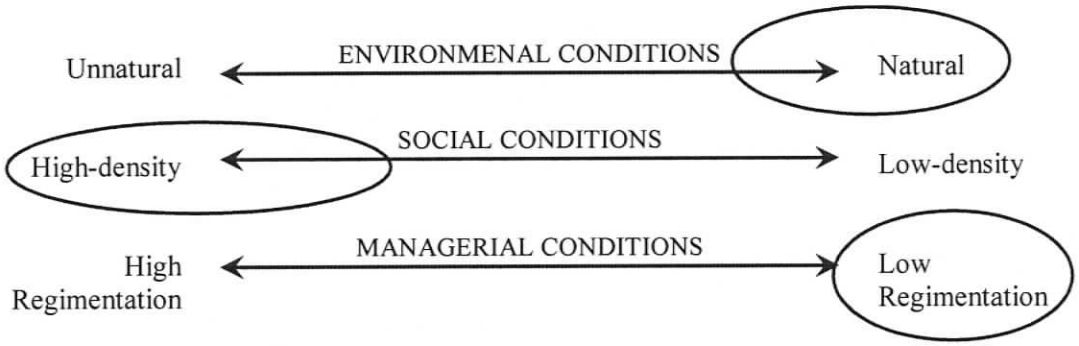
While more data are required to fully inventory the recreation settings, these findings provide a preliminary indication of the opportunity classes in Koh Chang Marine National Park. Personal observations of setting conditions suggest that there is little variation between snorkeling sites with respect to access, on-site management, social interaction, and degree of regimentation. The setting conditions described for Koh Chang are *analogous* to the "rustic or roaded natural" opportunity class described by Driver et al. (1987) for terrestrial settings, or "semi-modern" as described by Clark & Stankey (1979):

- reefs are easy to access (no physical exertion is required), but a return trip requires approximately three hours of travel time;

- the reefs are predominantly natural with moderate evidences of sights and sounds of humans, although the sounds (music, motor boats, etc.) do not harmonize with the natural environment;
- changes to the natural environment are not very apparent, with the exception of Koh Wai, where hospitality services are provided;
- comforts and conveniences are provided on board the boat. Equipment is provided, as are washroom facilities, food and drinks, and comfortable chairs;
- use oscillates between low, moderate, and high, but inter-party contacts are frequent and often unavoidable, and opportunities to experience solitude are scarce; and
- environmental impacts are becoming prevalent. The potential for coral damage is high given the frequency of high-impact behaviours and moderate to high levels of use.

The other four recreation opportunity classes described by Driver et al. (1987) (primitive, semi-primitive/non-motorized, semi-primitive/motorized, concentrated/rural, and modern/urban) are not particularly well represented in Koh Chang (refer to Chapter 2, Table 2.1 for a description of each class). In general, vessel-based tour operators provide a single, uniform type of snorkeling experience that can be characterized as natural/ undeveloped with low levels of regimentation and moderate to high levels of use (Figure 4.4).

FIGURE 4.11 Characterization of the Opportunity Classes in Koh Chang



Since participants in the same activity typically demonstrate significant differences in their preferences for a protected area's physical, natural, social, and managerial conditions (Clark & Stankey, 1979; Manning, 1986), providing a single, uniform type of snorkeling opportunity may leave many snorkelers, quite possibly even the majority, less than fully satisfied. Visitors' satisfaction with elements of the snorkeling experience is explored in greater detail in the next chapter.

CHAPTER 5 Visitors' Evaluations of the Snorkeling Environment and Experience

To make decisions about how to manage recreational use to enhance visitor satisfaction, it is important to understand the elements of the recreation experience that visitors value, and how visitors perceive the quality of the elements. Visitor experiences are determined by the condition of the natural, social, managerial, and physical components of the resource (Manning, 1985). The natural conditions include the corals, fish and other marine life; the numbers and types of people, boats, or infrastructure one travels with and/or encounters comprise elements of the social condition (Shafer et al., 1998). The restrictions or liberties permitted by park managers and/or operator staff represent conditions of on-site management, while physical conditions of the setting include weather and water conditions (Shafer et al., 1998).

One of the objectives of this thesis was to determine the conditions present during the snorkeling experience that were most influential on visitors' experiences and thus useful in the selection of indicators in a LAC process. This chapter seeks to:

1. develop an understanding of the elements of the snorkeling experience that contribute to visitor satisfaction by first measuring the relative importance of the various physical, natural, managerial, and social conditions, and then measuring satisfaction with actual conditions experienced;

2. identify diversity in the range of recreational opportunities that visitors seek by segmenting the sample into smaller, more homogenous sub-groups; and

3. identify indicators of setting conditions that require attention from park managers and tour operators using Importance-Performance (I-P) Analysis (Martilla & James, 1977).

Results are summarized at the aggregate (Part A Section 5.1) and disaggregate level (Part A Sections 5.2 and 5.3). For the disaggregate analysis, respondents were divided into i) high, medium, and low specialized groups, and ii) Thai and Non-Thai groups, to explore the influence of specialization and culture on visitors' evaluations of environmental conditions.[1]

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[1] *Note*: Visitors' evaluations of the social conditions are explored in greater detail in the Chapter 6.

In Part B (Sections 5.4 through 5.6), the importance and satisfaction responses are integrated using Importance-Performance (I-P) Analysis (Martilla & James, 1977). The I-P analysis framework will provide an initial step toward determining minimum acceptable standards by identifying indicators of setting conditions that park managers and tour operators should be concerned about. The I-P analysis will also incorporate segmentation to provide more useful and accurate results. A summary and discussion of research findings concludes the chapter.

PART A: Visitors' Evaluations of Snorkeling Conditions

5.1 AGGREGATE RESULTS

5.1.1 The Importance of Day-Trip Conditions to Visitors' Snorkeling Experience

Physical, Natural, and Social Features

Visitors were asked to rate the importance of 12 environment and setting features to their snorkeling experience in Koh Chang using a 5-point Likert-scale, where 1= "not at all important", 4= "extremely important" and 5= "not sure". For purposes of analysis, these results were recoded as 1= "not at all important", 3= "not sure", and 5= "extremely important". Figures 5.1a-c show the percentage of snorkelers who rated each feature 4 or 5 on the importance scale. The physical conditions – warm weather, easy snorkeling conditions, and good underwater visibility – were rated as important by at least 82% of visitors (Figure 5.1a). Features related to the natural conditions were also valued highly by a majority of the respondents (Figure 5.1b). At least 90% of the sample rated the variety of marine life, undamaged snorkeling sites, variety of coral species, and abundance of marine life as "quite" or "extremely important". The social conditions (number of other snorkelers, number of boats) were rated as least important to snorkelers (Figure 5.1c).

FIGURE 5.1a The Importance of Various Physical Conditions (Q12) (Missing cases excluded)

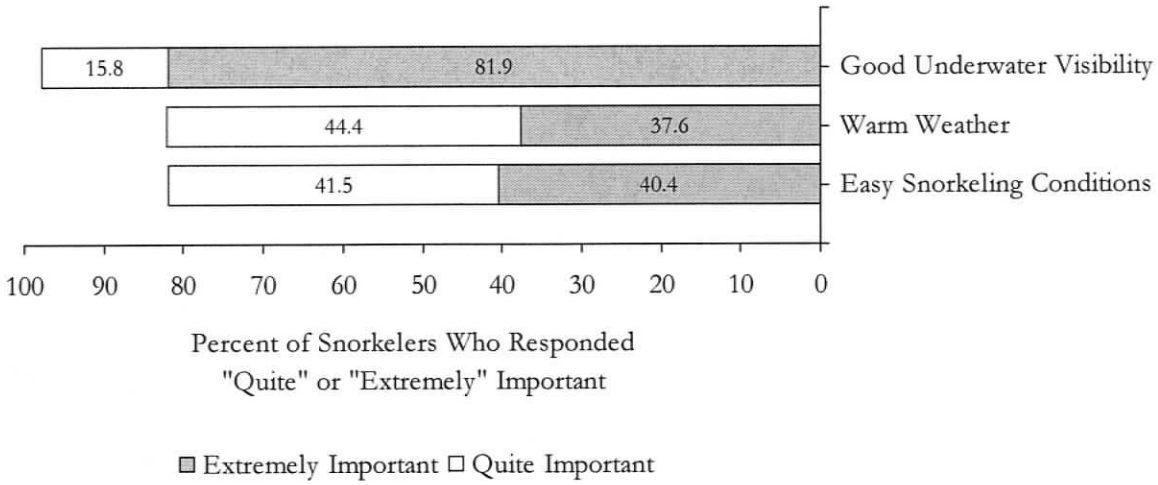


FIGURE 5.1b The Importance of Various Natural Conditions (Q12) (Missing cases excluded)

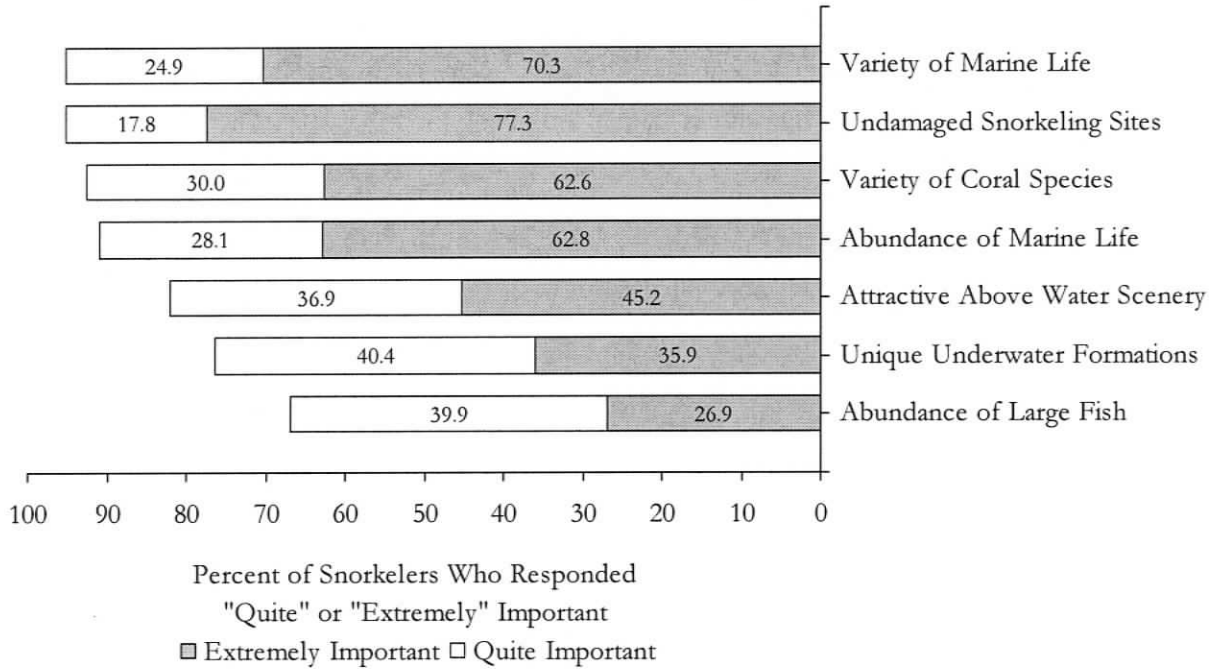
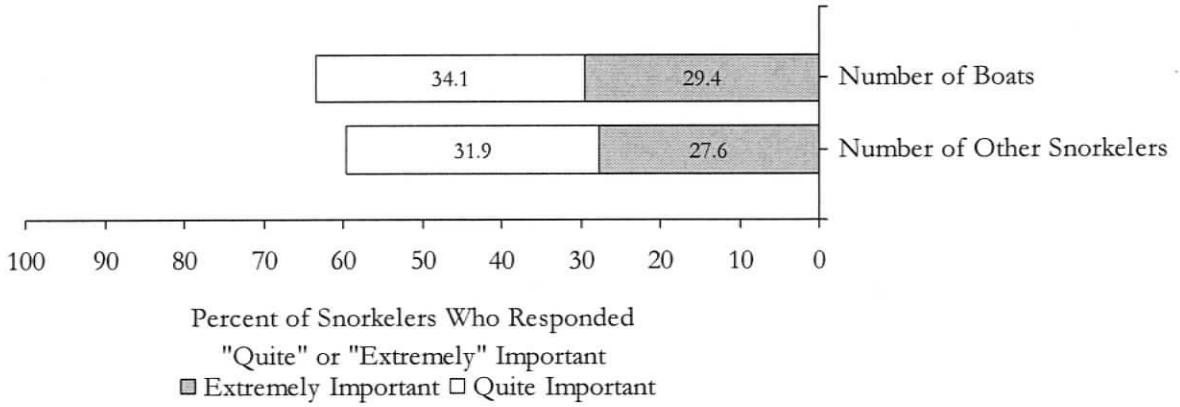


FIGURE 5.1c The Importance of Social Conditions (Q12) (Missing cases excluded)

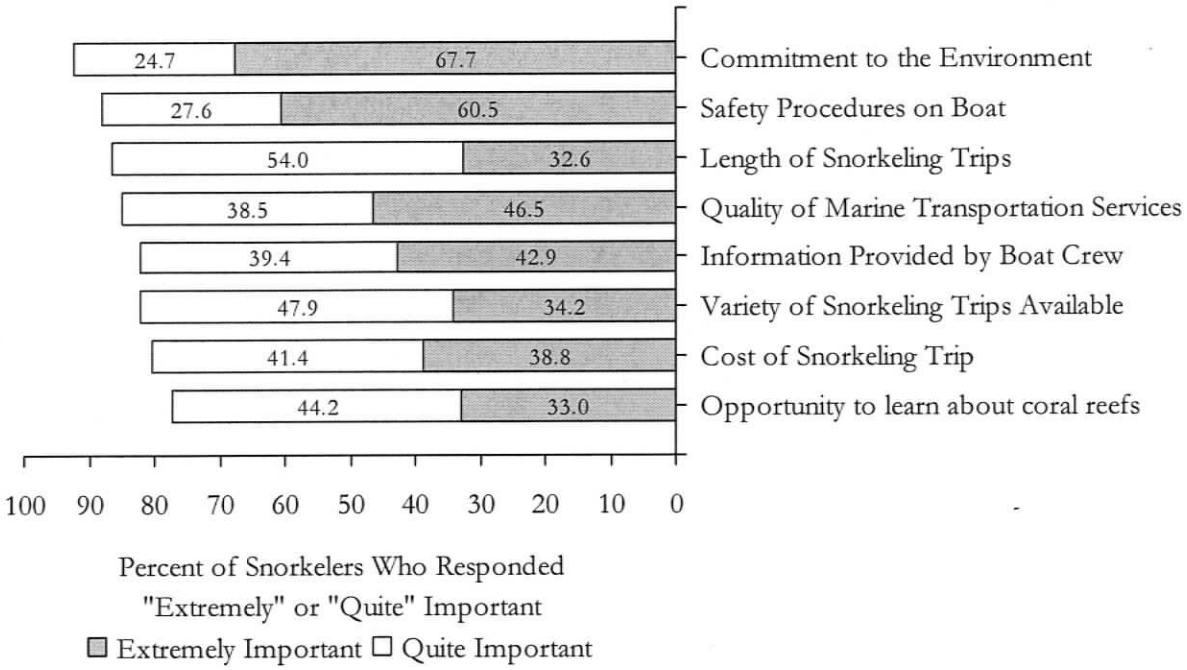


Service Features

Using a 5-point Likert scale where 1= "not at all important", 4= "extremely important" and 5= "not sure", survey participants were asked to indicate the importance of seven service features to their snorkeling experiences in Koh Chang. For purposes of analysis, the results were recoded as 1= "not at all important", 3= "not sure", and 5 = "extremely important". Figure 5.2 shows the percentage of snorkelers who rated the importance of each service feature a 4 or 5. The 'commitment to the environment by boat crew' was rated as important by 92.4% of respondents; 88% of respondents rated safety procedures on the boat and length of snorkeling trips as important, while at least 80% of the sample felt that the quality of marine transportation services, the information provided by the boat crew, the variety of snorkeling trips available, and the cost of snorkeling trip were important features. The cost of the snorkeling trip was rated the least important service feature, but generally, snorkelers indicated a high degree of importance for each service feature.

Visitors were also asked to rate the importance of the opportunity to learn about coral reef ecosystems, and 77.2% (n=552) of snorkelers responded "quite important" or "extremely important". Twenty-one percent (n=147) of respondents did not rate the opportunity to learn as important (Figure 6.2).

FIGURE 5.2 The Importance of Various Service Features (Q18) (Missing cases excluded)



Visitors' Perceptions of the Importance of All 20 Day-Trip Conditions

Table 5.1 summarizes mean results for visitors' perceptions of the importance of all 20 condition items to their snorkeling experience in Koh Chang. The results are listed in descending order, from the most important to the least important condition. Five of the top ten most important items concern the natural conditions (undamaged snorkeling sites, variety of marine life, variety of coral species, abundance of marine life, and attractive above water scenery), and four of the top 10 items concern the managerial conditions (commitment to the environment by boat crew, safety procedures on board the boat, quality of marine transportation services, and information provided by boat crew). Items ranking 11th through to 14th were predominately related to weather conditions (temperature, sea state) and service conditions (length of snorkeling trips and variety of trips available). Items ranked in the bottom five relate primarily to natural conditions (unique underwater formations, abundance of large fish) and the social conditions (number of other boats and number of snorkelers). Visitors rated the opportunity to learn more about coral reefs as least important.

TABLE 5.1 Visitors' Perceptions of the Importance of 20 Condition Items to Their Snorkeling Experience (Q12, Q18, Q22)[a, b]

Rank	Condition item	Mean	Standard Deviation
1	Good underwater visibility	4.8	0.54
2	Undamaged snorkeling sites	4.7	0.67
3	Variety of marine life	4.6	0.70
4	Variety of coral species	4.5	0.81
5	Abundance of marine life	4.5	0.85
6	Commitment to the environment by boat crew	4.5	0.84
7	Safety Procedures on boat	4.4	0.98
8	Quality of marine transportation services	4.2	1.01
9	Attractive above water scenery	4.1	1.15
10	Information provided by boat crew	4.1	1.12
11	Length of snorkeling trips	4.1	0.93
12	Warm weather	4.0	1.12
13	Easy snorkeling conditions	4.0	1.12
14	Variety of snorkeling trips available	4.0	1.04
15	Cost of snorkeling trips	4.0	1.12
16	Unique underwater formations	3.9	1.16
17	Abundance of large fish	3.6	1.26
18	Number of boats	3.5	1.36
19	Number of other snorkelers	3.4	1.43
20	Coral reef learning opportunities	3.1	0.81

[a] Missing cases excluded

[b] Recoded response categories ranged from 1= "not at all important", 2= "slightly important", 3= "not sure", 4= "quite important", 5= "extremely important"

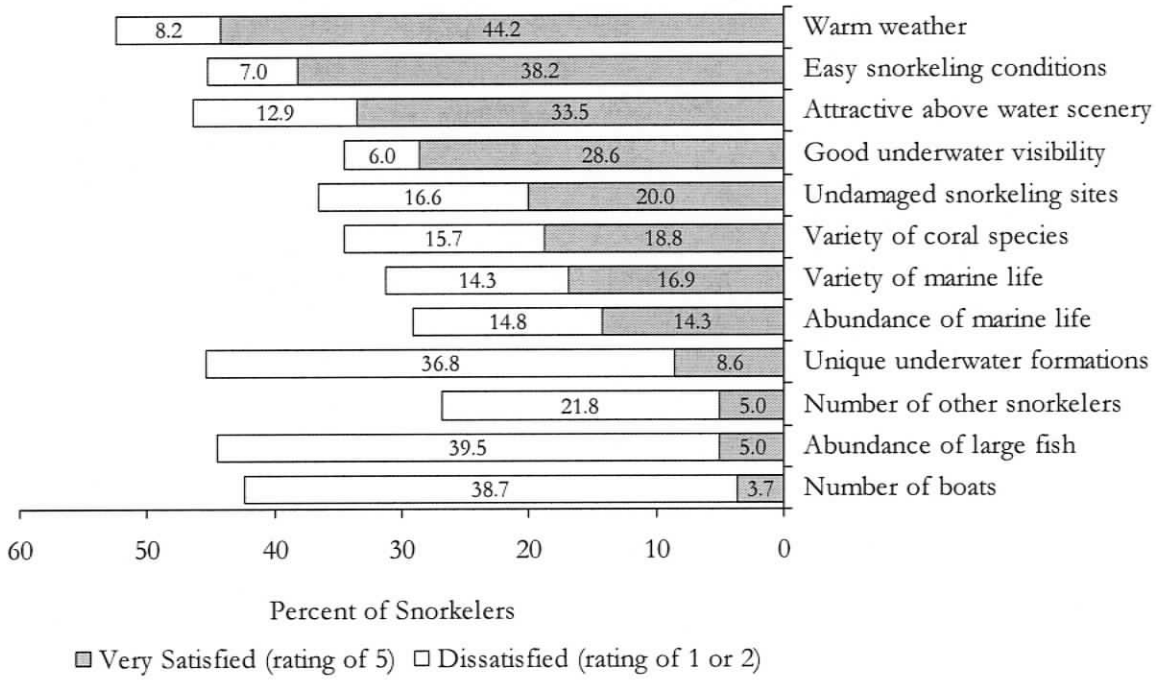
The mean scores summarized in Table 5.1 are useful for ranking all the condition items, but the averages conceal interesting findings. For example, mean results suggest that visitors do not consider the bottom five ranked conditions as important, however, frequency distributions indicate that a large percentage of the sample rate these items as a 4 or 5 on the importance scale (Figures 5.1 and 5.2). As a case in point, more than 75% of respondents rate the opportunity to learn about coral reefs and the presence of unique underwater formations as "quite" or "extremely" important, and more than half of respondents rate the abundance of large fish (66.8%, n=465), the number of boats (63.5%, n=543), and the number of other snorkelers (59.5%, n=414) as "quite" or "extremely" important. This variability in response is explored in greater detail in sections 5.2 and 5.3.

5.1.2 Visitors' Satisfaction With Day-Trip Conditions

Physical, Natural, and Social Conditions

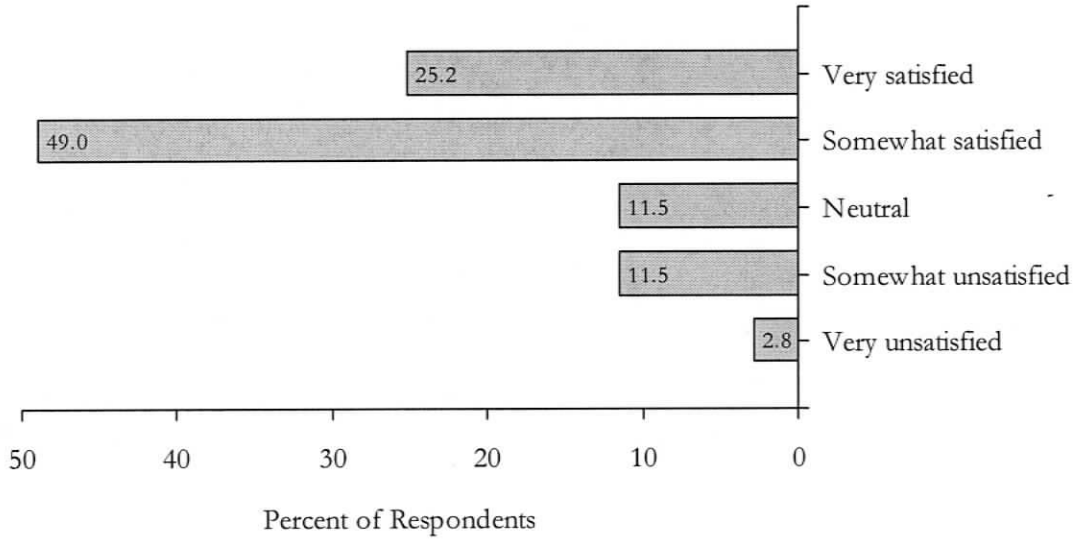
In addition to measures of the importance of environment and setting features to visitors' snorkeling experience, respondents were asked to indicate their level of satisfaction with the same 12 features using a 5-point Likert scale, where 1= "very unsatisfied" and 5= "very satisfied". Figure 5.3 shows that for the environment and setting features listed, snorkelers were most satisfied with the physical conditions (snorkeling conditions, weather, visibility). Less than two thirds of respondents were "very satisfied" with the natural conditions (variety of marine life, variety of coral species, abundance of marine life, unique underwater formations). The features that were rated as least important to visitors' experiences – number of other snorkelers and number of boats - were also rated as least satisfying.

FIGURE 5.3 Visitors' Satisfaction With Physical, Natural, and Social Conditions (Q14) (Missing cases excluded)



Taking into consideration all 12 of the environment and setting features, snorkelers were asked to indicate their overall level of satisfaction with the snorkeling environment in Koh Chang, using a 5-point Likert scale (1= "very unsatisfied", 5= "very satisfied"). The frequency distributions are summarized in Figure 5.4. The mean score of 3.8 (SD=1.02) suggests that overall, the sample was "somewhat satisfied" with the snorkeling environment.

FIGURE 5.4 Respondents' Overall Satisfaction with Physical, Natural, and Social Conditions (Q15) (Missing cases excluded; *n*=710)



A t-test was used to examine the relationship between overall satisfaction with the physical, natural, and social conditions, and satisfaction with individual condition items. For purposes of analysis, the 5 satisfaction response categories were recoded as 1= "somewhat/very unsatisfied and neutral", and 2= "somewhat/very satisfied". Results, summarized in Table 5.2, show that visitors who are "somewhat/very satisfied" overall report higher mean satisfaction scores for individual condition items compared with visitors who are "somewhat/very unsatisfied". This analysis indicates that the individual condition items are significant contributors to overall satisfaction.

TABLE 5.2 Comparison of Visitors' Overall Satisfaction with the Physical, Natural, and Social Conditions with Visitors' Satisfaction with Individual Condition Items

	SOMEWHAT/VERY UNSATISFIED/ NOT SURE		SOMEWHAT/ VERY SATISFIED				
Condition items	**Mean**	**SD**	**Mean**	**SD**	**t**	***df***	**Sig***
Physical conditions (Q12)							
Warm weather	1.6	0.48	1.8	0.40	-3.17	621	**.002***
Easy snorkeling conditions	1.6	0.49	1.9	0.33	-7.07	620	**.000***
Good underwater visibility	1.4	0.49	1.8	0.40	-8.72	616	**.000***
Natural conditions (Q12)							
Attractive above water scenery	1.5	0.50	1.8	0.38	-6.76	612	**.000***
Undamaged snorkeling sites	1.3	0.46	1.7	0.46	-8.29	621	**.000***
Variety of marine life	1.3	0.45	1.7	0.46	-8.30	619	**.000***
Variety of coral species	1.3	0.47	1.7	0.47	-6.47	618	**.000***
Abundance of marine life	1.2	0.42	1.6	0.48	-8.33	619	**.000***
Abundance of large fish	1.1	0.29	1.3	0.45	-4.00	618	**.000***
Unique underwater formations	1.1	0.35	1.4	0.49	-5.50	618	**.000***
Social conditions (Q12)							
Number of snorkelers	1.1	0.33	1.3	0.45	-3.44	618	**.001***
Number of boats	1.1	0.31	1.2	0.44	-3.23	616	**.000***

*Significant at $p < 0.05$

The recreation satisfaction literature suggests that satisfied customers will provide companies with repeat business, and make positive recommendations to others (Oppermann, 1988; Weaver, Weber, & McCleary, 2007). Visitors were asked to indicate whether or not they would return to Koh Chang for snorkeling based on the quality of the coral reef environment, and 73.1% (n=517) said "yes" and 26.9% (n=190) said "no". More than 85% of snorkelers (86.3%, n=609) said they would recommend snorkeling to other tourists based on the quality of the coral reef environment. This indicates that a majority of visitors are satisfied with the snorkeling experience and environment.

A chi-square test was used to determine whether visitors who were willing to return to Koh Chang for snorkeling were more likely to rate their overall satisfaction with physical, natural, and social condition items as "very" or "somewhat" satisfied. The analysis, summarized in Table 5.3, indicates that there is a positive relationship between willingness to return and visitors' overall satisfaction.

TABLE 5.3 Visitors' Overall Satisfaction with Physical, Natural, and Social Conditions and Willingness to Return to Koh Chang for Snorkeling (Missing cases excluded)

	Willingness to return?				
Overall satisfaction (Q15)	**YES**	**NO**	Π^2	*df*	**Sig***
Very satisfied	88.8	11.2			
Somewhat satisfied	77.7	22.3			
Neutral	51.3	48.8	81.61	4	**.000***
Somewhat unsatisfied	46.9	53.1			
Very unsatisfied	45.0	55.0			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

A chi-square test was also used to determine whether visitors' overall satisfaction influenced their willingness to recommend snorkeling to other visitors. Results of the analysis, summarized in Table 5.4, show that visitors were more likely to recommend snorkeling to other tourists if they were "somewhat" or "very satisfied" overall with the physical, natural, and social conditions.

TABLE 5.4 Visitors' Overall Satisfaction with Physical, Natural, and Social Conditions and Willingness to Recommend Snorkeling to Other Tourists (Missing cases excluded)

	Willingness to recommend snorkeling?				
Overall satisfaction (Q15)	**YES**	**NO**	Π^2	*df*	**Sig***
Very satisfied	97.2	2.8			
Somewhat satisfied	92.8	7.2			
Neutral	65.0	35.0	111.14 [a]	4	**.000***
Somewhat unsatisfied	64.2	35.8			
Very unsatisfied	55.0	45.0			

[a] Cell has an expected count of less than 5.

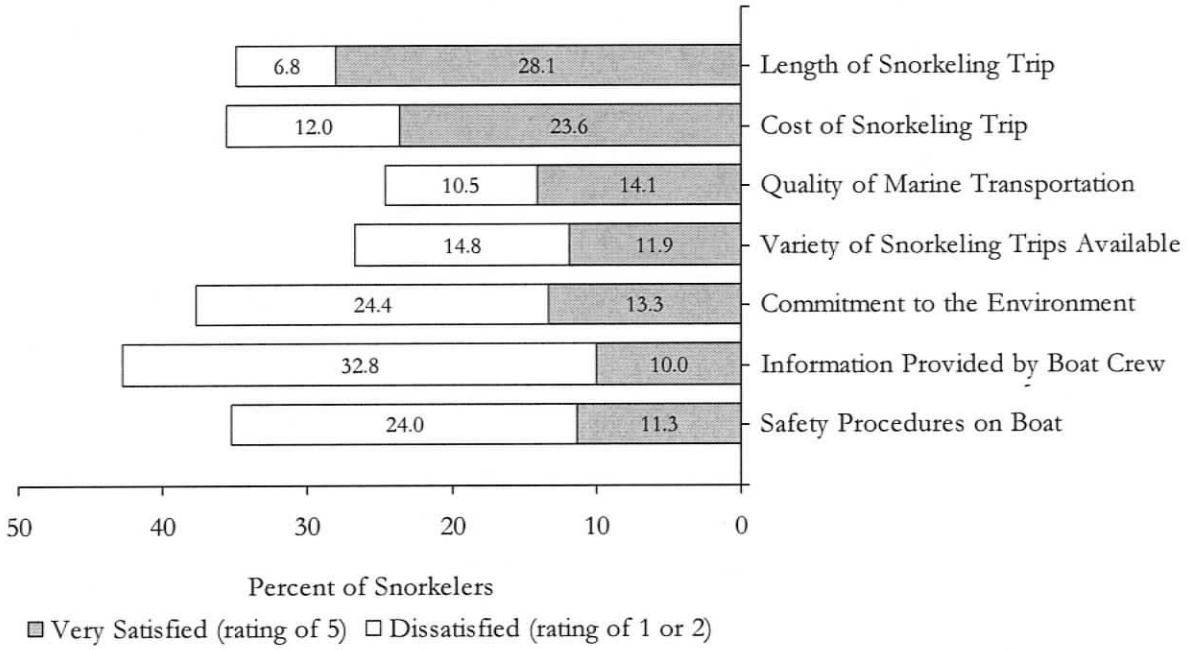
* Significant at $p < 0.05$ (chi-square, 2-tailed)

Service features

Snorkelers were asked to rate their satisfaction with service features using a five-point Likert scale, where 1= "very unsatisfied" and 5= "very satisfied". The most satisfying service feature was the length of snorkeling trips, with 28.1% of the sample responding "very"

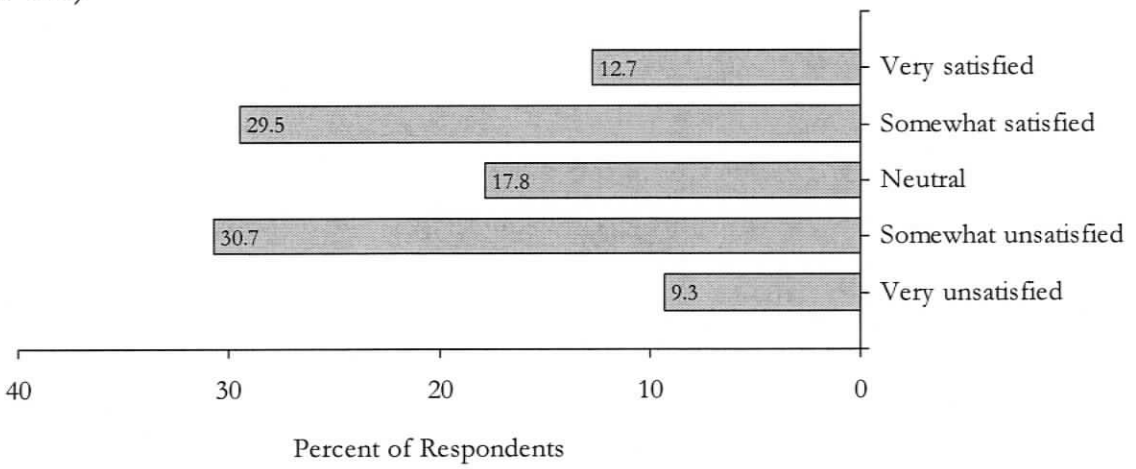
satisfied (Figure 5.5). Less than 25% of snorkelers rated the other service features as "very" satisfying.

FIGURE 5.5 Visitors' Satisfaction with Service Features (Q19) (Missing cases excluded)



When asked to take into consideration all seven service features and indicate overall level of satisfaction using a 5-point Likert scale (1= "very unsatisfied", 5= "very satisfied"), 12.7% (n=88) of respondents indicated that they were "very" satisfied, while 40.0% (n=276) indicated that they were "very" or "somewhat" unsatisfied with the service features provided (Figure 5.6).

FIGURE 5.6 Overall Satisfaction with Service Features (Q20) (Missing cases excluded; *n*=691)



The relationship between overall satisfaction and satisfaction with individual condition items was examined using t-tests. The results of this analysis, summarized in Table 5.5, indicate that a majority of the individual service condition items are *not* significant contributors to overall satisfaction. Visitors who are "somewhat/very satisfied" overall report higher mean satisfaction scores for only two of the individual service condition items compared with visitors who are "somewhat/very unsatisfied".

TABLE 5.5 Comparison of Visitors' Overall Satisfaction with the Service Conditions with Visitors' Satisfaction with Individual Service Condition Items

	SOMEWHAT/VERY UNSATISFIED/ NOT SURE		SOMEWHAT/ VERY SATISFIED				
Service condition items (Q19)	**Mean**	**SD**	**Mean**	**SD**	**t**	***df***	**Sig***
Information provided by crew	1.5	0.50	1.3	0.45	5.56	679	**.000***
Commitment to the environment	1.5	0.50	1.4	0.49	2.23	678	**.027***
Safety procedures on boat	1.4	0.50	1.3	0.47	2.69	678	**.007***
Length of snorkeling trips	1.7	0.47	1.8	0.39	-4.13	676	**.000***
Quality of marine transportation	1.5	0.5	1.6	0.50	-1.94	674	.053
Variety of snorkeling trips	1.4	0.5	1.5	0.50	-0.77	679	.441
Cost of snorkeling trip	1.5	0.5	1.7	0.46	-6.37	677	**.000***

[a] 2 tailed t-test, *Significant at $p < 0.05$

To determine if there is a relationship between visitors' overall satisfaction with service conditions and willingness to return to Koh Chang for snorkeling, a chi-square test was performed, and the differences are statistically different (Table 5.6). Visitors who were "very" or "somewhat" satisfied overall were more likely to return, although a higher percentage of visitors who were "very unsatisfied' or "somewhat unsatisfied" were also more likely to return to Koh Chang for snorkeling.

TABLE 5.6 Visitors' Overall Satisfaction with Service Conditions and Willingness to Return to Koh Chang for Snorkeling (Missing cases excluded)

	Willingness to return?				
Overall satisfaction (Q20)	**YES**	**NO**	Π^2	*df*	**Sig***
Very satisfied	72.4	27.6			
Somewhat satisfied	61.4	38.6			
Neutral	56.3	43.7	72.43	4	**.000***
Somewhat unsatisfied	89.5	10.5			
Very unsatisfied	92.2	7.8			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

A chi-square test was also used to determine whether visitors' overall satisfaction with service conditions influenced their willingness to recommend snorkeling to other visitors. Results of the analysis, summarized in Table 5.7, show that visitors were more likely to recommend snorkeling to other tourists if they were "somewhat" or "very satisfied" overall with the physical, natural, and social conditions. However, visitors that were "somewhat" or "very" unsatisfied were also likely to recommend snorkeling to other tourists.

Results summarized in Tables 5.6 and 5.7 show that the quality of the services provided does not appear to have a strong influence on visitors' willingness to return or recommend snorkeling to other visitors (i.e., both satisfied and unsatisfied visitors responded favourably). Other factors such as the natural conditions may exert a greater influence on visitors' willingness to snorkel in Koh Chang again or recommend snorkeling to others. Price point – a topic discussed in greater detail in Section 5.6, may also explain these results.

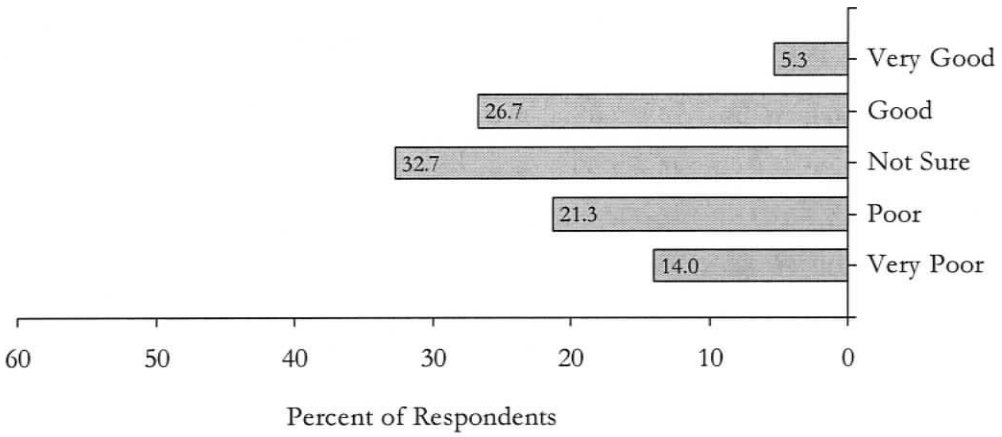
TABLE 5.7 Visitors' Overall Satisfaction with Service Conditions and Willingness to Recommend Snorkeling to Other Tourists (Missing cases excluded)

	Willingness to recommend snorkeling?				
Overall satisfaction (Q20)	**YES**	**NO**	Π^2	*df*	**Sig***
Very satisfied	86.0	14.0			
Somewhat satisfied	81.7	18.3			
Neutral	76.5	23.5	31.07	4	**.000***
Somewhat unsatisfied	94.8	5.2			
Very unsatisfied	95.3	4.7			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

Respondents were asked to rate the opportunity to learn about coral reefs in Koh Chang MNP using a 5-point Likert scale, where 1= "very poor" and 5= "very good". The results, summarized in Figure 5.7, indicate that a significant portion of the sample (n=233, 32.7%) was not able to rate the opportunity to learn in Koh Chang. Of those who could evaluate the learning opportunity, 32.0% (n=228) of respondents rated the opportunity to learn as "good" or "very good", while a slightly larger percentage of respondents (35.3%, n=252) rated the opportunity to learn as "poor" or "very poor".

FIGURE 5.7 Ratings of Opportunity to Learn About Coral Reefs (Q23)
(Missing cases excluded)



Visitors' Satisfaction With All 20 Day-Trip Conditions

Table 5.8 summarizes the mean values and standard deviations for respondents' assessment of all 20 day-trip conditions. Mean results are presented in descending order, from the most to the least satisfactory condition. Four of the top 10 most satisfactory conditions concern the natural conditions (attractive above water scenery, undamaged snorkeling sites, variety of marine life, variety of coral species), and six of the top 10 items concern the managerial or service conditions (length of snorkeling trips, cost of snorkeling trips, quality of marine transportation services) and the physical conditions (temperature, sea state, clarity of water). Items ranked 11th through to 14th were predominately related to service conditions (quality of marine transportation services, variety of snorkeling trips available, commitment to the environment by boat crew, safety procedures on board the boat). Four of the five items ranked as least satisfactory were also ranked as least important (opportunity to learn about coral reefs, abundance of large fish, number of boats, number of other snorkelers).

TABLE 5.8 Visitors' Satisfaction With All 20 Condition Items (Q14, Q19, Q23)

Rank (I)[a]	Rank (S)[b]	Condition item	Mean	Standard Deviation
12	1	Warm weather	4.1	1.02
13	2	Easy snorkeling conditions	4.1	0.94
9	3	Attractive above water scenery	4.0	0.91
11	4	Length of snorkeling trips	3.9	0.90
1	5	Good underwater visibility	3.8	1.01
15	6	Cost of snorkeling trips	3.7	1.01
2	7	Undamaged snorkeling sites	3.6	1.03
3	8	Variety of marine life	3.6	1.00
4	9	Variety of coral species	3.6	1.01
8	10	Quality of marine transportation services	3.6	0.92
5	11	Abundance of marine life	3.5	0.97
14	12	Variety of snorkeling trips available	3.4	0.94
6	13	Commitment to the environment by boat crew	3.2	1.13
7	14	Safety Procedures on boat	3.2	1.07
16	15	Unique underwater formations	3.2	0.95
10	16	Information provided by boat crew	3.0	1.21
20	17	Coral reef learning opportunities	2.9	1.11
17	18	Abundance of large fish	2.8	1.00
18	19	Number of boats	2.8	1.05
19	20	Number of other snorkelers	2.8	1.00

[a] Importance
[b] Satisfaction

Variation in Response

The standard deviations around mean responses indicate variability in evaluations of the importance of, and satisfaction with, day trip conditions (Tables 5.1, 5.8). Not all snorkelers feel the same about the importance of the condition items listed, and not all snorkelers rate their level of satisfaction with the conditions the same. Variability in response, explored in greater detail in the next two sections, is also supported by respondents' comments:

"Very beautiful and well-protected."

"This is my first time snorkeling! This is remarkable nature and I want it to remain like this."

"It was very enjoyable. I would recommend it to people."

"First time here and very impressive, very beautiful."

"Best water I've seen in Thailand so far!"

"Very enjoyable, good value for money. Coral looked very healthy. Hope it stays like that!"

"Beautiful, clean sea, no garbage, nice weather."

"Very impressive. My first time. I never thought the undersea world in Thailand would be this beautiful. If there were more fish it would be great."

"Although the coral reef at the snorkeling sites was well protected and in good order, I noticed that 100 yards to left and right, the coral was nearly all destroyed."

"Beautiful corals, but some are almost lost and damaged."

"Coral reefs are destroyed."

"I saw quite a lot of dead coral, and that makes me want to stop snorkeling."

"At some sites the water wasn't clear, a lot of sand. Fish were not in abundance but pretty beautiful, some I have never seen before."

"Visibility poorer than expected. Reefs a bit more damaged than expected."

"The waves were too strong today, causing some troubles while snorkeling but the corals were beautiful. However, fish were not in abundance. Sea was not clear in some spots, maybe because I have been snorkeling in the Andaman Sea several times so I did not feel so excited about the undersea world. But overall, the corals here are okay."

"Somewhat satisfied b/c waves were too strong. I want to return when the waves are good. The first site was beautiful but the waves were too strong."

"Not as beautiful as I thought it would be. Doesn't look clean. Too many sea urchins, dangerous."

"Too much garbage in Koh Wai."

5.2 DISAGGREGATE RESULTS – HIGH, MEDIUM, AND LOW SPECIALIZED SNORKELERS

To examine the influence of specialization on snorkelers' evaluations of the physical, natural, managerial, and social conditions, respondents were segmented into groups smaller groups on the basis of self reported level of experience. Respondents were asked to describe their snorkeling experience by choosing one of four response categories: "novice", "intermediate", "advanced", or "expert". These four response categories were collapsed into 3 categories for analysis – high (n=88), medium (n=232), and low-specialized (n=390).

5.2.1 Visitors' Evaluation of the Importance of Day-Trip Conditions

Figures 5.8 and 5.9 show the percentage of high, medium, and low specialized snorkelers who responded "extremely important" when asked to rate the level of importance of day trip conditions. In general, a greater percentage of high specialized respondents rate the natural conditions as "extremely" important, while a greater percentage of medium and low specialized respondents rate the physical and service conditions as "extremely" important, with the exception of underwater visibility, staff's commitment to the environment, and learning opportunities. All three groups rate the importance of the social conditions similarly, although a slightly higher percentage of high specialized snorkelers rate the number of other snorkelers and the number of boats as "extremely" important.

FIGURE 5.8 Comparison of High, Medium, and Low Specialized Respondents' Evaluations of the Importance of the Physical, Natural, and Social Conditions (Q12) (Missing cases excluded; statistically significant differences are indicated by an asterisk.)

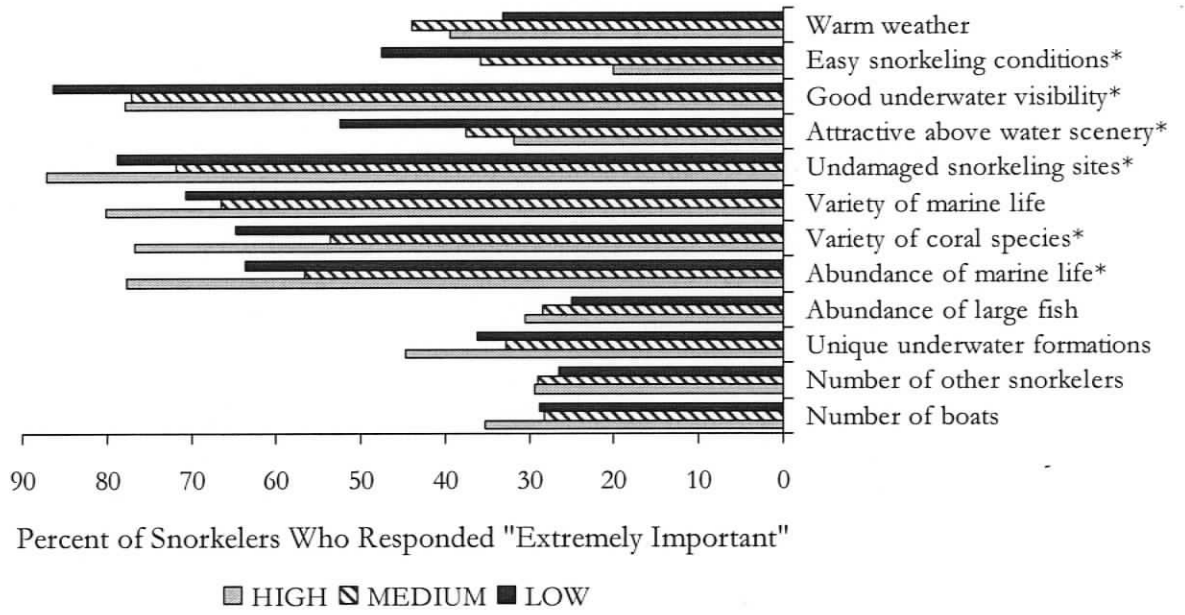


FIGURE 5.9 Comparison of High, Medium, and Low Specialized Respondents' Evaluations of the Importance of the Service Conditions (Q19, Q20) (Missing cases excluded; statistically significant differences are indicated by an asterisk.)

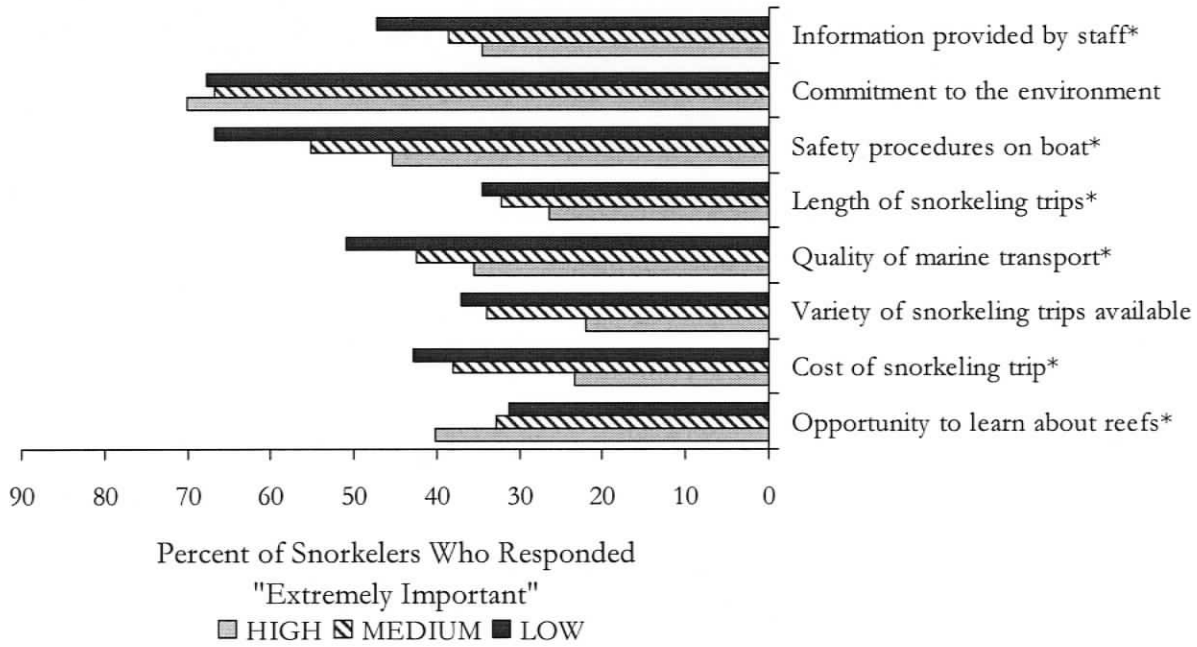


Table 5.9 shows mean values for visitors' evaluations of the importance of day-trip conditions. Differences in mean values among high, medium, and low specialized groups were examined using analysis of variance (ANOVA) tests. Statistically significant differences between the groups are reported for 12 or 60% of the condition items, with importance decreasing as specialization increases for the following condition items:

- Easy snorkeling conditions
- Good underwater visibility
- Attractive above water scenery
- Information provided by boat crew
- Safety procedures on boat
- Length of the snorkeling trips
- Quality of marine transportation services
- Cost of snorkeling trip

Importance increased as specialization increased for the following condition items:

- Undamaged snorkeling sites
- Variety of coral species
- Abundance of marine life
- Opportunity to learn about coral reefs

TABLE 5.9 Comparison of Visitors' Evaluations of the Importance of Day-Trip Conditions by Level of Specialization[a,b]

	HIGH		MEDIUM		LOW					Bonferroni Comparisons*		
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**F**	***df***	**Sig***	**H-M**	**M-L**	**H-L**
Physical conditions (Q12)												
Warm weather	4.0	1.16	4.1	1.08	3.9	1.13	2.37	2	.094			
Easy snorkeling conditions	3.3	1.34	3.9	1.15	4.2	0.96	26.81	2	**.000***	*	*	*
Good underwater visibility	4.7	0.51	4.7	0.64	4.8	0.46	4.49	2	**.012***		*	
Natural conditions (Q12)												
Attractive above water scenery	3.6	1.39	3.9	1.17	4.2	1.03	14.75	2	**.000***	*	*	*
Undamaged snorkeling sites	4.8	0.57	4.6	0.77	4.7	0.60	4.39	2	**.013***	*	*	
Variety of marine life	4.8	0.52	4.6	0.73	4.6	0.71	2.45	2	.087			
Variety of coral species	4.6	0.78	4.4	0.88	4.5	0.76	4.76	2	**.009***	*	*	
Abundance of marine life	4.7	0.73	4.4	0.87	4.5	0.85	3.32	2	**.037***	*		
Abundance of large fish	3.4	1.42	3.7	1.23	3.6	1.24	1.27	2	.280			
Unique underwater formations	4.0	1.12	3.8	1.21	3.9	1.13	2.41	2	.090			
Social conditions (Q12)												
Number of snorkelers	3.4	1.42	3.4	1.44	3.4	1.42	0.07	2	.936			
Number of boats	3.6	1.40	3.5	1.40	3.5	1.34	0.67	2	.511			
Service conditions (Q18)												
Information provided by boat crew	3.8	1.24	3.9	1.18	4.2	1.03	6.89	2	**.001***		*	*
Commitment to the environment	4.5	0.87	4.6	0.94	4.6	0.76	1.25	2	.288			
Safety procedures on boat	4.0	1.16	4.2	1.05	4.5	0.86	10.73	2	**.000***		*	*
Length of snorkeling trips	3.9	0.98	3.4	1.02	4.1	0.86	3.57	2	**.029***			
Quality of marine transportation services	3.8	1.19	4.1	0.99	4.3	0.97	6.10	2	**.001***			*
Variety of snorkeling trips available	3.8	1.00	4.0	1.04	4.0	1.04	1.17	2	.311			
Cost of snorkeling trip	3.6	1.19	3.9	1.14	4.1	1.06	7.35	2	**.001***	*		*
Opportunity to learn about reefs (Q22)	4.1	0.99	3.9	1.07	3.8	1.16	4.24	2	**.015***			*

[b] Recoded response categories ranged from 1= "not at all important", 2= "slightly important", 3= "not sure", 4= "quite important", 5= "extremely important";
*Significant at $p < 0.05$

5.2.2 Visitors' Satisfaction with Day-Trip Conditions

Figures 5.10 and 5.11 show the percentage of high, medium, and low specialized snorkelers who responded "very satisfied" when asked to rate their level of satisfaction with the day-trip conditions. A greater percentage of high specialized respondents are "very" satisfied with the weather and the snorkeling conditions, while low specialized snorkelers are more satisfied with the underwater visibility. Low specialized snorkelers are also generally more satisfied with the natural conditions, with the exception of the above water scenery. No generalizations can be made about the social conditions, as high, medium, and low specialized groups responded similarly. Looking at the frequency distributions for satisfaction with service conditions (Figure 5.11), all three specialization groups rate their levels of satisfaction as quite low. High specialized snorkelers are more satisfied with the length of the snorkeling trips, the variety and cost of trips, and the opportunity to learn more about reefs.

FIGURE 5.10 Comparison of High, Medium, and Low Specialized Respondents' Satisfaction with Physical, Natural, and Social Conditions (Q14) (Missing cases excluded; statistically significant differences are indicated by an asterisk.)

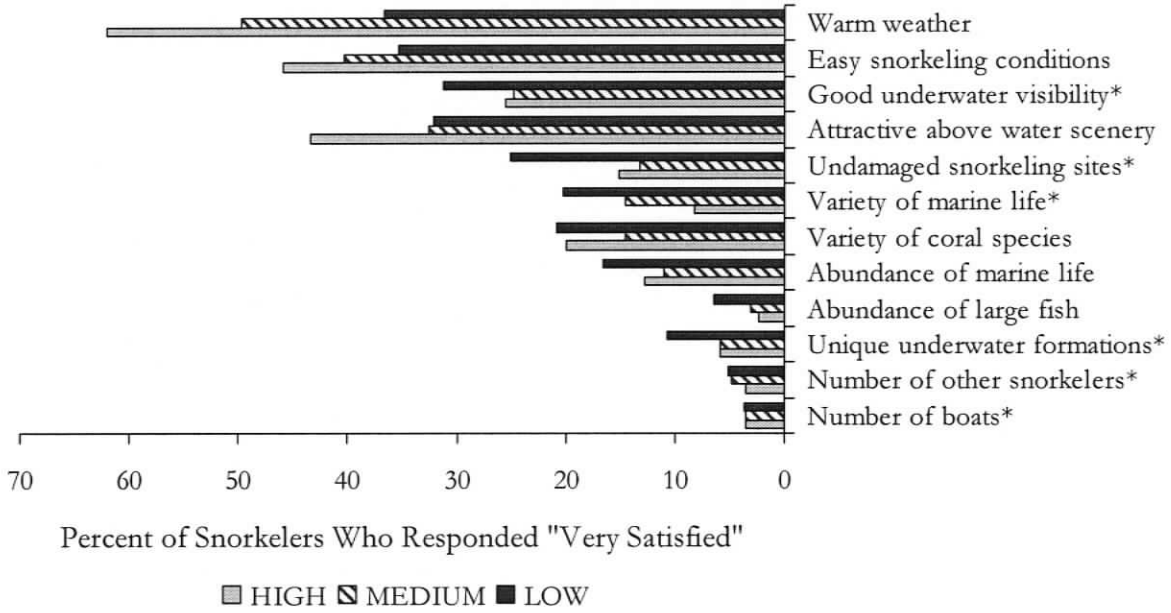


FIGURE 5.11 Comparison of High, Medium, and Low Specialized Respondents' Satisfaction with Service Conditions (Q19) (Missing cases excluded; statistically significant differences are indicated by an asterisk.)

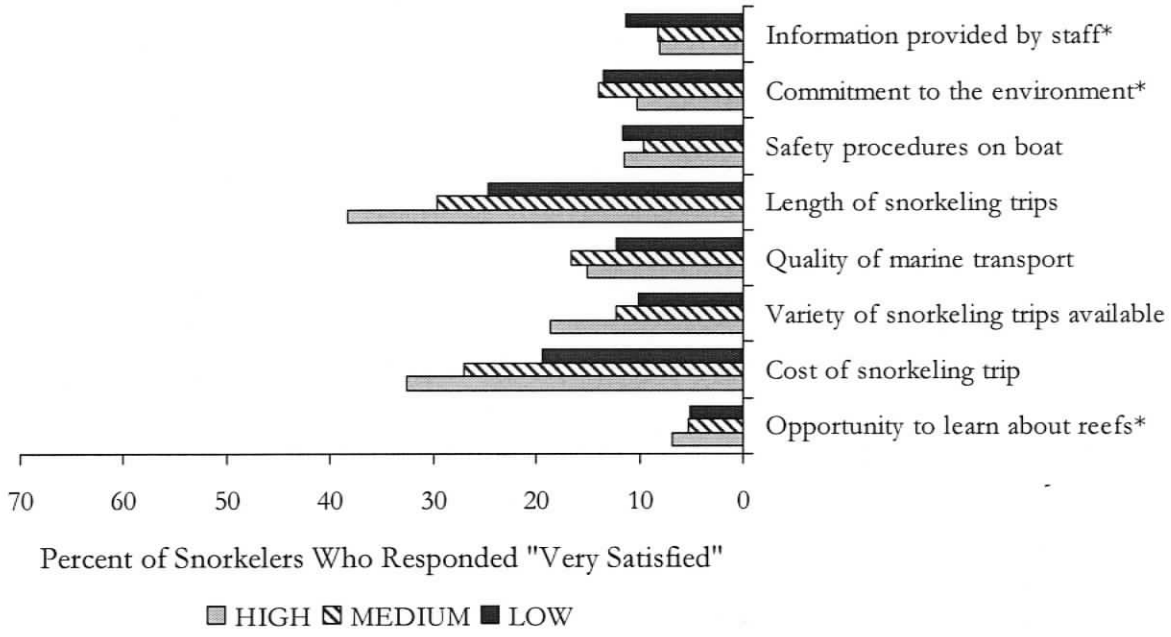


Table 5.10 shows mean values for visitors' satisfaction with day-trip conditions. Differences in mean values between high, medium, and low specialized groups were examined using ANOVA. Significant differences between the groups occur for 10 (50%) of the 20 condition items. The analysis indicates that low specialized snorkelers are more satisfied with the natural, social, and service conditions than are medium and low specialized snorkelers. Satisfaction decreased as specialization increased for the following condition items:

- Good underwater visibility
- Undamaged snorkeling sites
- Variety of marine life
- Unique underwater formations
- Number of other snorkelers
- Number of boats
- Information provided by boat crew
- Commitment to the environment by boat crew
- Opportunity to learn about coral reefs

Satisfaction increased as specialization increased for only one condition item, 'warm weather'.

TABLE 5.10 Comparison of Visitors' Satisfaction With Day-Trip Conditions by Level of Specialization[a,b]

Condition items	HIGH		MEDIUM		LOW					Scheffe Comparisons*		
	Mean	SD	Mean	SD	Mean	SD	F	*df*	Sig*	H-M	M-L	H-L
Physical conditions (Q14)												
Warm weather	4.3	1.03	4.1	1.10	4.0	0.96	3.31	2	**.037***			*
Easy snorkeling conditions	4.1	0.95	4.0	1.04	4.1	0.88	0.57	2	.566			
Good underwater visibility	3.6	1.14	3.7	1.05	4.0	0.93	9.31	2	**.000***		*	*
Natural conditions (Q14)												
Attractive above water scenery	4.1	1.03	3.9	0.96	4.0	0.84	1.04	2	.355			
Undamaged snorkeling sites	3.5	1.02	3.3	1.05	3.8	0.99	14.26	2	**.000***		*	*
Variety of marine life	3.4	0.89	3.4	1.04	3.7	0.98	5.29	2	**.005***		*	
Variety of coral species	3.6	1.05	3.4	0.99	3.6	1.00	2.78	2	.063			
Abundance of marine life	3.5	0.93	3.4	0.96	3.6	0.97	3.23	2	**.040***		*	
Abundance of large fish	2.7	0.86	2.7	0.97	2.9	1.03	2.87	2	.057			
Unique underwater formations	3.0	0.92	3.1	0.91	3.3	0.97	4.08	2	**.017***		*	
Social conditions (Q14)												
Number of snorkelers	2.4	1.11	2.6	1.05	2.9	1.01	12.56	2	**.000***		*	*
Number of boats	2.4	1.08	2.6	0.99	2.9	0.94	12.36	2	**.000***		*	*
Overall satisfaction (Q15)	3.7	1.18	3.7	1.10	3.9	0.93	3.84	2	**.022***			
Service conditions (Q19)												
Information provided by boat crew	2.6	1.22	2.9	1.22	3.2	1.16	10.58	2	**.000***		*	*
Commitment to the environment	2.9	1.15	3.2	1.16	3.3	1.10	4.52	2	**.011***			*
Safety procedures on boat	3.0	1.15	3.1	0.99	3.2	1.09	1.91	2	.148			
Length of snorkeling trips	4.1	0.85	3.9	0.93	3.9	0.90	2.34	2	.097			
Quality of marine transportation services	3.5	0.94	3.5	0.99	3.6	0.88	0.67	2	.510			
Variety of snorkeling trips available	3.4	1.00	3.4	0.97	3.4	0.91	0.69	2	.934			
Cost of snorkeling trip	3.8	1.07	3.7	1.02	3.6	1.00	2.40	2	.091			
Opportunity to learn about reefs (Q23)[c]	2.7	1.17	2.6	1.14	3.0	1.05	24.89	2	**.000***		*	
Overall satisfaction (Q20)	3.6	1.04	3.3	1.15	2.8	1.21	10.56	2	**.000***		*	*

[a] Recoded response categories ranged from 1= "very unsatisfied", 2= "somewhat unsatisfied", 3= "neutral", 4= "somewhat satisfied", 5= "very satisfied"; [b] Response categories ranged from 1= "very poor", 2= "poor", 3= "neutral", 4= "good", 5= "very good"; * Significant at $p < 0.05$

Differences among specialization groups with respect to visitors' mean evaluation of overall satisfaction with the physical, natural, and social condition items and overall satisfaction with service condition items were examined using ANOVA (Table 5.10). There are significant differences in mean scores between high, medium, and low specialized snorkelers' evaluation of overall satisfaction with the physical/natural/social conditions, with satisfaction *increasing* as specialization *decreases* (i.e., an inverse relationship). There are also significant differences in mean ratings of overall satisfaction with the managerial conditions, with satisfaction *increasing* as specialization *increases*.

A chi-square test was used to determine whether there are significant differences among high, medium, and low specialized snorkelers' willingness to return to Koh Chang for snorkeling based on the quality of the coral reef environment (Table 5.11). There are significant differences between the groups (Π^2=11.24, df=2, p=.004), with a greater percentage of low specialized snorkelers responding "yes". When respondents were asked if they would be willing to recommend snorkeling to other tourists visiting Koh Chang, chi square test results reveal that low specialized snorkelers were more willing than medium and high specialized snorkelers to make a recommendation (Π^2 =6.66, df=2, p=.036) (Table 5.11).

TABLE 5.11 Respondents' Willingness to Return to Koh Chang and Recommend Snorkeling to Other Tourists: A Comparison of High, Medium, and Low Specialized Snorkelers (Missing cases excluded)

	Response by Specialization (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
Willingness to return?						
Yes	67.8	66.7	78.2	**.004***	11.24	2
No	32.2	33.3	21.8			
Willingness to recommend snorkeling?						
Yes	79.3	84.1	88.9	**.036***	6.66	2
No	20.7	15.9	11.1			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

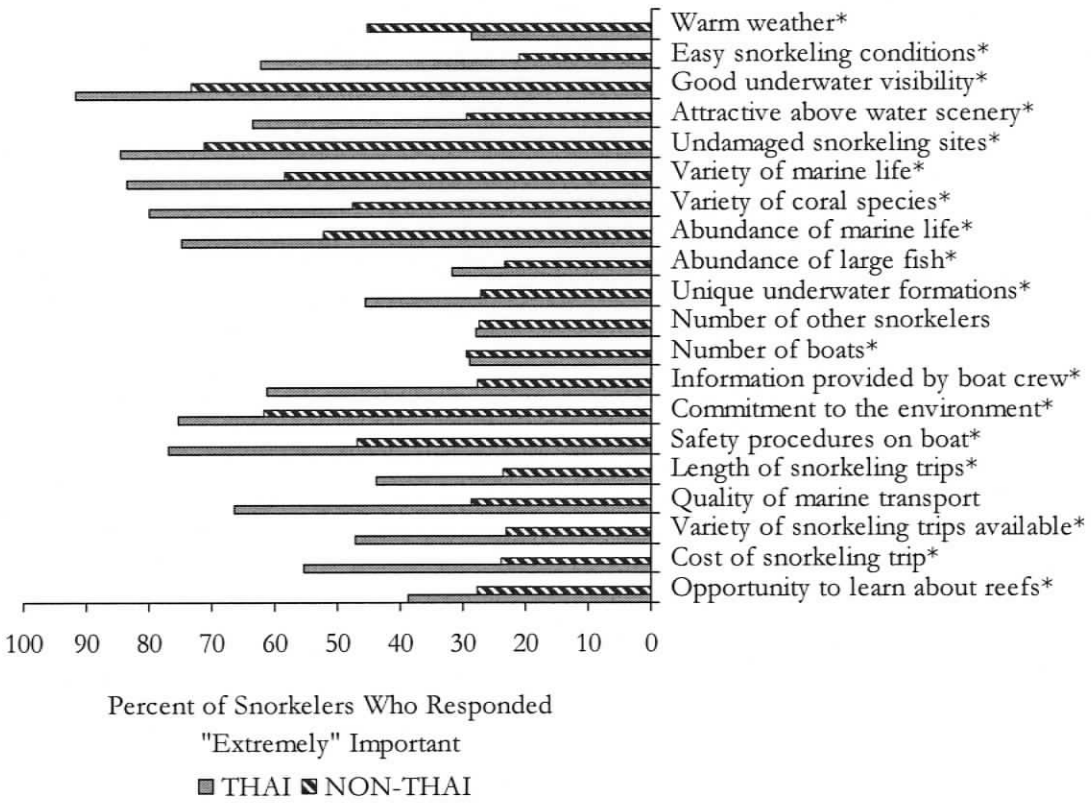
5.3 DISAGGREGATE RESULTS - THAI AND NON-THAI VISITORS

This section explores variation in Thai and Non-Thai visitors' evaluations of the physical, natural, managerial, and social conditions.

5.3.1 Visitors' Evaluation of the Importance of Day-Trip Conditions

Figure 5.12 shows the percentage of Thai and Non-Thai snorkelers who responded "extremely important" when asked to rate the level of importance of day trip conditions. In general, both Thai and Non-Thai respondents place a high level of importance on all day trip conditions, but in the main, a greater percentage of Thai respondents rate the natural and service conditions as "extremely" important. Both groups rate the importance of the social conditions similarly.

FIGURE 5.12 Comparison of Thai and Non-Thai Respondents' Evaluations of the Importance of Day-Trip Conditions (Q12, Q18) (Missing cases excluded; statistically significant differences are indicated by an asterisk.)



T-test results indicate that Thai and Non-Thai visitors vary significantly in terms of their evaluation of the importance of day trip conditions (Table 5.12). For both Thai and Non-Thai snorkelers, the natural conditions appear to be the most important condition items (i.e., the mean scores for the natural features are *generally* higher than those reported for other condition items), while the social conditions are rated as least important. There are statistically significant differences in the evaluations of the mean level of importance placed on 95% (19 out of 20) of the physical, natural, social, and managerial condition items respondents were asked to rate. With the exception of 'warm weather', mean results indicate that Thais place a greater level of importance on all day trip conditions compared with Non-Thais. Thai snorkelers place a higher level of importance on the following condition items:

- Easy snorkeling conditions
- Good underwater visibility
- Attractive above water scenery
- Undamaged snorkeling sites
- Variety of marine life
- Variety of coral species
- Abundance of marine life
- Abundance of large fish
- Unique underwater formations
- Number of boats
- Information provided by boat crew
- Commitment to the environment by boat crew
- Safety procedures on board the boat
- Length of snorkeling trips
- Quality of marine transportation services
- Variety of snorkeling trips available
- Cost of snorkeling trip
- Opportunity to learn about coral reefs

Interestingly, Thai and Non-Thai snorkelers do not vary significantly in their evaluation of the importance of the number of other snorkelers, but there are statistically significant differences between the two groups with respect to the level of importance attached to the number of boats at the snorkeling sites.

TABLE 5.12 Comparison of Visitors' Evaluations of the Importance of Day-Trip Conditions: A Comparison of Thai and Non-Thai Visitors[a]

Condition items	THAI		NON-THAI		Mean diff.	t	*df*	Sig*
	Mean	SD	Mean	SD				
Physical conditions (Q12)								
Warm weather	3.8	1.19	4.2	1.02	-0.43	-5.05	682	**.000***
Easy snorkeling conditions	4.4	0.93	3.7	1.14	0.75	9.34	680	**.000***
Good underwater visibility	4.9	0.39	4.7	0.64	0.22	5.45	683	**.000***
Natural conditions (Q12)								
Attractive above water scenery	4.5	0.86	3.7	1.23	0.76	9.33	679	**.000***
Undamaged snorkeling sites	4.8	0.57	4.6	0.73	0.17	3.47	683	**.001***
Variety of marine life	4.8	0.57	4.5	0.76	0.31	5.90	685	**.000***
Variety of coral species	4.7	0.60	4.3	0.90	0.46	7.80	685	**.000***
Abundance of marine life	4.7	0.65	4.3	0.95	0.38	6.04	676	**.000***
Abundance of large fish	3.7	1.24	3.5	1.27	0.24	2.50	678	**.013***
Unique underwater formations	4.1	1.05	3.7	1.20	0.46	5.22	673	**.000***
Social conditions (Q12)								
Number of snorkelers	3.5	1.36	3.3	1.49	0.20	1.84	677	.066
Number of boats	3.6	1.25	3.4	1.44	0.26	2.49	679	**.013***
Service conditions (Q18)								
Information provided by crew	4.5	0.79	3.7	1.20	0.80	10.32	691	**.000***
Commitment to the environment	4.7	0.59	4.4	0.97	0.32	5.16	691	**.000***
Safety procedures on boat	4.7	0.64	4.1	1.12	0.62	8.78	689	**.000***
Length of snorkeling trips	4.3	0.78	3.8	0.99	0.45	6.56	690	**.000***
Quality of marine transportation	4.6	0.65	3.8	1.12	0.82	11.61	689	**.000***
Variety of snorkeling trips	4.2	0.94	3.7	1.07	0.49	6.36	687	**.000***
Cost of snorkeling trip	4.3	0.97	3.7	1.15	0.62	7.64	690	**.000***
Opportunity to learn about coral reefs (Q22)	4.0	1.02	3.7	1.18	0.33	4.00	697	**.000***

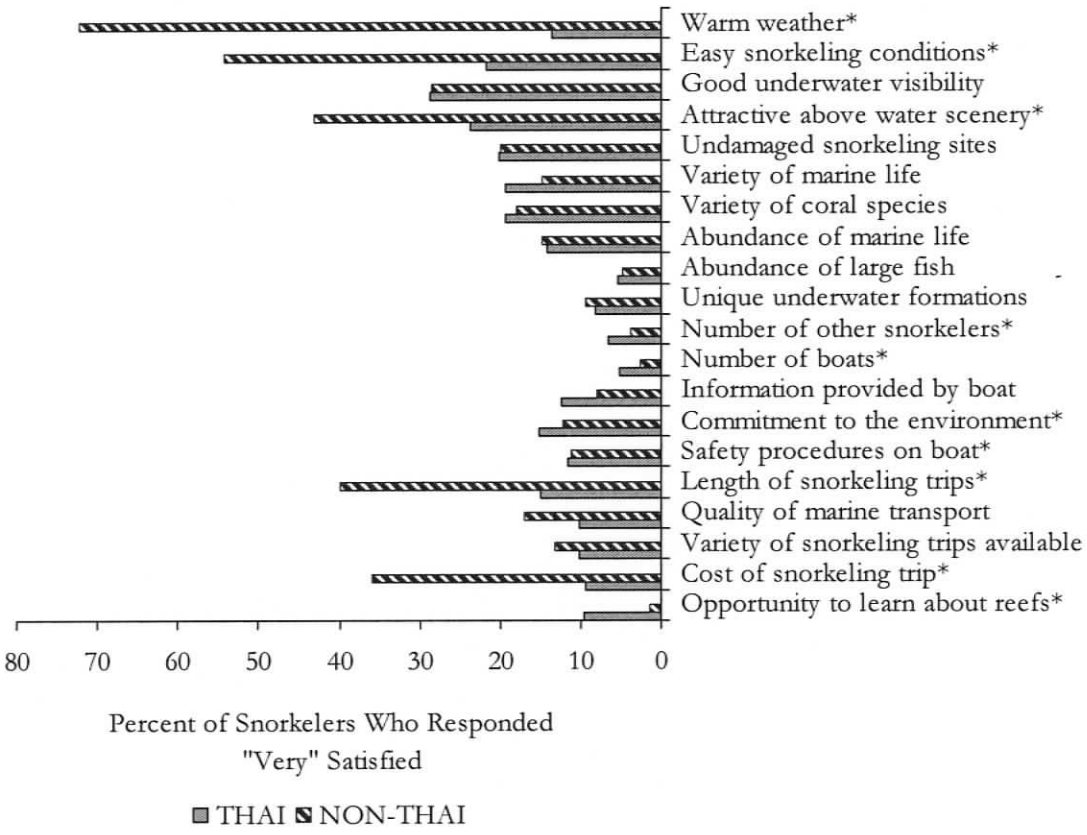
[a] Recoded response categories ranged from 1= "not at all important", 2= "slightly important", 3= "not sure", 4= "quite important", 5= "extremely important"
*Significant at $p < 0.05$ (2 tailed t-test)

5.3.2 Visitors' Satisfaction with Day-Trip Conditions

Thai and Non-Thai visitors also vary in terms of their evaluation of their satisfaction with day trip conditions. Figure 5.13 shows the percentage of Thai and Non-Thai snorkelers who responded "very satisfied" when asked to rate their satisfaction with day trip conditions. Satisfaction levels are generally low for both Thai and Non-Thai snorkelers. In the main, a greater percentage of Thai respondents are "very" satisfied with the social conditions, while a greater percentage of Non-Thai respondents are "very" satisfied with the physical and service conditions, with the exception of the opportunity to learn about coral reefs. One

percent of Non-Thai respondents rate the opportunity to learn about reefs as "very good", compared with 9.5% of Thai respondents. No generalizations can be made about the natural conditions, as both Thai and Non-Thai groups responded similarly.

FIGURE 5.13 Comparison of Thai and Non-Thai Respondents' Satisfaction with Day-Trip Conditions (Q14, Q19, Q20) (Missing cases excluded; statistically significant differences are indicated by an asterisk.)



Differences in mean values between Thai and Non-Thai visitors were examined using t-tests (Table 5.13). Statistically significant differences between the two groups are reported for 11 out of 20 (55%) of the condition items. Generally, Thai snorkelers are more satisfied with the social conditions, and Thai and Non-Thai snorkelers feel similarly satisfied with the natural conditions; generalizations cannot be made for evaluations of the physical or service conditions.

TABLE 5.13 Comparison of Visitors' Satisfaction With Day-Trip Conditions: A Comparison of Thai and Non-Thai Visitors[a]

Condition items	THAI		NON-THAI		Mean diff.	t	*df*	Sig*
	Mean	SD	Mean	SD				
Physical conditions (Q14)								
Warm weather	3.6	0.86	4.5	0.99	-0.83	-11.83	688	**.000***
Easy snorkeling conditions	3.9	0.83	4.3	0.98	-0.38	-5.47	688	**.000***
Good underwater visibility	3.9	0.97	3.8	1.05	0.11	1.38	685	.165
Natural conditions (Q14)								
Attractive above water scenery	3.9	0.85	4.1	0.96	-0.22	-3.16	681	**.002***
Undamaged snorkeling sites	3.7	0.98	3.5	1.07	0.15	1.92	687	.055
Variety of marine life	3.6	1.04	3.6	0.96	0.02	0.30	688	.765
Variety of coral species	3.6	1.03	3.6	0.99	0.01	0.16	675	.874
Abundance of marine life	3.5	1.01	3.5	0.94	-0.07	-0.99	671	.323
Abundance of large fish	2.7	1.06	2.9	0.95	-0.13	-1.66	686	.098
Unique underwater formations	3.2	0.98	3.2	0.94	-0.15	-0.23	674	.839
Social conditions (Q14)								
Number of snorkelers	3.1	0.98	2.4	1.00	0.70	9.29	684	**.000***
Number of boats	3.1	0.90	2.4	0.95	0.69	9.70	685	**.000***
Overall satisfaction (Q15)	3.8	0.92	3.8	1.11	-0.03	-0.38	692	.700
Service conditions (Q19)								
Information provided by crew	3.4	1.08	2.7	1.20	0.77	8.83	683	**.000***
Commitment to the environment	3.5	1.07	3.1	1.15	0.41	4.80	681	**.000***
Safety procedures on boat	3.3	1.11	3.1	1.04	0.17	2.06	682	**.040***
Length of snorkeling trips	3.7	0.90	4.1	0.84	-0.47	-7.08	658	**.000***
Quality of marine transportation	3.5	0.89	3.6	0.94	-0.06	-0.90	678	.370
Variety of snorkeling trips	3.3	0.96	3.4	0.91	-0.07	-1.01	661	.312
Cost of snorkeling trip	3.3	0.95	4.0	0.96	-0.64	-8.73	673	**.000***
Opportunity to learn about coral reefs (Q22)[b]	3.3	1.00	2.4	1.02	0.94	12.32	693	**.000***
Overall satisfaction (Q20)	2.2	0.90	3.8	0.96	-1.55	-21.5	674	**.000***

[a]Response categories ranged from 1= "very unsatisfied", 2= "somewhat unsatisfied", 3= "neutral", 4= "somewhat satisfied", 5= "very satisfied"

[b]Response categories ranged from 1= "very poor", 2= "poor", 3= "not sure", 4= "good", 5= "very good"

*Significant at $p < 0.05$ (2 tailed t-test)

Non-Thai snorkelers are more satisfied with:

- Warm weather
- Easy snorkeling conditions
- Attractive above-water scenery
- Length of snorkeling trip
- Cost of the snorkeling trip

Thai snorkelers are more satisfied with:

- Number of other snorkelers
- Number of boats
- Information provided by boat crew
- Commitment to the environment by boat crew
- Safety procedures on board the boat
- Opportunity to learn about coral reefs

Differences between Thai and Non-Thai respondents' mean evaluation of overall satisfaction with the physical, natural, and social condition items and overall satisfaction with service condition items were examined using t-tests (Table 5.13). There are significant differences in mean scores between Thai and Non-Thai respondents' evaluation of overall satisfaction with service condition items; Non-Thai respondents are more satisfied overall with the managerial conditions than are Thai respondents.

Visitors were asked if they would be willing to return to Koh Chang for snorkeling based on the quality of the coral reef environment (Table 5.14). Chi-square tests indicate that there are significant differences between Thai and Non-Thai snorkelers, with 85.7% (n=287) of Thai snorkelers responding "yes", compared with 61.6% (n=220) of Non-Thai snorkelers (χ^2=51.0, df=1, p=.000). Thai respondents were also more willing to recommend snorkeling to other tourists visiting Koh Chang (Table 5.14) (χ^2=11.7, df=1, p=.001).

TABLE 5.14 Respondents' Willingness to Return to Koh Chang and Recommend Snorkeling to Other Tourists: A Comparison of Thai and Non-Thai Snorkelers
(Missing cases excluded)

	Response (%)				
	THAI	NON-THAI	Sig*	χ^2	*df*
Willingness to return?					
Yes	85.7	61.6	**.000***	51.02	1
No	14.3	38.4			
Willingness to recommend snorkeling?					
Yes	90.7	81.7	**.001***	11.70	1
No	9.3	18.3			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

PART B: IMPORTANCE-PERFORMANCE ANALYSIS

5.4 AGGREGATE RESULTS

5.4.1 I-P Grids for the Physical, Natural, and Social Conditions

Table 5.15 summarizes mean importance and satisfaction scores for the physical, natural, and social condition items. Plotting the means of the 12 condition items into two-dimensional space places all of the attributes in quadrants A (concentrate here) and B (area of satisfaction) (Figure 5.14).[2]

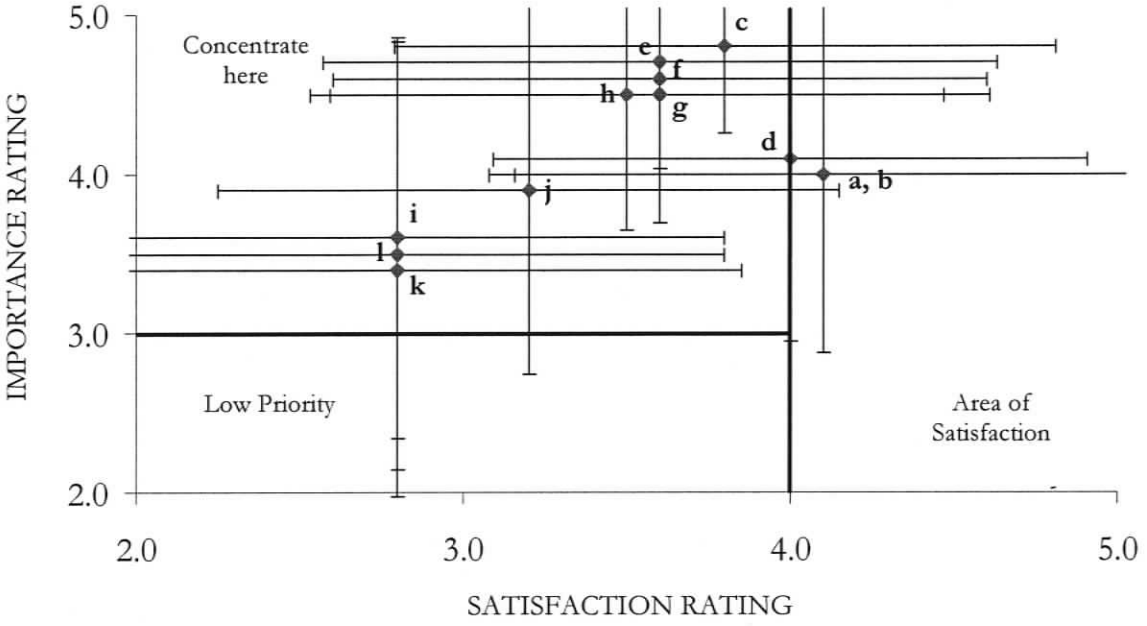
TABLE 5.15 Importance – Satisfaction Mean Values and Standard Deviations
(Missing cases excluded)

Condition Items	Mean Importance Ratings[1]	SD	Mean Satisfaction Ratings[2]	SD
Physical, Natural, Social conditions				
Warm weather	4.0	1.12	4.1	1.02
Easy snorkeling conditions	4.0	1.12	4.1	0.94
Good underwater visibility	4.8	0.54	3.8	1.01
Attractive above water scenery	4.1	1.15	4.0	0.91
Undamaged snorkeling sites	4.7	0.67	3.6	1.03
Variety of marine life	4.6	0.70	3.6	1.00
Variety of coral species	4.5	0.81	3.6	1.01
Abundance of marine life	4.5	0.85	3.5	0.97
Abundance of large fish	3.6	1.26	2.8	1.00
Unique underwater formations	3.9	1.16	3.2	0.95
Number of other snorkelers	3.4	1.43	2.8	1.05
Number of boats	3.5	1.36	2.8	1.00
Service conditions				
Information provided by boat crew	4.1	1.12	3.0	1.21
Commitment to the environment by boat crew	4.5	0.84	3.2	1.13
Safety procedures on boat	4.4	0.98	3.2	1.07
Length of snorkeling trip	4.1	0.93	3.9	0.90
Quality of marine transport services	4.2	1.01	3.6	0.92
Variety of snorkeling trips available	4.0	1.04	3.4	0.94
Cost of snorkeling trip	4.0	1.12	3.7	1.01
Opportunity to learn about coral reefs	3.1	0.81	2.9	1.11

[1] Importance response categories range from 1 "not at all important" to 5 "extremely important"
[2] Performance response categories ranged from 1 "very unsatisfied" to 5 "very satisfied"

[2] To focus on setting attributes that visitors feel are "quite" or "extremely" important, the importance crosshair was placed at a value of 3.0, while the performance crosshair was placed at 4.0 to identify features rated below "somewhat" satisfied. Refer to Chapter 2, Section 2.3.2 for a discussion of the I-P Analysis concept, and Chapter 3, Section 3.3.1 for a more detailed discussion of how the action grid was developed.

FIGURE 5.14 Importance-Satisfaction Grid for Physical, Natural, and Social Conditions (Missing cases excluded)



Legend

a	Warm weather
b	Easy snorkeling conditions
c	Good underwater visibility
d	Attractive above water scenery
e	Undamaged snorkeling sites
f	Variety of marine life
g	Variety of coral species
h	Abundance of marine life
i	Abundance of large fish
j	Unique underwater formations
k	Number of other snorkelers
l	Number of boats

Interpreting the importance-satisfaction matrix, the weather and snorkeling conditions are strengths in the visitor experience; these features were rated as both more important and more satisfying to visitors than other features of the snorkeling environment and experience. Areas where park managers and tour operators can concentrate on improving the visitor experience include all attributes that relate to the natural conditions (features labelled e through j), as well as the social conditions (features labelled k and l). These features were rated as both more important, and less satisfying to visitors. One attribute – attractive above

water scenery, did not fall firmly into a quadrant, and as a result no clear direction for management action can be offered.

5.4.2 I-P Grids for the Service Conditions

Plotting the means of the eight service condition items (Table 5.15) onto a two-dimensional matrix places all of the attributes into the quadrant of high importance-low satisfaction (quadrant A, concentrate here) (Figure 5.15). These results show that the service conditions in Koh Chang do not meet snorkelers' standards, and improvements to the quality of services offered should be a major priority for park managers and tour operators.

FIGURE 5.15 Importance-Satisfaction Grid for Service Conditions (Missing cases excluded)

Legend

m	Information provided by boat crew
n	Commitment to the environment by boat crew
o	Safety procedures on board the boat
p	Length of snorkeling trip
q	Quality of marine transportation services
r	Variety of snorkeling trips available
s	Cost of snorkeling trip
t	Opportunity to learn about coral reefs

5.4.3 Variability in Response

Since the action grids are constructed using the mean, or average satisfaction scores, it is reasonable to expect that many visitors will be more or less satisfied than indicated on the I-P grids. For example, Figure 5.14 shows that respondents consider attribute 'k' (the number of other snorkelers) lower in importance and lower in performance. However, approximately 34% of participants find this attribute more satisfying than the mean response, and 34% find this attribute less satisfying than the mean response. Management action based on results of the I-P analysis using only the information provided by the mean ratings of the visitors can displace visitors with different experiential requirements. Additionally, in the traditional I-P framework, attributes that fall a large distance from the axes are interpreted the same as attributes that land extremely close to the axes, and as a result, the framework may be categorizing an attribute with little confidence that it truly fits the category. In Figures 5.14 and 5.15, for example, attributes labelled "a", "b", "p", and "t" fall close to other quadrant boundaries.

An approach that incorporates a measure of statistical variance can greatly increase the validity of the I-P approach, and improve the confidence of correctly categorizing an attribute. Hammitt et al. (1996), for example, recommend constructing a "zone of tolerance" around the importance and satisfaction axes using one-half standard deviation around the means; features that fall within the zone of tolerance are not considered different from each other, nor interpreted. In this study, standard deviations around mean responses were used to incorporate variability in response. In Figures 5.14 and 5.15, the lines radiating horizontally for performance and vertically for importance represent plus or minus one standard deviation from the mean. When standard deviations are incorporated in the I-P analysis, 18 out of 20 attributes (90%) fall within two or more I-P quadrants (Table 5.16). For example, when a measure of statistical variance is included in the analysis, the social condition items (number of other snorkelers, number of boats) fall into the 'concentrate here' *and* 'low priority' quadrants. Some visitors rate this condition as high importance and low satisfaction, while other visitors rate the same condition as both low importance and low satisfaction, making it difficult to identify the appropriate management action. By including a measure of statistical variance in the analysis the results are more conservative, since variation in visitors' evaluations of the physical, natural, social, and service conditions is taken into consideration.

TABLE 5.16 Attributes With Overlapping I-P Quadrants[1]

		Quadrant without statistical variance included	Quadrant with statistical variance included[2]
a	Warm weather	B	A, B
b	Easy snorkeling conditions	B	A, B
c	Good underwater visibility	A	A, B
d	Attractive above water scenery	A, B	A, B, C
e	Undamaged snorkeling sites	A	A, B
f	Variety of marine life	A	A, B
g	Variety of coral species	A	A, B
h	Abundance of marine life	A	A, B
i	Abundance of large fish	A	A, C
j	Unique underwater formations	A	A, B, C
k	Number of other snorkelers	A	A, C
l	Number of boats	A	A, C
m	Information provided by boat crew	A	A
n	Commitment to the environment	A	A, B
o	Safety procedures on board the boat	A	A, B
p	Length of snorkeling trip	A	A, B, C
q	Quality of marine transportation services	A	A, B, C
r	Variety of snorkeling trips available	A	A
s	Cost of snorkeling trip	A	A, B, C
t	Opportunity to learn about coral reefs	A	A, B, C

[1] A – Concentrate management here; B – Area of satisfaction; C - Low priority for managers

Since the sample is not homogenous (i.e., there is a diversity of visitor characteristics that influence evaluations of setting conditions), the importance-satisfaction analysis at the aggregate level has limited utility. Efficacy of the I-P analysis can, however, be improved with market segmentation, since segmentation helps to account for the diversity that exists between groups. In the next two sections, segmentation is incorporated into the analysis to investigate how importance and satisfaction responses for different groups of visitors fall into quadrants in the I-P grid.

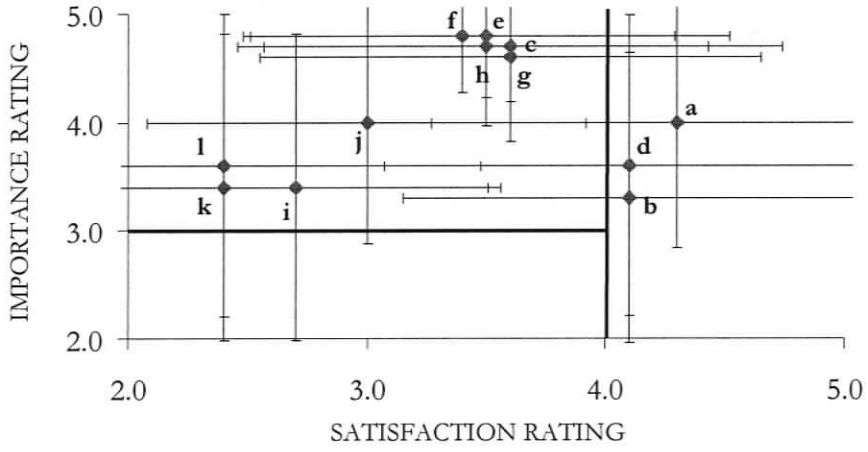
5.5 DISAGGREGATE RESULTS – HIGH, MEDIUM, AND LOW SPECIALIZED SNORKELERS

5.5.1 Segmented I-P Grids for the Physical, Natural, and Social Conditions

In Section 5.2 above, the aggregate sample was segmented into high, medium, and low specialized groups based on self-reported level of snorkeling skill. The analysis revealed differences among the groups with respect to mean importance and satisfaction scores for a range of physical, natural, and social conditions (Tables 5.9 and 5.10). Figure 5.16 illustrates these differences graphically using importance-satisfaction grids, and the legend in Table 5.17 compares how the attributes fall into the I-P quadrants by level of specialization.

FIGURE 5.16 Importance-Satisfaction Grids for Physical, Natural, and Social Conditions by Specialization Level (Missing cases excluded)

Figure 5.16a High Specialized Snorkelers



Legend

a	Warm weather
b	Easy snorkeling conditions
c	Good underwater visibility
d	Attractive above water scenery
e	Undamaged snorkeling sites
f	Variety of marine life
g	Variety of coral species
h	Abundance of marine life
i	Abundance of large fish
j	Unique underwater formations
k	Number of other snorkelers
l	Number of boats

Figure 5.16b Medium Specialized Snorkelers

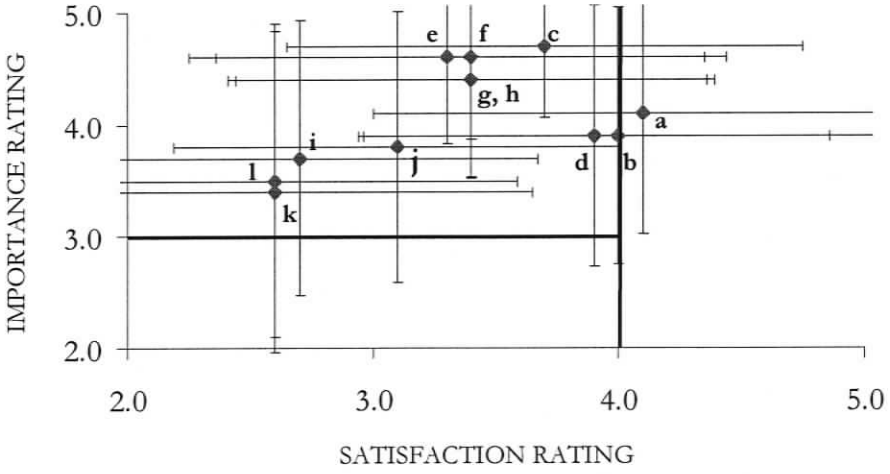
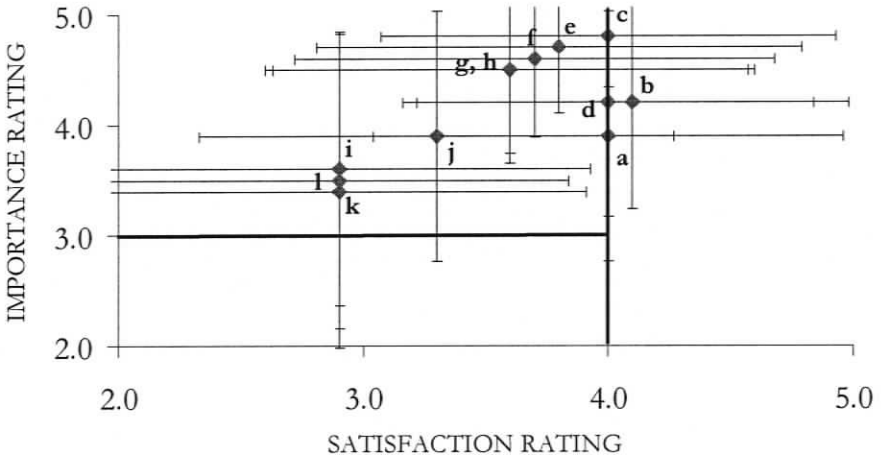


Figure 5.16c Low Specialized Snorkelers



Legend

a	Warm weather
b	Easy snorkeling conditions
c	Good underwater visibility
d	Attractive above water scenery
e	Undamaged snorkeling sites
f	Variety of marine life
g	Variety of coral species
h	Abundance of marine life
i	Abundance of large fish
j	Unique underwater formations
k	Number of other snorkelers
l	Number of boats

TABLE 5.17 Legend Indicating I-P Quadrants for Physical, Natural, and Social Conditions by Specialization Group

	Condition Items	I-P Quadrant HIGH	MEDIUM	LOW
a	Warm weather	Area of satisfaction	Area of satisfaction	Borderline
b	Easy snorkeling conditions	Area of satisfaction	Borderline	Area of satisfaction
c	Good underwater visibility	Concentrate here	Concentrate here	Borderline
d	Attractive above water scenery	Area of satisfaction	Concentrate here	Borderline
e	Undamaged snorkeling sites	Concentrate here	Concentrate here	Concentrate here
f	Variety of marine life	Concentrate here	Concentrate here	Concentrate here
g	Variety of coral species	Concentrate here	Concentrate here	Concentrate here
h	Abundance of marine life	Concentrate here	Concentrate here	Concentrate here
i	Abundance of large fish	Concentrate here	Concentrate here	Concentrate here
j	Unique underwater formations	Concentrate here	Concentrate here	Concentrate here
k	Number of other snorkelers	Concentrate here	Concentrate here	Concentrate here
l	Number of boats	Concentrate here	Concentrate here	Concentrate here

The segmented I-P grids show that:

- a majority of the natural (85%) conditions and social (100%) conditions are important yet performance is unsatisfactory;
- management action taken to improve the natural and social conditions will benefit high, medium, and low-specialized groups, although the same strategy will affect each group differently, given the location of attributes within the quadrants;
- for low specialized snorkelers, clear management direction cannot be offered for three attributes (a, b, d);
- high-specialized snorkelers are more satisfied with physical features of the snorkeling trip such as warm weather and easy snorkeling conditions;

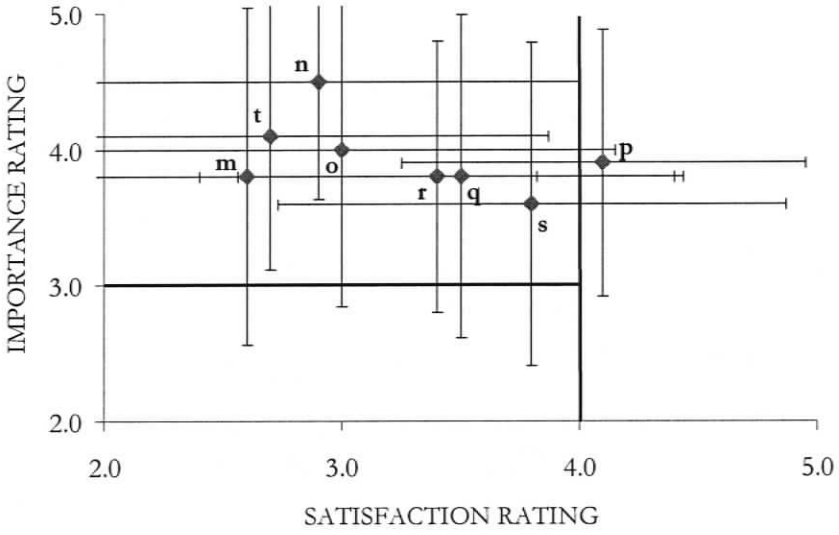
As reported in Section 5.2, there are significant differences among specialization groups with respect to mean importance and mean satisfaction ratings for a number of attributes. However, the segmented I-P grids do not recognize these differences in an obvious manner, as the variables that appear in the 'concentrate here' quadrant are the same for all sample groups (homogenous and segmented samples). The differences among specialization groups are apparent only when the relative location of attributes within the quadrants is examined.

5.5.2 Segmented I-P Grids for the Service Conditions

Figure 5.17 illustrates the segmented I-P grids for service condition items, and Table 5.18 compares how the service attributes fall into the I-P quadrants by level of specialization.

FIGURE 5.17 Importance-Satisfaction Grid for Service Conditions by Level of Specialization (Missing cases excluded)

Figure 5.17a High Specialized Snorkelers



Legend

m	Information provided by boat crew
n	Commitment to the environment
o	Safety procedures on board
p	Length of snorkeling trip
q	Quality of marine transport
r	Variety of trips available
s	Cost of snorkeling trip
t	Opportunity to learn about reefs

Figure 5.17b Medium Specialized Snorkelers

Figure 5.17c Low Specialized Snorkelers

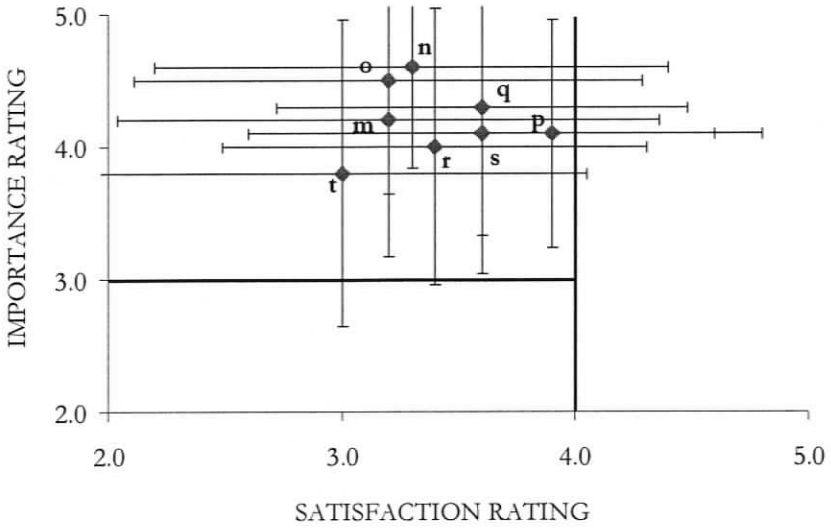


TABLE 5.18 Legend Indicating I-P Quadrants for Service Conditions by Specialization Group

	Condition Items	I-P Quadrant		
		HIGH	MEDIUM	LOW
m	Information provided by boat crew	Concentrate here	Concentrate here	Concentrate here
n	Commitment to the environment	Concentrate here	Concentrate here	Concentrate here
o	Safety procedures on board the boat	Concentrate here	Concentrate here	Concentrate here
p	Length of snorkeling trip	Area of satisfaction	Concentrate here	Concentrate here
q	Quality of marine transportation services	Concentrate here	Concentrate here	Concentrate here
r	Variety of snorkeling trips available	Concentrate here	Concentrate here	Concentrate here
s	Cost of snorkeling trip	Concentrate here	Concentrate here	Concentrate here
t	Opportunity to learn about coral reefs	Concentrate here	Concentrate here	Concentrate here

The segmented I-P grids for service conditions show that:

- a majority of the service condition items are important to visitors but performance is unsatisfactory;
- high, medium, and low-specialized snorkelers have similar expectations for the services provided, and all groups are not satisfied with the service conditions;
- with the exception of 'length of snorkeling trip', management action taken to improve the quality and variety of all services will appeal to high, medium, and low-specialized snorkelers;
- there are subtle differences between the I-P grids for high, medium, and low-specialized snorkelers. These differences relate to the position of service attributes within their respective quadrants;

- interpretation of the I-P grids constructed on the basis of specialization does not vary considerably from the I-P grid for the sample without segmentation.

5.5.3 Variability in Response

Not surprisingly, when a measure of statistical variance around mean ratings is included in the segmented I-P analysis, a number of condition items are forced into another quadrant (Table 5.19). For high- and low-specialized snorkelers respectively, variance in response forced 55% and 45% of the attributes into a second quadrant. Specialization does not account for all the variability in response reported for the sample without segmentation, and consequently, results for the segmented I-P grids should be interpreted with caution.

TABLE 5.19 Condition Items With Overlapping Quadrants[1]

		HIGH		MEDIUM		LOW	
		Quadrant without statistical variance	Quadrant with statistical variance	Quadrant without statistical variance	Quadrant with statistical variance	Quadrant without statistical variance	Quadrant with statistical variance
a	Warm weather	B	B, A	B	B, A	Borderline	A, B
b	Easy snorkeling conditions	B	B, A	Borderline	A, B	B	B, A
c	Good underwater visibility	A	A, B	A	A, B	Borderline	A, B
d	Attractive above water scenery	B	B, A	A	A, B, C	Borderline	A, B
e	Undamaged snorkeling sites	A	A, B	A	A, B	A	A, B
f	Variety of marine life	A	A, B	A	A, B	A	A, B
g	Variety of coral species	A	A, B	A	A, B	A	A, B
h	Abundance of marine life	A	A, B	A	A, B	A	A, B
i	Abundance of large fish	A	A, C	A	A, C	A	A, C
j	Unique underwater formations	A	A, C	A	A, C	A	A, B, C
k	Number of other snorkelers	A	A, C	A	A, C	A	A, C
l	Number of boats	A	A, C	A	A, C	A	A, C
m	Information provided by crew	A	A, C	A	A, C	A	A, B
n	Commitment to the environment	A	A	A	A, B	A	A, B
o	Safety procedures	A	A, C	A	A, B	A	A, B
p	Length of snorkeling trip	B	B, A	A	A, B, C	A	A, B
q	Quality of marine transportation	A	A, B, C	A	A, B	A	A, B
r	Variety of snorkeling trips	A	A, B, C	A	A, B	A	A, B, C
s	Cost of snorkeling trip	A	A, B, C	A	A, B, C	A	A, B
t	Opportunity to learn about reefs	A	A	A	A, B, C	A	A, B, C

[1] A – Concentrate management here; B – Keep up the good work; C – Area of satisfaction

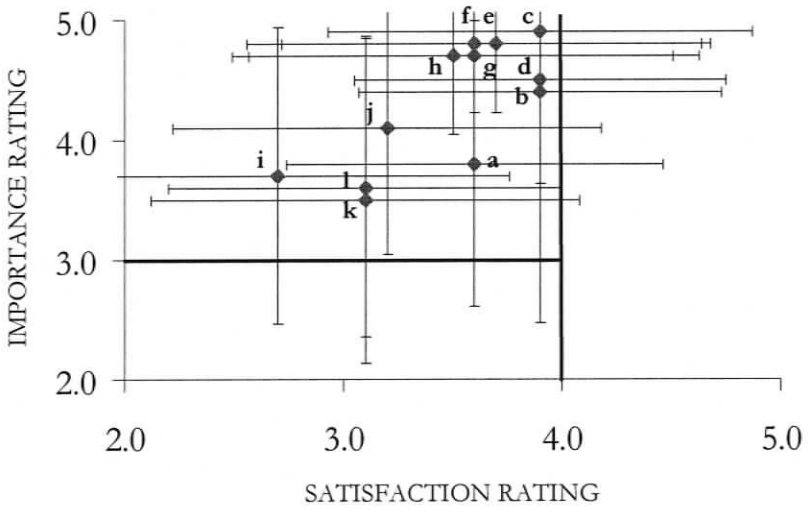
5.6 DISAGGREGATE RESULTS – THAI AND NON-THAI VISITORS

5.6.1 Segmented I-P Grids for the Physical, Natural, and Social Conditions

In Section 5.3 above, visitors were also segmented into groups on the basis of country of origin (Thai and Non-Thai), which was used as a proxy for culture. Differences between Thai and Non-Thai respondents' mean evaluations of the snorkeling conditions were reported for a number of attributes, and these results are represented visually in Figure 5.18. Table 5.20 compares the results in tabular form.

FIGURE 5.18 Importance-Satisfaction Grids for Physical, Natural, and Social Conditions by Country of Origin (Missing cases excluded)

Figure 5.18a Thai Snorkelers



Legend

- a Warm weather
- b Easy snorkeling conditions
- c Good underwater visibility
- d Attractive above water scenery
- e Undamaged snorkeling sites
- f Variety of marine life
- g Variety of coral species
- h Abundance of marine life
- i Abundance of large fish
- j Unique underwater formations
- k Number of other snorkelers
- l Number of boats

Figure 5.18b Non-Thai Snorkelers

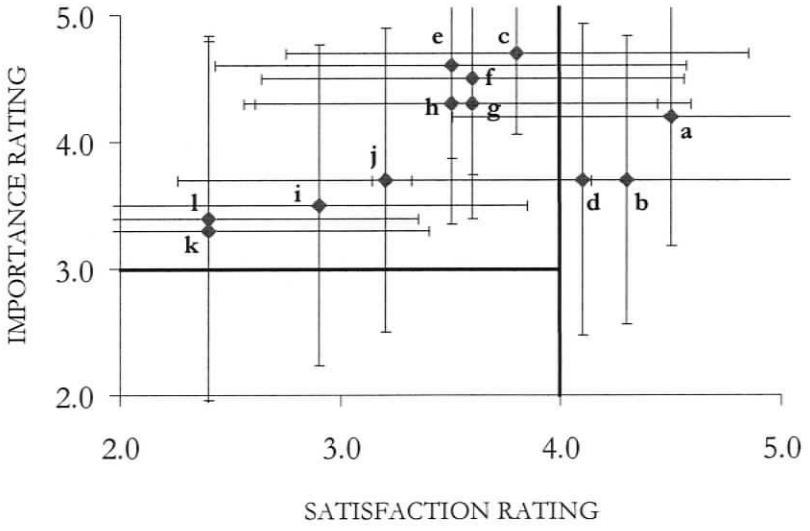


TABLE 5.20 Legend Indicating I-P Quadrants for Physical, Natural, and Social Conditions by Country of Origin

		I-P Quadrant	
	Condition Items	**THAI**	**NON-THAI**
a	Warm weather	Concentrate here	Area of satisfaction
b	Easy snorkeling conditions	Concentrate here	Area of satisfaction
c	Good underwater visibility	Concentrate here	Concentrate here
d	Attractive above water scenery	Concentrate here	Area of satisfaction
e	Undamaged snorkeling sites	Concentrate here	Concentrate here
f	Variety of marine life	Concentrate here	Concentrate here
g	Variety of coral species	Concentrate here	Concentrate here
h	Abundance of marine life	Concentrate here	Concentrate here
i	Abundance of large fish	Concentrate here	Concentrate here
j	Unique underwater formations	Concentrate here	Concentrate here
k	Number of other snorkelers	Concentrate here	Concentrate here
l	Number of boats	Concentrate here	Concentrate here

The segmented I-P grids show that:

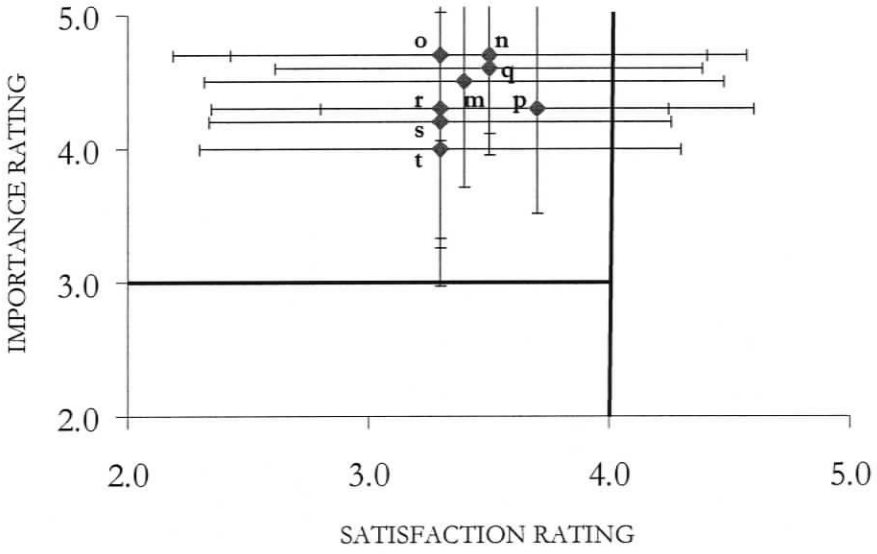
- an overwhelming majority of the physical, natural, and social condition items are important to visitors, but performance is unsatisfactory;
- both Thai and Non-Thai snorkelers have similar expectations for their snorkeling experience, and both groups report low levels of satisfaction;
- management action taken to improve the quality of the natural environment (condition items e through l) will appeal to both Thai and Non-Thai respondents, although specific management actions will affect each group differently;
- non-Thai respondents were less satisfied than Thai Respondents with the temperature experienced while snorkeling and the snorkeling conditions, suggesting that tour operators catering to foreigners' needs should pay closer attention to the physical conditions before embarking on a snorkeling trip;
- interpretation of the I-P grids constructed on the basis of country of origin does not differ appreciably from interpretation of the I-P grid for the sample without segmentation. With the exception of Non-Thai respondents' importance-satisfaction ratings for attributes 'a', 'b', and 'd', the same suite of attributes fall into the 'concentrate here' quadrant at the aggregate and disaggregate level. However, important differences between groups are revealed when the location of attributes within quadrants is examined.

5.6.2 Segmented I-P Grids for the Service Conditions

Figure 5.19 illustrates the segmented I-P grids for service condition items, and Table 5.21 compares how the service attributes fall into the I-P quadrants by country of origin.

FIGURE 5.19 Importance-Satisfaction Grids for Service Conditions by Country of Origin (Missing cases excluded)

Figure 5.19a Thai Snorkelers



Legend

- m Information provided by boat crew
- n Commitment to the environment
- o Safety procedures on board the boat
- p Length of snorkeling trip
- q Quality of marine transportation services
- r Variety of snorkeling trips available
- s Cost of snorkeling trip
- t Opportunity to learn about coral reefs

Figure 5.19b Non-Thai Snorkelers

TABLE 5.21 Legend Indicating I-P Quadrants for Service Conditions by Country of Origin

		I-P Quadrant	
Condition Items		**THAI**	**THAI**
m	Information provided by boat crew	Concentrate here	Concentrate here
n	Commitment to the environment	Concentrate here	Concentrate here
o	Safety procedures on board the boat	Concentrate here	Concentrate here
p	Length of snorkeling trip	Concentrate here	Area of satisfaction
q	Quality of marine transportation services	Concentrate here	Concentrate here
r	Variety of snorkeling trips available	Concentrate here	Concentrate here
s	Cost of snorkeling trip	Concentrate here	Borderline
t	Opportunity to learn about coral reefs	Concentrate here	Concentrate here

The segmented I-P grids show that:

- Thai visitors generally rate all service conditions as more important than do Non-Thai visitors, while Non-Thai visitors rate all service conditions as less satisfying;
- Thai respondents rate each service conditions similarly, as shown by the cluster of service attributes between 4.0-5.0 on the importance scale, and 3.0-4.0 on the satisfaction scale;
- management action taken to improve the quality and variety of services offered will appeal to both Thai and Non-Thai respondents, although in different ways.
- the I-P grids for the sample without segmentation does not look very different from the I-P grids constructed on the basis of country of origin, i.e., the interpretation of findings is similar since virtually the same attributes appear in the "concentrate here" quadrant. The location of attributes *within* the I-P quadrants, however are very different for Thai and Non-Thai visitors.

5.6.3 Variability in Response

Since the action grids are constructed using the mean, or average satisfaction scores, it is reasonable to expect that many Thai and Non-Thai visitors will be more or less satisfied than indicated on the segmented I-P grids. When a measure of statistical variance is included in the segmented I-P analysis, the management action required becomes fuzzy for a number of attributes (Table 5.22). For both Thai and Non-Thai groups, all of the attributes fall into a second quadrant when variance around the mean responses is included.

TABLE 5.22 Condition Items With Overlapping Quadrants[1]

		THAI		NON-THAI	
		Quadrant without statistical variance	Quadrant with statistical variance[2]	Quadrant without statistical variance	Quadrant with statistical variance[2]
a	Warm weather	A	A, B, C	B	B, A
b	Easy snorkeling conditions	A	A, B, C	B	B, A
c	Good underwater visibility	A	A, B	A	A, B
d	Attractive above water scenery	A	A, B	B	B, A
e	Undamaged snorkeling sites	A	A, B	A	A, B
f	Variety of marine life	A	A, B	A	A, B
g	Variety of coral species	A	A, B	A	A, B
h	Abundance of marine life	A	A, B	A	A, B
i	Abundance of large fish	A	A, C	A	A, C
j	Unique underwater formations	A	A, B	A	A, B, C
k	Number of other snorkelers	A	A, B, C	A	A, C
l	Number of boats	A	A, C	A	A, C
m	Information provided by boat crew	A	A, B	A	A, C
n	Commitment to the environment	A	A, B	A	A, B
o	Safety procedures on board the boat	A	A, B	A	A, B
p	Length of snorkeling trip	A	A, B	B	B, A
q	Quality of marine transportation	A	A, B	A	A, B, C
r	Variety of snorkeling trips available	A	A, B	A	A, B, C
s	Cost of snorkeling trip	A	A, B	Borderline	A, B
t	Opportunity to learn about reefs	A	A, B	A	A, C

[1] A – Concentrate management here; B – Area of satisfaction; C - Low priority for managers

5.6 Summary and Discussion of Major Findings

This chapter sought to develop an understanding of the elements of the snorkeling experience that contribute to visitor satisfaction by first measuring the relative importance of the various physical, natural, managerial, and social conditions, and then measuring satisfaction with actual conditions experienced. Diversity in the range of recreational opportunities that visitors seek was identified by segmenting the sample into smaller, more homogenous sub-groups on the basis of specialization and culture, and indicators of setting conditions that require attention from park managers and tour operators were identified using Importance-Performance (I-P) Analysis (Martilla & James, 1977). In this last section, major research findings are summarized, along with a discussion of the implications for park managers and tourism providers.

Condition items that have the greatest potential to add to or detract from visitor experiences are related to the quality of the natural environment.

In general, respondents indicate a high degree of importance for each physical, natural, and social condition item, with at least 50% of the sample rating each condition item as "quite" or "extremely" important. The most influential condition items to visitors' snorkeling experiences relate to the physical (underwater visibility) and natural (undamaged snorkeling sites, variety of marine life, variety of coral species, abundance of marine life) conditions.

These findings are similar to those reported by Bennett (2002), Roman (2004), and Shafer et al. (1998) (Table 5.23), although comparisons should be made with caution, as these studies differ in the condition items measured. Generally, features related to the physical and natural conditions are rated as most important by both divers and snorkelers in all four studies. Interestingly, the number of other people, an indicator that has frequently been used in social carrying capacity studies in LAC planning, was rated among the least important influences in this study, and the social conditions were also some of the least influential items on snorkelers' experiences in the study conducted by Shafer et al. (1998). The number of other users encountered is important for divers (Bennett, 2002; Davis, Banks, & Davey, 1996; Derrin et al., 1995; Dixon et al., 1993; Kenchington, 1990), and in terrestrial environments, the opportunity to visit un-crowded destinations is of critical importance (e.g., see Hollenhorst & Gardner, 1994; Manning, 1986; Roggenbuck et al. 1993).

TABLE 5.23 The Most, and Least Important Physical, Natural, and Social Condition Items Reported in Related Studies

This study	**Bennett (2002)**[a] Study of Divers in Phuket, Thailand	**Roman, 2004**[b] Study of snorkelers in Koh Chang, Thailand	**Shafer et al., 1998c** Study of snorkelers in the GBR
TOP 5			
Good underwater visibility	Variety and amount of marine life	Clear water	Types of fish I saw
Undamaged snorkeling sites	Clear unpolluted dive sites	Fish	Size of the coral I saw
Variety of marine life	Undamaged dive sites	Coral	Total amount of coral I saw
Variety of coral species	Good underwater visibility	Variety of fish types	Number of different kinds of coral
Abundance of marine life	Good weather	Variety of coral colours	Colour of the fish I saw
BOTTOM 5			
Warm weather	Other sharks	Variety of coral shapes	Number of people snorkeling
Unique underwater formations	Unique formations	Sandy beaches	Currents in the water around the reef
Abundance of large fish	Good above water scenery	Underwater rock formations	Number of people on the pontoon
Number of boats	Easy dive conditions	Uninhabited islands	Amount of wind
Number of other snorkelers	Good photo opportunities	Rocky coastlines	Number of human-made objects in the water

[a] Divers were asked to rate 16 environment and setting features on a 5-point scale, where 1= not at all important, 5= extremely important. Divers were asked to evaluate environment and setting features related to the physical, natural, and social conditions.

[b] Snorkelers were asked to rate the importance of 11 biophysical features on a 5-point scale, where 1= not at all important, 5 = extremely important. Respondents were not asked to consider the social conditions using the same response format.

[c] Snorkelers were asked to rate the influence of 24 conditions on their experience using a 7-point scale, where 1= very negatively, 7= very positively. Condition items were related to the physical, natural, social, and managerial conditions. For purposes of comparison, this table pulled out the condition items that related to the physical, natural, and social conditions.

The managerial conditions are less important to visitors' experiences than are the physical and natural conditions. The opportunity to learn about coral reefs is the least important service condition item.

The managerial conditions are generally rated as less important than the natural conditions, but more important to visitors' snorkeling experiences than the social conditions. The most important service feature was the boat crew's commitment to the environment, and safety

procedures on board the boat. Visitors evaluated other service conditions similarly, with mean responses falling between 4.0 and 4.2, with the exception of interpretation services. By and large, respondents are indifferent about the importance of the opportunity to learn about coral reefs, rating this service condition slightly above neutral (mean=3.1 out of 5). This finding is somewhat surprising, and departs from results reported by other authors who have examined visitors' evaluations of the importance of education and interpretation in marine environments (e.g., see Luck, 2003; Shafer et al., 1998). In the study of snorkelers by Shafer & Inglis (2000), for example, the two most influential service features on visitors' enjoyment of their snorkeling experiences were related to the opportunity to learn about nature, and the opportunity to learn about a coral reef. Similarly, in Saltzer's (2002) study, the importance of learning about nature was identified as a highly influential factor on visitors' satisfaction with their reef experiences, and in Bennett's (2002) study, 90% of divers rated the information provided by the dive master as "very" or "extremely" important (mean=4.3 on a scale of 1-5, where 1=not at all important and 5=extremely important). More research is needed to determine why visitors in Koh Chang evaluate the importance of interpretation services differently from reef visitors in other locations, but perhaps visitors in this study are more concerned with the snorkeling environment than they are with the snorkeling experience. It should be noted that there is considerable variability around the mean importance rating (SD=1.11), indicating that for some visitors, the opportunity to learn is an important aspect of the snorkeling experience.

Visitors report low levels of satisfaction with the physical, natural, and social conditions experienced.

The level of visitor satisfaction with day trip conditions is quite low, as less than 50% of the sample are "very satisfied" with each of the 12 physical, natural, and social condition items. Less than one-fifth of respondents are "very satisfied" with the quality of the natural environment (variety of coral species, variety of marine life, abundance of marine life, unique underwater formations, abundance of large fish), and conditions relating to the number of boats and other snorkelers received the largest proportion of negative responses (less than 10% were "very satisfied" with the social conditions). Items related to the physical conditions (weather and sea state conditions) are generally rated the highest (these condition items scored an average of between 3.8-4.1). Visitors also reported low levels of overall

satisfaction with the physical, natural, and social day-trip conditions - only 25% are "very satisfied".

Results from this study help to identify features of the snorkeling environment and experience that are less satisfying for snorkelers, and these results should be considered in management objectives and future actions to ensure that environmental quality is maintained, and positive snorkeling experiences are provided. The natural conditions are very influential on visitors' evaluations of the quality of the snorkeling experience, and so park managers and tour operators should work hard to address condition items that can be manipulated by management intervention. For example, regulations that prohibit or limit commercial and recreational fishing could be enforced to protect the variety and abundance of marine life, and patterns of use could be altered to meet visitors' preferences for the number of other snorkelers and boats. Strategies for managing the environmental and social impacts of use are discussed in greater detail in chapters 6 and 7.

There are some similarities between these findings and those reported by Roman (2002) for snorkelers in Koh Chang (Table 5.24). Snorkelers in Roman's (2004) study were least satisfied with some aspects of the natural environment, including the variety of fish and coral (Table 5.24), and only 23% were "very satisfied" overall with their snorkeling trip. Similarly, respondents in Bennett's (2002) study in Phuket, Thailand were most satisfied with the weather, the snorkeling conditions (e.g., sea state, visibility), and the above water scenery, and least satisfied with conditions that related to the marine life (Table 5.24). However, divers in Bennett's (2002) study were more satisfied overall - 39% gave their trip a score of eight out of 10 or higher (where 1=very unsatisfied, 10=very satisfied).

Snorkelers in the Great Barrier Reef (GBR) and Malaysia were generally more satisfied with the natural conditions than were snorkelers in Koh Chang. Condition items that had the highest level of influence on snorkelers' enjoyment of reef trips in the GBR included the size of the corals, total amount of coral, number and different types of coral, and types of fish. These condition items received a mean score of at least six out of seven, where 1=very negative influence, and 7=very positive influence. The number of people on the boat, the number of people snorkelling, and the number of human-made objects in the water received the largest proportion of negative responses (Shafer & Inglis, 2000). In the study conducted by Saltzer (2002), features of the reef trip that were rated as "good" or "very" good by over 75% of reef visitors included the cleanliness of the environment, water

TABLE 5.24 The Most, and Least Satisfying Physical, Natural, and Social Condition Items Reported in Related Studies

This study	Bennett (2002)[a] Study of divers in Phuket, Thailand	Roman (2004)[b] Study of snorkelers in Koh Chang, Thailand	Shafer (2000)[c] Study of snorkelers in the GBR
TOP 5			
Warm weather	Warm weather	Clear water	Types of fish
Easy snorkeling conditions	Good weather	Sandy beaches	Size of corals
Attractive above water scenery	Variety and amount of marine life	Fish	Total amount of coral
Good underwater visibility	Good above water scenery	Uninhabited islands	Number of different types of coral
Undamaged snorkeling sites	Clear unpolluted dive sites	Rocky coastlines	Colour of fish
BOTTOM 5			
Abundance of marine life	Good photo opportunities	Variety of fish types	Currents in the water
Unique underwater formations	Other sharks	Coral	Amount of wind
Abundance of large fish	Turtles	Underwater rock formations	Number of people on the boat
Number of boats	Manta rays	Variety of coral shapes	Number of people snorkeling
Number of other snorkelers	Whale sharks	Variety of coral colours	Number of human-made objects

[a] Divers were asked to rate their level of satisfaction with 16 environment and setting features on a 5-point scale, where 1= very unsatisfied, 5= very satisfied. Divers were asked to evaluate environment and setting features related to the physical, natural, and social conditions. Rank is based on frequency distributions.

[b] Snorkelers were asked to rate their level of satisfaction with 11 biophysical features on a 5-point scale, where 1= very unsatisfied, 5 = very satisfied. Respondents were not asked to consider the social conditions using the same response format. Rank is based on mean response values.

[c] Snorkelers were asked to rate the level of influence condition items had on snorkelers enjoyment using a 7-point scale, where 1= very negative, 7=very positive. Snorkelers were asked to evaluate environment and setting features related to the physical, natural, and social conditions. Rank is based on mean response values.

quality, the fish, and the coral. The feature with the lowest rating (although still generally positive) was the marine life other than fish and coral (Saltzer, 2002). Respondents reported high levels of overall enjoyment, with 81% giving their trip a score of eight or higher out of 10. Ninety-eight percent of divers in Musa's (2002) study in Sipadan, Malaysia rated their experience as 'satisfied' or 'extremely satisfied'. Abundance and variety of marine life were considered to be central determinants of diver satisfaction, while dissatisfaction was mainly attributed to poor underwater visibility, crowding, and over-development on the island.

Overall, a comparison of results from this study with related studies does not reveal a clear, consistent pattern, with perhaps the exception of Roman's (2004) study of visitors to Koh Chang in 2002. Visitors from both studies generally reported low levels of overall satisfaction, and snorkelers also rated satisfaction with most individual condition items negatively (Table 5.25).

TABLE 5.25 Visitor Satisfaction with Natural Features of the Snorkeling Environment: A Comparison of 2002 and 2005 Visitors to Koh Chang

THIS STUDY		ROMAN (2004)	
Condition item	**Visitors responding "very" satisfied (%)**	**Condition item**	**Visitors responding "very" satisfied (%)**
Underwater visibility	28.1	Clear water	41.5
Variety of marine life	16.6	Variety of fish types	24.0
Variety of coral	18.4	Coral	21.4
Abundance of marine life	14.1	Large number of fish	26.4
Underwater formations	8.4	Underwater rock formations	11.5
Overall satisfaction	25.2	Overall satisfaction	23.1

Visitors report low levels of satisfaction with managerial features of the snorkeling trip.

Satisfaction scores for the managerial conditions are generally low, as less than 15% of respondents are "very satisfied" with five out of the seven service features, and only 13% are "very satisfied" overall with all seven service features. Respondents are most satisfied with the length and cost of the snorkeling trips, and least satisfied with the information provided by the boat crew and the safety procedures on board the boat. A majority of visitors are dissatisfied with the information provided, as only 5% of respondents evaluated the opportunity to learn about coral reefs as "very good". These findings help to identify aspects of the snorkeling experience that require attention from park managers and tourism providers to ensure quality of service and positive snorkeling experiences. Improvement of all service features would provide a snorkeling experience that is more enjoyable, and would contribute to the sustainability of the industry.

Levels of satisfaction with service trip features were much higher in Bennett's (2004) study, where, for example, 65% of divers were "very satisfied" with the information provided by the dive master (compared with 10% of snorkelers in this study), and over 50% were "very satisfied" with the commitment to the environment by boat crew and the safety procedures on board the boat (compared with 13% and 11% of snorkelers, respectively). Mean satisfaction ratings of service features were also higher in Saltzer's (2002) study of reef visitors to the Great Barrier Reef Marine Park. For example, 'information provided about the reef' and 'staff knowledge' received mean scores of 3.9 and 4.5 respectively (on a 5-point Likert scale), compared with 3.0 and 3.2 for this study. Service conditions also had a positive influence on snorkelers' enjoyment of reef trips in Shafer & Inglis's (2000) study. Results from these studies suggest that tourism providers in Koh Chang do not provide a level of service that is on par with other snorkeling locations in, and outside of Thailand.

A majority of visitors would be willing to return to Koh Chang for snorkeling and recommend snorkeling to other tourists.

More than 70% of respondents indicated a willingness to return to Koh Chang for snorkeling, and more than 85% are willing to recommend snorkeling to other tourists. A higher percentage of snorkelers (82%) in Roman's (2004) study indicated a willingness to provide tour companies with repeat business, while a slightly lower percentage (80%) of snorkelers were willing to recommend snorkeling to others visiting Koh Chang. The likelihood of repeat visits to Koh Chang for snorkeling is high when compared with results reported by Saltzer (2002): when visitors were asked if they would visit the Great Barrier Reef again, only 46% responded "yes, definitely".

In this study, a majority of visitors are willing to pay for the opportunity to snorkel again and recommend the activity to other tourists, despite low satisfaction scores for day trip conditions and low overall satisfaction scores. However, this finding should not be used to endorse the status quo for a number of reasons:

- visitors' thresholds for acceptable limits of environmental degradation, for example, may not have been reached, but if conditions are allowed to deteriorate, some visitors will be displaced to other parks;

- price point may have a significant influence on visitors' intent to return or willingness to make a recommendation. Visitors' may be willing to pay to snorkel in

Koh Chang again because the cost of a day-trip is quite low (approx. US$12.50), but fewer visitors might be willing to return if the price increased substantially, particularly if the conditions were allowed to deteriorate;

- twenty-seven percent of respondents indicated they would *not* be willing to return to Koh Chang and 14% would *not* make a recommendation. Tourism providers should be striving to maximize repeat business and cultivate a positive image to ensure sustainability of the industry, and inaction may not achieve this outcome; and

- there is a positive correlation between visitors' overall satisfaction with the physical, natural, and social conditions and their willingness to return and recommend snorkeling. Since visitors who are more satisfied are also more willing to pay to snorkel again and endorse the experience to other tourists, park managers and tour operators should take action to address aspects of the snorkeling experience that are not satisfying to visitors.

There is variability in respondents' evaluations of the importance of, and satisfaction with, day-trip conditions. This variability is explained, in part, by specialization.

Standard deviations around mean importance and satisfaction responses indicate that there is considerable variability in respondents' evaluations of the snorkeling conditions. This variability in response is partially explained when visitors are segmented into smaller, more homogeneous subgroups on the basis of specialization.

Research findings partially support the idea that individuals with different levels of specialization have different setting and management preferences. High specialized snorkelers placed a significantly higher level of importance on undamaged snorkeling sites, the variety of coral species, the abundance of marine life, and the opportunity to learn more about coral reefs. Generalists (visitors with less skill) rated the importance of easy snorkeling conditions, good underwater visibility, attractive above-water scenery, information provided by boat crew, safety procedures, length of trips, quality of marine transport, and cost of the recreation experience higher.

Bennett (2002) reported similar findings for high specialized divers in Phuket. Features that were significantly more important for high specialized divers were aspects of the dive experience that related to the natural conditions such as the presence of sharks and manta rays, while aspects of the physical and managerial conditions (good weather, warm water, good underwater visibility, easy dive conditions, guidance of dive staff), were

significantly more important to low specialized divers. For both studies, aspects of the marine environment (e.g., abundance and variety of marine life, etc.) increased in importance as specialization increased, while aspects of the trip experience (e.g., safety procedures on board the boat, sea state conditions, etc.) decreased in importance as specialization increased.

Satisfaction with day-trip conditions also varied among high, medium, and low specialized visitors. In general, satisfaction decreased as specialization increased. Low specialized snorkelers were significantly more satisfied overall with the physical, natural, and social conditions, and, with the exception of 'warm weather', low specialized snorkelers rated all individual satisfaction items more positively than high specialized snorkelers. There is also a significant relationship between specialization and overall satisfaction with service conditions, with mean satisfaction scores increasing as specialization increases. This might be expected since high specialized snorkelers placed a lower level of importance on service conditions, and therefore may have had lower expectations for performance. A significantly greater number of low specialized snorkelers are more willing to return to Koh Chang for snorkeling, and to make a recommendation to other tourists.

Bennett (2002), and Roman (2004) also examined the influence of specialization on visitors' satisfaction with day-trip conditions. Roman (2004) reported similar findings – intermediate/experienced snorkelers were less satisfied overall than novice snorkelers, and novice snorkelers were more likely to recommend snorkeling to others visiting Koh Chang. Bennett (2002) also found an inverse relationship between the level of diver specialization and satisfaction with the dive trip, and suggested that as the level of diver specialization increases, it becomes significantly more challenging for resource and industry mangers to provide a satisfying experience. A dive experience that is evaluated by a high specialized diver as "mediocre" may be considered extremely satisfying to a diver with little or no prior experience, and therefore no basis for comparison (Bennett, 2002). High specialized recreationists often have very specific ideals and the most demanding expectations, and therefore require a higher resource quality and a greater degree of 'wilderness' (i.e., few other users) to be satisfied (Bennett, 2002).

Findings reported here suggest that individuals with different levels of specialization differ in the attributes they identify as being most influential on their snorkeling experience, and they also differ in how they evaluate the actual conditions experienced. Park managers and tour operators will therefore need to provide for a range of opportunities to suit the

different experiences sought by visitors with different levels of specialization, as suggested by Dearden et al. (2006) for Phuket.

Variation in respondents' evaluations of the importance of, and satisfaction with, day-trip conditions is also related to culture.

Significant differences are apparent among Thai and Non-Thai respondents' evaluations of the importance of *all* day trip condition items, except for the number of other snorkelers. Warm weather is significantly more important for Non-Thai respondents, while Thai respondents rate the importance of all other 18 day-trip conditions as significantly more important. The research presented in this study is one of the first efforts to empirically examine the relationships among reef visitors' evaluations of the importance of day-trip conditions by individuals from different cultural backgrounds, and so no comparisons can be made with results from other studies.

Significant differences in satisfaction ratings between Thai and Non-Thai visitors support the idea that different cultural groups do not evaluate recreation experiences the same. Although mean satisfaction ratings for condition items are generally low for both Thai and Non-Thai visitors, response patterns are evident between the two groups with respect to the social conditions: Thai respondents rate satisfaction with the social conditions significantly higher. Thai respondents also rate several service conditions significantly higher, particularly interpretive-like services such as information provided by boat crew, safety procedures, and the opportunity to learn about coral reefs. Non-Thai visitors might rate these condition items as less satisfying because most tour boats do not have English speaking staff on board, making it difficult to communicate safety and interpretive information to passengers who speak a language other than Thai.

Non-Thai respondents are generally more satisfied with the physical conditions, rating their satisfaction with the weather and snorkeling conditions significantly higher. Both groups rate their satisfaction with the natural conditions similarly. Non-Thai respondents are more satisfied <u>overall</u> with the service conditions, but Thai visitors are more willing to return to Koh Chang based on the quality of the natural environment, and they are also more willing to recommend snorkeling to other tourists visiting Koh Chang. Results from this study indicate that culture appears to be a useful variable to differentiate visitors into more homogenous subgroups, given the differences between domestic and foreign visitors'

evaluations of the importance of, and satisfaction with, various physical, natural, social, and managerial conditions on snorkeling experiences.

The aggregate ratings in the importance-satisfaction grids indicate that a high level of action is needed to improve the quality of the visitor experience.

The aggregate importance and satisfaction grids for the natural, social, and service condition items favour a management strategy that requires a high level of action and resources, as 85% of the attributes fall into the "concentrate here" quadrant. These attributes are important to visitors, but low levels of satisfaction indicate that visitors are not pleased with the conditions experienced. The only attributes falling into the "area of satisfaction" quadrant are related to conditions that are generally difficult for tour operators to control, such as weather and sea state, although operators can decide whether or not to travel to reef sites when the physical conditions might make the trip uncomfortable for visitors.

One attribute – attractive above water scenery, fell on the crosshair that divides the "concentrate here" and "area of satisfaction" quadrants, making it difficult to identify a clear management strategy. Managers might want to assign this condition item to the "area of satisfaction" quadrant, since other attributes more clearly need attention, and it may not be easy for managers to influence the attractiveness of the above-water scenery.

The I-P quadrants highlighted many weaknesses of the snorkeling industry, which is unfortunate given the importance of this form of marine tourism to the local economy. Park managers and tourism providers have a great deal of work to do to improve the snorkeling environment and experience.

These findings are most easily compared to those reported by Bennett (2002), because the same approach was used to create the quadrants and locate the matrix crosshairs. For the physical, natural and social conditions, findings reported in Bennett's (2002) study were consistent with those reported here, as similar attributes of the dive experience fell into the "area of concern" quadrant (analogous to the "concentrate here" quadrant) (Table 5.26). Results for the I-P matrices for service conditions were quite different from those reported here - in Bennett's (2002) study, no service attributes fell into the "area of concern" with the exception of 'the opportunity to learn more about reef environments', indicating that the provision of trip services was a strength of the dive

tourism industry. The same cannot be said for Koh Chang, since all service attributes fell into the "concentrate here" quadrant (Table 5.26).

TABLE 5.26 A Comparison of I-P Results Across Related Studies

Condition item	THIS STUDY	BENNETT (2002)
Physical, Natural, Social Conditions		
Warm weather	Area of satisfaction	Area of satisfaction
Easy snorkeling conditions	Area of satisfaction	Area of satisfaction
Good underwater visibility	Concentrate here	Concentrate here
Attractive above water scenery	Concentrate here	Area of satisfaction
Undamaged (snorkeling) sites	Concentrate here	Concentrate here
Variety of marine life	Concentrate here	Concentrate here
Variety of coral species	Concentrate here	-
Abundance of marine life	Concentrate here	-
Abundance of large fish	Concentrate here	Concentrate here
Unique underwater formations	Concentrate here	Concentrate here
Number of other (snorkelers)	Concentrate here	Concentrate here (no crowding by other divers)
Number of boats	Concentrate here	-
Clear unpolluted dive sites	-	Concentrate here
Whale sharks	-	Concentrate here
Other sharks	-	Concentrate here
Manta rays	-	Concentrate here
Turtles	-	Concentrate here
Good photo opportunities	-	Area of caution
Service conditions		
Information provided by crew	Concentrate here	Area of satisfaction
Commitment to the environment	Concentrate here	Area of satisfaction
Safety procedures on board	Concentrate here	Area of satisfaction
Length of (snorkeling) trip	Concentrate here	-
Quality of marine transport	Concentrate here	-
Variety of (snorkeling) trips	Concentrate here	-
Cost of snorkeling trip	Concentrate here	-
Opportunity to learn about reefs	Concentrate here	Concentrate here
Accommodation on boat	-	Area of satisfaction
Food on boat	-	Area of satisfaction
Friendliness of boat crew	-	Area of satisfaction
Good dive master	-	Area of satisfaction
Good dive buddy	-	Area of satisfaction
Enjoyable dive group	-	Area of satisfaction
High quality of general service	-	Area of satisfaction
Additional activities (courses, shore trips, etc.)	-	Area of caution

Roman (2004) also used I-P matrices to visually compare visitors' importance and satisfaction ratings for a range of biophysical conditions. However, a different approach was used to create the quadrants and locate the crosshairs, and these differences may potentially contribute to similar attributes being allocated to very different quadrants. Roman (2004) placed the importance crosshair at 4.0 on a scale that ranged from 0-5, and the satisfaction crosshair at 1.0 (somewhat satisfied) on a scale that ranged from -2 to +2, and modified the grid by subdividing the "concentrate management here" quadrant into "major areas of concern" (mean satisfaction score <0.5) and "minor areas of concern" (mean satisfaction score >0.5). Methodological differences aside, several areas of concern were identified by Roman (2004) for snorkelers in Koh Chang including the variety of coral colours, the variety of coral shapes, the variety of fish types, and the large number of fish. These results complement those of this study.

In this study, incorporation of a measure of statistical variance in the I-P analysis demonstrated how variance in mean importance and satisfaction ratings can lead to misinterpretation and inaccurate and ineffective planning, unless steps are taken to account for differences among user groups. Ninety percent of the condition items were forced into a second quadrant when variance in response was plotted on the I-P grids.

If park managers and tour operators want to take a conservative approach, attributes that cross more than one quadrant can be excluded from management action (Tarrant & Smith, 2002). However, this strategy essentially maintains the status quo, and the recreation experience will continue to disappoint a number of visitors. Alternatively, overlapping attributes can be assigned a particular management strategy based on resource availability, customer input, and the ability of management to noticeably influence the condition in a positive manner. Park managers and tour operators should administer limited resources (time, money, and expertise) where they are most needed and where they will do the most good, both for the recreation experience of visitors, and the ecological integrity of the park.

The segmented I-P grids reveal subtle, yet important differences.

Results from other studies (e.g., Bruyere et al., 2002; Wade & Eagles, 2003) indicate that the level of confidence in assigning an attribute to a management strategy can be improved with segmentation. In this study, however, the end results of the I-P analysis do not change considerably when segmentation is incorporated. The aggregate ratings in importance-

satisfaction lead managers to follow virtually the same strategy as the segmented ratings. On the surface this appears to be an extremely valuable finding, as park managers and tour operators might, with confidence, apply a singular management strategy that will appease multiple user groups. But differences between high, medium, and low specialized, and Thai and Non-Thai groups exist (as illustrated in sections 5.2 and 5.3), and these differences cannot be ignored.

Users may be alienated or displaced as a result of following the aggregate-based results of the I-P analysis for a couple of reasons. First, the relative positioning of attributes within the quadrants is clearly different across sub-groups (Figures 5.18-5.21), indicating that radical management action applied to every snorkeling site could result in a significant *decrease* in levels of satisfaction for some visitors, quite possibly the majority. Second, there is no way to determine if expressed importance and satisfaction is based on a positive or negative attitude about an attribute. The number of other snorkelers, for example, can be considered important based on either favourable (i.e., a lower density of snorkelers is better) or unfavourable (i.e., a lower density of snorkelers is undesirable) reasons. I-P analysis traditionally assumes that expressed importance is based on a favourable evaluation, but this may not always be the case, making it difficult to know whether, for example, to increase or decrease levels of use.

The findings reported here have significant implications for how I-P results are interpreted. Traditionally, management action is dictated by the quadrants into which attributes fall. But results from this study suggest that researchers and park managers must also look at how the attributes *within* the I-P quadrants differ across visitor segments. Management actions that ignore "within-quadrant" differences will produce results that alienate and displace visitors, and misallocate funds.

More detailed information about visitors' evaluations of the snorkeling conditions (e.g., perceptions of crowding) can enhance interpretation of I-P results, but in the absence of more information, managers should seek to provide a variety of snorkeling experiences and environments, as also suggested by Dearden et al. (2006) and Shafer & Inglis (2000). The basic assumption underlying the Recreation Opportunity Spectrum (ROS) framework is that quality in outdoor recreation is best assured through provision of a diverse set of opportunities, as a wide range of tastes and preference for recreational opportunities exists among the public (Clark & Stankey, 1979).

The I-P results provide valuable input to the selection of indicators for application of the Limits of Acceptable Change framework - but not all indicators are good indicators.

One of the objectives of this research was to take an initial step in applying the ROS and LAC frameworks by identifying indicators of snorkeling conditions that are of value to visitors. The I-P approach can be used as a tool to identify park management issues perceived to be the most important by visitors, and areas in which resource efforts need to be most concentrated. Attributes that fall within the 'concentrate here' quadrant, for example, can be used as indicators of setting conditions that park managers and tour operators should be concerned about. However, not all the attributes included in the visitor survey make "good" indicators. Chapter 2, Section 2.2.2, provided a list of criteria that can be used to evaluate the efficacy of an indicator. When these criteria are applied to the attributes that fall within the 'concentrate here' quadrant in Figures 5.16 and 5.17, the analysis suggests that some indicators are better than others (Table 5.27). The evaluation of merit is subjective, but nevertheless, it does provide a useful guide to the selection of a "few good" indicators.

Attributes related to the social conditions (the number of other snorkelers, the number of boats) may have the greatest potential as setting indicators, although the position of these condition items on the aggregate action grid shows that these indicators are generally the least important to visitors' experiences. These indicators are, however, important to the ecology of the area, as high levels of use can negatively impact the quality of the natural environment, an issue that is discussed in greater detail in the next chapter. Poor indicators include 'underwater visibility' and 'variety of coral species', since these conditions are not always correlated with human activities, and are not integrative (i.e., improvements will not greatly influence the condition of other attributes), responsive to change, or output oriented. These indicators are important to visitors, but preference should be given to indicators that meet a range of desired LAC criteria.

Application of the LAC planning framework requires selecting indicators that singly, or in combination, best reflect the conditions to be preserved or achieved in the area. The high scores for condition items listed in Table 5.27 suggest that most of the attributes that fall within the "concentrate here" quadrant on the aggregate I-P grids would make good indicators. These indicators were identified using input from visitors, and visitor opinions are

TABLE 5.27 Evaluation of Potential LAC Indicators Against Criteria for "Good" Indicators

Potential Indicator	CHARACTERISTICS OF GOOD LAC INDICATORS [a]										
	Specific and quantifiable	Significant [b]	Correlated with human activities	Measured simply and reliably	Integrative	Attainable	Output oriented	Cost effective	Responsive to change	Repeatable	SCORE
Underwater visibility	×	✓	✓/×	×	×	×	×	×	×	✓	3
Undamaged snorkeling sites	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	9
Variety of marine life	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	9
Variety of coral species	✓	✓	×	×	×	×	×	×	×	✓	3
Abundance of marine life	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	9
Abundance of large fish	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	9
Unique underwater formations	✓	✓	×	×	✓	✓	×	✓	✓	✓	7
Number of other snorkelers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
Number of boats	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
Information provided by boat crew	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	9
Commitment to the environment	×	✓	✓	✓	✓	✓	×	✓	✓	✓	8
Safety procedures on boat	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	9
Length of snorkeling trip	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	9
Quality of marine transport services	×	✓	✓	×	×	✓	×	✓/×	✓	✓	5/6
Variety of snorkeling trips available	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	10
Cost of snorkeling trip	✓	✓	✓	✓	×	✓	✓	✓/×	✓	✓	8/9
Learning opportunities	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	9

[a] Criteria of good indicators derived from Belnap (1998), Buckley (2003), Merigliano (1990), and Roggenbuck et al. (1993).

[b] Significance relates to the importance of the impact to the ecology of the area, or to people. Attributes with a mean importance score of 4.0 or higher were considered to be important or significant to people.

an important input to LAC decision making (Stankey et al., 1985). However, other sources will also influence the final selection of indicators including park agency policy and legal mandates, stakeholder opinion, resource availability, and expertise. If, for example, resources are scarce, then park managers may elect to adapt a conservative strategy and re-evaluate the approach used to set the crosshairs on the I-P grid, since crosshair placement determines which attributes need management attention. For this study, the crosshairs were placed at 3.0 for the importance scale and 4.0 for the satisfaction scale to reflect standards of 'quite important' and 'extremely satisfied'. If the importance crosshair is shifted up to 4.0 to reflect standards of 'extremely important', the following indicators are excluded from consideration: abundance of fish, number of other snorkelers, number of boats, unique underwater formations, variety of snorkeling trips offered, cost of snorkeling trips, and the opportunity to learn about coral reefs. The goals of the protected area will determine the placement of the gridlines, and maintaining high-quality experiences should be chief among them, since this is essential if the area is to remain competitive with other forms of tourism and retain budgetary allocations from government treasuries (McCool, 2002 cited in Tonge & Moore, 2006). Regardless of where the crosshairs are placed, the I-P approach can assist managers in the identification of LAC indicators, and thereby overcome a major challenge with implementation of this planning framework..

Once appropriate indicators have been identified, managers must specify standards of quality that describe the acceptable and appropriate conditions for each indicator. As discussed in earlier sections, visitors do not feel the same about the influence of condition items on their snorkeling experience, nor do they evaluate the actual conditions experienced the same. Managers will therefore need to establish different standards for indicators to provide for a range of opportunities. "As one moves across the opportunity classes for any given indicator, the standards should describe a logical progression or gradation of conditions" (Stankey et al., 1985, p.13). In the next chapter, an indicator for the "number of other snorkelers" is developed, and the results help to illustrate the importance of providing a range of recreation opportunity classes within the park.

CHAPTER 6 The Environmental and Social Impacts of Use

Two major goals of protected area management are to limit negative environmental impacts, and to enhance visitor satisfaction with recreation experiences. Achievement requires an understanding of how the natural resource base is affected by tourism and recreation activities, and how visitor experiences are affected by use levels. This chapter uses data collected from the tour operator and visitor surveys to develop an understanding of the environmental and social impacts of use, and how identified impacts might be managed by investigating:

- tour operators' perceptions of the impact of various activities on the reef environment;
- tour operators' support for a range of management strategies available to limit environmental and social impacts of use;
- visitors' knowledge of coral reef ecosystems and minimal impact behaviours;
- visitors' perceptions of the impact of snorkeling on the reef environment;
- behaviours observed by survey respondents that may have negative impacts on the quality of the visitor experience and the natural environment; and
- visitors' perceptions of crowding and encounter norms.

Where appropriate, the discussion of results will draw upon personal observations of snorkeler and tour operator behaviour (reviewed in Chapter 4) to enhance understanding of the impacts of use. The chapter is divided into two parts: Part A (sections 6.1 through 6.4) looks at the environmental impacts of use, while Part B (sections 6.5 through 6.7) examines the social impacts of use. Since results reported in the previous chapter indicated that snorkelers demonstrate significant differences in their expectations for, and satisfactions with, the snorkeling environment and experience, visitors are segmented into more uniform subgroups on the basis of specialization and culture. 'Self reported level of experience' was used to disaggregate respondents into high (n=390), medium (n=232), and low (n=88) specialized groups, and 'country of origin' was used to disaggregate respondents into Thai (n=337) and Non-Thai (n=363) groups. The chapter concludes with a summary and discussion of the implications of research findings for the Koh Chang snorkeling industry.

PART A: ENVIRONMENTAL IMPACTS OF USE

6.1 Tour Operator Survey

6.1.1 Perceptions of Human Impact on the Environment

Tour operators were asked to rate the impact of 14 different activities on Koh Chang's coral reef ecosystems using a 5-point Likert scale, where 1= "no impact, 4= "very large impact", and 5= "not sure". For purposes of analysis, the results were recoded as 0= "not sure", and 1= "no impact" to 4= "very large impact". Mean results, summarized in Table 6.1, indicate that tour operators perceive anchoring and standing on top of coral reefs, garbage disposal, commercial fishing, sewage disposal, and touching coral as having a large to very large impact. SCUBA diving, touching marine animals, boating, and recreational fishing are perceived to have a small to moderate impact, while snorkeling, feeding fish, kayaking, and swimming are perceived by tour operators to have a small impact on the environment.

TABLE 6.1 Tour Operators' Mean Evaluations of the Perceptions of Impact on Koh Chang's Coral Reef Ecosystems (Tour Operator Survey, Q16)[a]

Activity	Mean	SD
Anchoring on top of coral reefs	4.0	0.00
Standing on top of coral reefs	3.9	0.35
Garbage disposal	3.6	0.74
Commercial fishing	3.1	0.90
Sewage disposal	3.1	1.12
Touching coral	2.9	1.12
SCUBA diving	2.5	1.05
Touching marine animals	2.5	1.31
Boating	2.2	0.71
Recreational fishing	1.9	0.64
Snorkeling	1.7	0.71
Feeding fish	1.7	0.95
Sea kayaking	1.5	0.53
Swimming	1.1	0.35

[a]Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"

Comments made by tour operators imply some level of frustration with speed boats anchoring on the reef:

> "If anchor out of the area is okay, but speed boats go on top of the reefs."
>
> "Most tour operators/managers do not go with staff especially speed boat staff, these people are not aware and irresponsible, just anchor. I used to tell them but they don't listen....even shout at me."
>
> "Be more restrict about speed boats which like to stop and anchor on top of the reefs. This can cause much damage. As well as the speed boats are fast moving which may lead to accident. Most foreigners don't like this."

When respondents were asked if tourists recreating in Koh Chang National Marine Park should be required to contribute an additional fee towards protection of the marine environment, 62.5% (n=5) responded "yes". Those who responded "yes" were asked to indicate how much the National Park should collect from tourists towards conservation of the marine environment. The average amount was 107.5 baht (SD=188.5) for Thai tourists (approx. US$2.80) and 78.75 baht (SD=171.2) for foreign tourists (approx. US$2.22). Surprisingly, tour operators felt that domestic visitors should contribute slightly more than foreign visitors. This might be because Thai visitors are perceived to have a greater impact on the environment than foreign visitors:

> "From what I see, there are only Thai tourists have inappropriate behaviours. They like to eat, drink on the beach and leave garbage all over. Should be a system to fine to stop the increase of this garbage...even cigarettes or tooth picks."

A few respondents used available space on the survey to react to questions concerning the impact of activities on Koh Chang's reefs, and whether or not tourists should be required to contribute an additional fee towards protection of the marine environment. Comments included:

> "Worry that if a national park fee is imposed on tourists it will reduce numbers of general visitors to Ban Bao. Koh Samet charges a fee but it is not used to benefit the island. We would prefer to control out own environment."
>
> "If have to pay tourists should pay one time and can access everywhere in the park. Pay at 500 baht."
>
> "Park staff should explain to the tourists why they are collecting the fee."

6.1.2 Tour Operator Support for Visitor Management Strategies

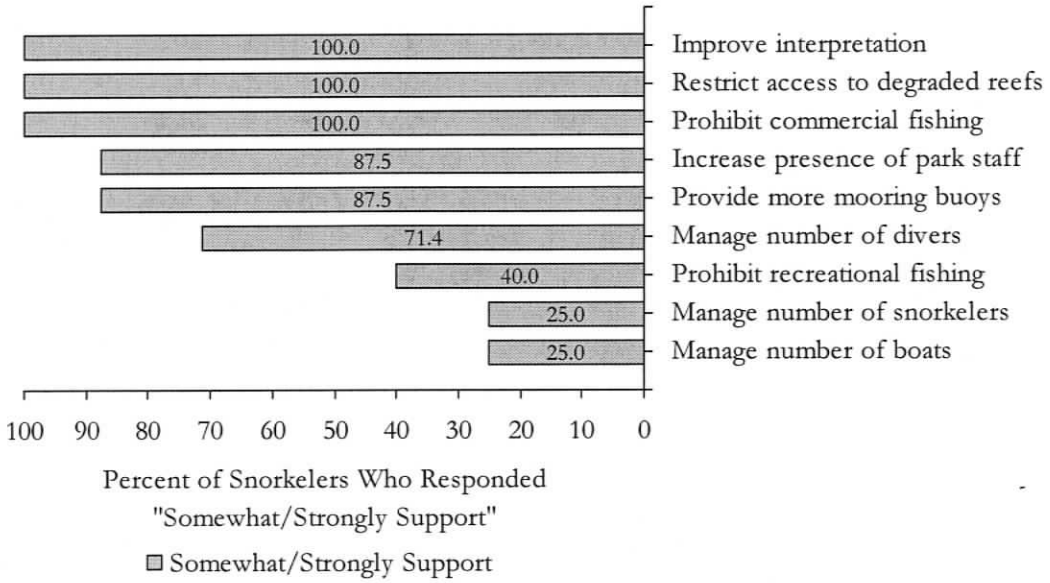
Tour operators were asked to rate their level of support for a variety of visitor management strategies using a 5-point Likert scale, where 1="strongly oppose", 3="neutral", and 5="strongly support". The results, summarized in Figure 6.1, indicate that there is strong support for improving opportunities for tourists to learn about coral reef ecosystems (100.0%, n=8), restricting access to coral reefs showing signs of degradation (100.0%, n=7), and prohibiting commercial fishing inside marine park boundaries (100%, n=7). A majority of respondents also support increased presence of park staff (87.5%, n=8), the provision of additional mooring buoys (87.5%, n=7), and management of the number of SCUBA divers permitted on the reefs each day (71.4%, n=5). A majority of tour operators *oppose* any restrictions placed on the number of boats (75.0%, n=6) and snorkelers (75.0%, n=6) permitted to visit coral reef sites, as well as any prohibitions on recreational fishing inside marine park boundaries (60.0%, n=3).

The last question of the survey provided tour operators an opportunity to comment further on their experiences operating a tour company in Koh Chang Marine National Park:

> "This business is attractive to both Thai and foreign tourists but during special events there will be many tourists, many boats are carrying too many tourists and pay less care about safety. The relevant agencies should organize some trainings about first aids to the tour operator staffs. As well as park staffs should keep eyes on everyday during high tourism season such as checking the boats that stop too close to the reefs or anchor on top of the reefs."

> "If every boat had one person able to give all relevant information and safety procedures. Garbage should be the responsibility of the boat captain or staff and disposal of upon return to Ban Bao. All boat trips to cease during low season to give the coral and fish a well deserved rest."

FIGURE 6.1 Tour Operator Support for a Range of Park Management Strategies
(Q18, Tour Operator Survey) (Missing cases excluded)[1]



6.2 VISITOR SURVEY – AGGREGATE ANALYSIS

This section explores visitors' knowledge of coral reef ecology and minimal impact behaviours, and visitors' observations of snorkeler and tour operator behaviours. In order to manage the use of coral reefs to ensure environmental conditions that provide enjoyable visitor experiences, it is also important to understand the impacts that recreationists perceive their sport to have on the reef environment, and so visitors' perceptions of impact are also explored.

6.2.1 What Do Visitors Know About Coral Reefs?

Visitor knowledge of coral reef environments was measured by asking visitors 12 questions about coral reef ecology and appropriate visitor behaviour. Respondents were asked to indicate whether they believed each question was true, false, or if they didn't know. Correct responses were computed for each respondent, with "don't know" responses computed as wrong answers. The results are summarized in Table 6.2. Generally, more visitors responded correctly to questions concerning appropriate visitor behavior than to questions concerning characteristics of coral reef communities.

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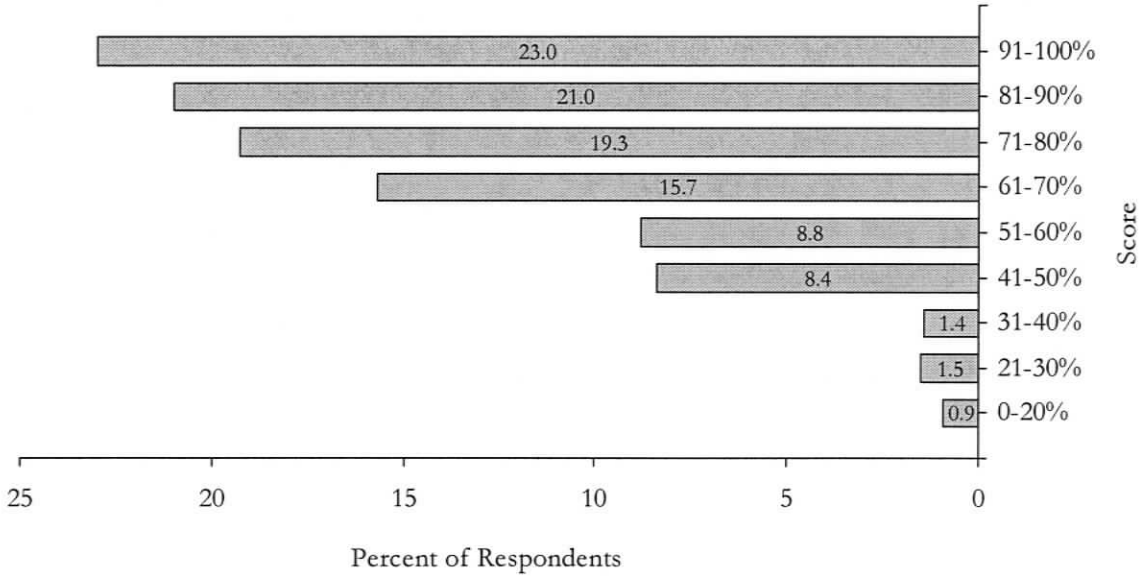
[1] For exact wording of each park management strategy, refer to Q18 of the Tour Operator Survey, Appendix B-1.

TABLE 6.2 Knowledge Quiz Results (Q21)

Question	Correct responses %	(*n*)
Reef knowledge		
Coral reef colonies can be hundreds of years old	75.9	(543)
Sand stirred up from the sea floor can kill corals	36.7	(261)
Corals are animals	75.8	(540)
Coral bleaching is a result of rising sea temperatures	33.2	(235)
Corals need sunlight to grow	65.2	(465)
Coral reefs are threatened ecosystems	87.9	(626)
Human impacts		
Park personnel should feed marine animals because the animals are probably hungry	81.1	(576)
Snorkelers do not harm corals when they touch them with their hands or feet	79.7	(565)
Tourism facilities on land can negatively impact coral reefs	84.8	(605)
Snorkelers should stand on the reef when they get tired	94.7	(676)
Boats can anchor on top of coral reefs without harming them	91.9	(655)
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	88.7	(634)

Learning quiz scores for participants were also computed (Figure 6.2). A majority of the sample (63.23%) scored at least 70% on the learning quiz. Only 12.3% (n=88) of respondents did not pass the learning quiz. The mean score was 8.9 questions answered correctly, or 74.2% (SD=2.15). These results show that overall, visitors demonstrate a good understanding of the reef environment.

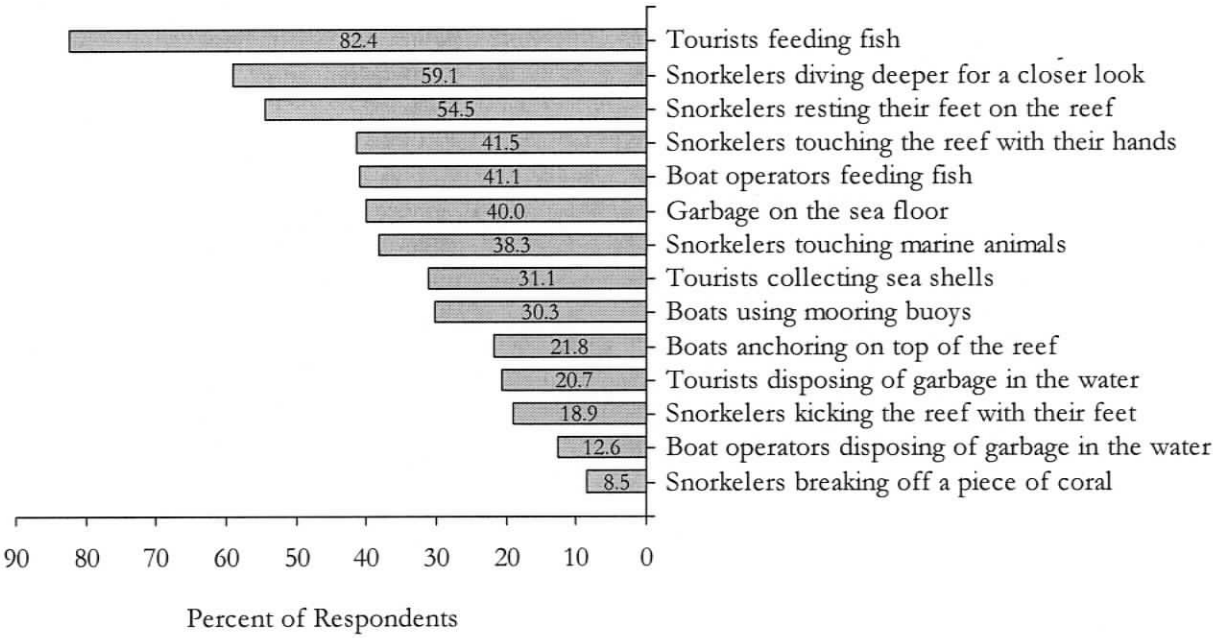
FIGURE 6.2 Learning Quiz Scores



6.2.2 Visitors' Observations of Behaviour

From a list of 14, snorkelers were asked to indicate which situations they noticed while snorkeling or traveling to snorkeling sites. The results are summarized in Figure 6.3. Potentially high impact behaviours observed by over one-third of respondents include: boat operators and tourists feeding fish, snorkelers resting their feet on the reef, snorkelers touching the reef with their hands, garbage on the sea floor, and snorkelers touching marine animals.

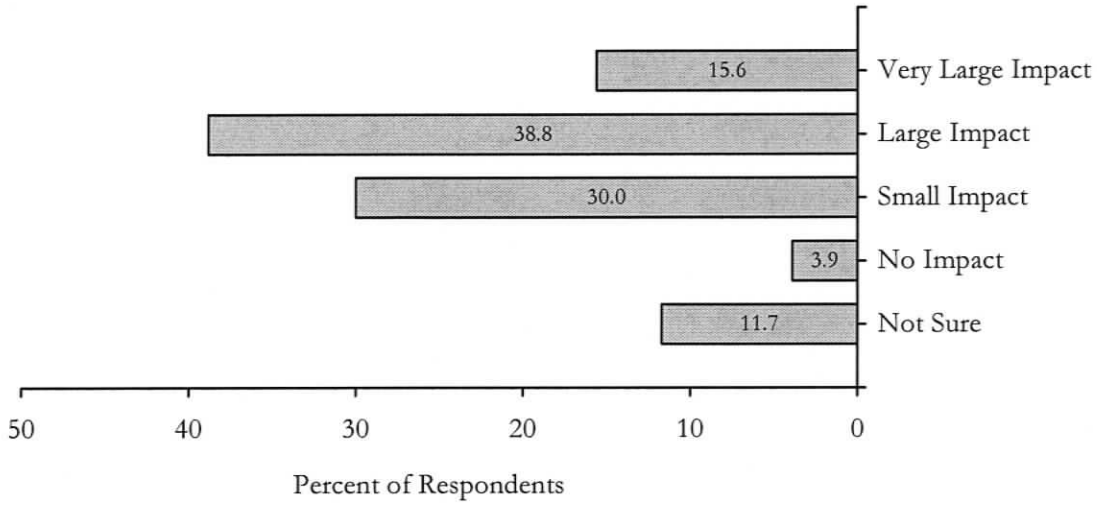
FIGURE 6.3 Behaviours Observed by Respondents While Snorkeling or Traveling to Snorkeling Sites (Q29, Q30) (Missing cases excluded; totals do not equal 100% due to multiple responses)



6.2.3 Visitors' Perceptions of Impact, and Visitors' Willingness to Contribute to Marine Conservation

Respondents were asked to indicate how much impact they feel snorkeling has on coral reefs in Koh Chang using a 5-point Likert scale, where 1= "very large impact", 4= "no impact", and 5= "not sure". The results indicate that 54.5% (n=381) of respondents rated the impact as "large" or "very large", while 30.0% (n=210) rated the impact as "small", and 3.9% (n=27) felt that snorkeling had "no impact" on Koh Chang's coral reefs (Figure 6.4).

FIGURE 6.4 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang (Q31) (Missing cases excluded; n=700)



A chi square test was used to determine whether perceptions of impact were influenced by the behaviours visitors witnessed while snorkeling and traveling to snorkeling sites (Table 6.3). The results show that for 12 of the 14 scenarios listed, there are statistically significant differences between the percentage of visitors who responded "large/very large", and the percentage who responded "small/ no impact/ not sure". Visitors who witnessed potentially high impact behaviours were more likely to perceive the impact of snorkeling as large.

TABLE 6.3 The Relationship Between Behaviours Observed and Perceptions of Impact (Missing cases excluded)

Behaviour observed? "Yes"	PERCEPTION OF IMPACT (%) Large/ Very Large	Small/ No impact/ Not sure	χ^2	*df*	Sig*
Boats using mooring buoys	59.3	40.7	0.05	1	.083
Tourists disposing of garbage in the water	68.3	31.7	14.14	1	**.000***
Boat operators disposing of garbage	70.1	29.9	9.87	1	**.002***
Tourists feeding fish	56.2	43.8	4.28	1	**.039***
Boat operators feeding fish	61.3	38.7	9.54	1	**.002***
Snorkelers resting their feet on the reef	65.5	34.5	42.74	1	**.000***
Snorkelers touching the reef with hands	63.6	36.4	17.21	1	**.000***
Snorkelers kicking the reef with their feet	67.9	32.1	12.14	1	**.000***
Snorkelers breaking off a piece of coral	80.3	19.7	18.07	1	**.000***
Snorkelers diving deeper for a closer look	59.8	40.2	12.04	1	**.001***
Snorkelers touching marine animals	56.3	43.7	0.62	1	.432
Garbage on the sea floor	61.0	39.0	8.41	1	**.004***
Tourists collecting sea shells	68.2	31.8	24.47	1	**.000**
Boats anchoring on top of the reef	69.0	31.0	17.12	1	**.000***

* Significant at $p < 0.05$ (chi-square, 2-tailed)

When visitors were asked if they would be willing to make an additional monetary contribution towards protection of the marine environment and the snorkeling sites visited in Koh Chang, less than half (*n*=289, 43.4%) of respondents responded "yes"(Table 6.4). Of those who were willing to make an additional monetary contribution, 57.3% were willing to contribute less than US$5.00.

TABLE 6.4 Visitors' Willingness to Make an Additional Monetary Contribution Towards Protection of the Marine Environment (Q32A, B)

Response	(%)	(*n*)
Yes	43.4	(289)
Amount willing to contribute (USD):		
Less than $5	57.3	(140)
$5-$10	8.2	(20)
$10.01 - $15	20.9	(51)
More than $15	13.5	(33)
Total	100.0	(244)
Missing		(45)
Mean	$4.18 USD	
SD	$17.24 USD	
No	56.6	(376)
Total	100.0	(665)

6.2.4 Impact of Snorkeling and Marine Conservation Efforts

In a study of divers in Phuket, Thailand, Bennett (2002) explored the relationship between divers' perception of negative impacts on the reef and interest in participating in marine conservation projects. The analysis was based on the premise that "willingness to participate in marine conservation efforts is related to divers' understanding of the need for such efforts" (Bennett, 2002, p.184). Results of the analysis supported this premise, as divers who indicated an interest in participating in a reef monitoring project were significantly more likely to witness evidence of impacts by members of their dive group. The objective of this section is to investigate the relationship between visitors' willingness to contribute to marine conservation and: 1) visitors' who witnessed negative behaviours while snorkeling, and 2) visitors' perceptions of the impact of snorkeling.

To determine whether visitors who witnessed negative impacts on the reef were more likely to be willing to make an additional contribution towards protection of the marine environment, a chi squared test was performed (Table 6.5). The analysis indicates that there is no relationship between willingness to contribute to marine conservation and the observance of potentially negative impacts.

TABLE 6.5 A Comparison of Visitors Who Observed Behaviours With Those Who Were, and Were Not Willing to Make an Additional Contribution to Marine Conservation (Missing cases excluded)

	Willing to Make an Additional Monetary Contribution Towards Reef Protection?				
Behaviour observed? "Yes"	**YES (%)**	**NO (%)**	χ^2	*df*	**Sig***
Snorkelers resting their feet on the reef	46.9	53.1	3.87	1	**.049***
Snorkelers touching the reef with hands	46.6	53.4	1.98	1	.160
Snorkelers kicking the reef with their feet	55.6	44.3	9.21	1	**.002***
Snorkelers breaking off a piece of coral	39.6	60.3	0.37	1	.541
Snorkelers diving deeper for a closer look	43.5	56.5	0.00	1	.962
Snorkelers touching marine animals	46.7	53.3	1.78	1	.182
Garbage on the sea floor	43.1	56.9	0.02	1	.881
Tourists collecting sea shells	45.3	54.7	0.45	1	.503
Boats anchoring on top of the reef	45.7	54.3	0.40	1	.528
Boats using mooring buoys	47.5	52.4	2.04	1	.157
Tourists disposing of garbage in the water	43.6	56.4	0.00	1	.976
Boat operators disposing of garbage	47.7	52.3	0.75	1	.386
Tourists feeding fish	44.6	55.4	1.81	1	.178
Boat operators feeding fish	39.8	60.0	2.57	1	.109

* Significant at $p < 0.05$ (chi-square, 2-tailed)

A chi-square test was also performed to determine whether visitors who were willing to make an additional contribution towards protection of the marine environment were more likely to rate the impact of snorkeling on the marine environment as "very large" or "large". The analysis, summarized in Table 6.6, indicates that there is no relationship between willingness to help conserve reef resources and visitors' perceptions of snorkeling impacts.

TABLE 6.6 A Comparison of Perceptions of Snorkeling Impacts and Visitors Who Were, and Were Not Willing to Make an Additional Contribution to Marine Conservation (Missing cases excluded)

	Willing to Make an Additional Monetary Contribution Towards Reef Protection?				
Perception of Impact	**YES (%)**	**NO (%)**	χ^2	*df*	**Sig***
Very large impact	6.7	9.1			
Large impact	19.4	19.6			
Small impact	12.7	17.8	7.41	3	.060
No impact	0.91	2.7			
Not sure	3.8	7.3			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

6.2.5 Perceived Impact of Snorkeling and Willingness to Return to Koh Chang, or Recommend Snorkeling to Other Visitors

Chapter 5 (Section 5.12) reported that 73% of visitors were willing to return to Koh Chang for snorkeling based on the quality of the coral reef environment, and 85% said they would recommend snorkeling to other tourists. A chi-square test was used to determine whether visitors who were willing to return to Koh Chang perceived the impact of snorkeling as smaller than visitors who were not willing to make a return trip, and results show that the differences between the two groups are not statistically significant (Table 6.7). A chi-square test was also used to determine if willingness to recommend snorkeling to other tourists was influenced by perceptions of impact, and the differences are significant (Table 6.7). Visitors who perceive the impact of snorkeling on Koh Chang's coral reefs as "very large" are *less* likely to make a positive recommendation to other park visitors.

TABLE 6.7 A Comparison of Perceptions of Snorkeling Impacts and Visitors' Willingness to Return to Koh Chang for Snorkeling, and Willingness to Recommend Snorkeling to Others (Missing cases excluded)

	Willing to Return?				
Perception of Impact	**YES (%)**	**NO (%)**	χ^2	*df*	**Sig***
Very large impact	13.5	20.6			
Large impact	38.0	41.3			
Small impact	31.6	26.5	8.66	4	.070
No impact	4.0	3.2			
Not sure	12.9	8.5			
	Willing to Recommend Snorkeling?				
Very large impact	13.9	25.0			
Large impact	38.2	42.7			
Small impact	31.4	21.9	11.55	4	**.021***
No impact	3.9	3.1			
Not sure	12.6	7.3			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

6.3 DISAGGREGATE VISITOR SURVEY RESULTS – HIGH, MEDIUM, AND LOW SPECIALIZED SNORKELERS

In the next section of this chapter, visitors are segmented into groups on the basis of specialization (high, medium, low) to explore whether visitors with different levels of experience differ in terms of their environmental awareness, observations of impact, perceptions of impact, and willingness to contribute to marine conservation.

6.3.1 Do High Specialized Snorkelers Know More About Coral Reefs than Low Specialized Snorkelers?

Chi square test results show that reef knowledge varies by level of specialization, as there are statistically significant differences in the percentage of correct responses for five of the six quiz questions (Table 6.8). In all five cases, the number of visitors responding correctly increases as specialization increases. There are also statistically significant differences in the percentage of correct responses for two of the questions testing knowledge of human impacts on coral reefs, with the number of correct responses increasing as specialization increases (Table 6.8).

TABLE 6.8 The Influence of Specialization on Visitors' Knowledge of Coral Reefs (Missing cases excluded)

Question	CORRECT RESPONSE (%) HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
Reef knowledge						
Coral reef colonies can be hundreds of years old	90.8	86.7	66.4	**.000***	47.21	4
Sand stirred up from the sea floor can kill corals	40.2	45.6	30.7	**.000***	31.51	4
Corals are animals	79.3	78.3	74.0	.249	5.40	4
Coral bleaching is a result of rising sea temperatures	54.0	34.8	27.6	**.000***	38.22	4
Corals need sunlight to grow	80.4	66.8	61.1	**.000***	20.83	4
Coral reefs are threatened ecosystems	94.2	90.0	85.6	**.045***	9.76	4
Human impacts						
Park personnel should feed marine animals because the animals are probably hungry	89.5	87.9	75.2	**.000***	20.49	4
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	91.9	91.8	86.4	.084	- 8.23	4
Tourism facilities on land can negatively impact reefs	89.6	85.8	83.5	.122	7.27	4
Snorkelers should stand on the reef when tired	95.4	95.7	94.1	.570	2.92	4
Boats can anchor on top of coral reefs without harming coral reef communities	91.9	92.7	92.0	.723	2.07	4
Snorkelers do not harm corals when they touch them with their hands or feet	87.0	85.7	84.9	**.001***	17.63	4

* Significant at $p < 0.05$ (chi-square, 2-tailed)

Table 6.9 compares mean learning scores by level of specialization. Chi square test results indicate that there are significant differences between high, medium, and low specialized snorkelers' learning scores, with mean scores increasing as specialization increases.

TABLE 6.9 Comparison of Visitors' Learning Scores by Specialization (Missing cases excluded)

	HIGH		MEDIUM		LOW				
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Π²**	***df***	**Sig***
Learning score[1]	9.7	2.10	9.4	1.94	8.5	2.14	75.87	22	**.000***

[1] Score ranges from 0 (none correct) to 12 (all correct)

* Significant at $p < 0.05$

6.3.2 Visitors' Observations of Behaviour

Differences between specialization groups with respect to observations of behaviours that may impact reefs were determined using a chi square test. Results indicate that for 10 out of the 14 scenarios listed, there are statistically significant differences in the percentage of respondents who indicated that they witnessed the behaviour (Table 6.10). In every instance, the percentage of respondents who observed the behaviour increases as specialization increases.

TABLE 6.10 Behaviours Observed by Respondents While Snorkeling or Traveling to Snorkeling Sites: A Comparison of High, Medium, and Low Specialized Groups
(Missing cases excluded)

	RESPONSE (%)					
Behaviour observed? "Yes"	**HIGH**	**MEDIUM**	**LOW**	**Sig***	**χ^2**	***df***
Snorkelers resting their feet on the reef	72.7	65.8	45.1	**.000***	37.27	2
Snorkelers touching the reef with their hands	57.9	44.3	36.5	**.001***	14.44	2
Snorkelers kicking the reef with their feet	35.2	17.1	16.8	**.000***	16.58	2
Snorkelers breaking off a piece of coral	14.8	8.8	7.2	.078	5.11	2
Snorkelers diving deeper for a closer look	76.1	67.1	51.8	**.000***	25.08	2
Snorkelers touching marine animals	39.8	39.6	38.1	.911	0.19	2
Garbage on the sea floor	48.9	40.3	40.1	.306	2.37	2
Tourists collecting sea shells	44.3	30.7	29.0	**.019***	7.87	2
Boats anchoring on top of the reef	32.9	22.8	18.6	**.012***	8.80	2
Boats using mooring buoys	43.2	33.3	26.4	**.005***	10.49	2
Tourists disposing of garbage in the water	31.8	16.2	21.2	**.009***	9.37	2
Boat operators disposing of garbage in the water	21.6	15.8	9.1	**.002***	12.72	2
Tourists feeding fish	78.4	83.3	84.7	.355	2.07	2
Boat operators feeding fish	52.9	43.6	38.1	**.032***	6.87	2

*Significant at $p < 0.05$ (chi-square, 2-tailed)

6.3.3 Visitors' Perceptions of Impact, and Visitors' Willingness to Contribute to Marine Conservation

Table 6.11 examines the influence of specialization on respondents' perceptions of the impact of snorkeling on coral reefs in Koh Chang. ANOVA test results show that mean evaluations are statistically different between high and low specialized snorkelers. Low specialized snorkelers perceive the impact to be smaller than do high and medium specialized snorkelers.

TABLE 6.11 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang: A Comparison of High, Medium, and Low-Specialized Groups (Missing cases excluded) [a]

						Bonferroni comparisons*		
Level of specialization	**Mean**	**SD**	**F**	**Sig***	***df***	**H-M**	**M-L**	**L-H**
High	2.6	1.21						
Medium	2.6	1.06	5.341	**.005***	2			*
Low	2.3	1.18						

[a] Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"
*Significant at $p < 0.05$

A chi square test was performed to determine whether there are significant differences between high, medium, and low specialized snorkelers' willingness to contribute to marine conservation. The differences between the three groups are not significant (Π^2=3.47, *df*=2, p=.177).

6.4 DISAGGREGATE VISITOR SURVEY RESULTS – THAI AND NON-THAI VISITORS

This section segments visitors into Thai and Non-Thai groups to explore whether visitors with different cultural backgrounds vary in terms of their environmental awareness, observations of impact, perceptions of impact, and willingness to contribute to marine conservation.

6.4.1 What Do Visitors' Know About Coral Reefs?

Chi square test results show that visitors' knowledge of coral reefs varies by country of origin (Table 6.12). There are statistically significant differences between the percentage of Thai and Non-Thai visitors who responded correctly to five of the six quiz questions related to reef knowledge, and three of the six quiz questions related to human impacts. In all cases but one ("corals are animals"), a greater percentage of Non-Thai visitors answered the quiz question correctly.

TABLE 6.12 Comparison of Thai and Non-Thai Visitors' Knowledge of Coral Reefs (Missing cases excluded)

Question	CORRECT RESPONSES (%) THAI	NON-THAI	Sig*	χ^2	*df*
Reef knowledge					
Coral reef colonies can be hundreds of years old	57.3	92.5	**.000***	11.88	2
Sand stirred up from the sea floor can kill corals	30.8	42.1	**.008***	9.66	2
Corals are animals	80.0	72.2	**.034***	6.74	2
Coral bleaching is a result of rising sea temperatures	27.5	38.9	**.000***	18.14	2
Corals need sunlight to grow	62.8	67.0	.258	2.71	2
Coral reefs are threatened ecosystems	84.5	90.9	**.036***	6.67	2
Human impacts					
Park personnel should feed marine animals because the animals are probably hungry	69.6	91.9	**.000***	61.8	2
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	82.5	94.2	**.000***	28.12	2
Tourism facilities on land can negatively impact reefs	81.9	86.9	.123	4.19	2
Snorkelers should stand on the reef when tired	92.0	97.2	**.008***	9.65	2
Boats can anchor on top of coral reefs without harming coral reef communities	94.4	92.2	.905	0.20	2
Snorkelers do not harm corals when they touch them with their hands or feet	75.6	83.0	**.050***	5.98	2

* Significant at $p < 0.05$ (chi-square, 2-tailed)

Table 6.13 compares mean learning scores by country of origin, and t-test results show that the differences between the two groups are statistically significant. Non-Thai respondents scored higher on the knowledge quiz than Thai respondents.

TABLE 6.13 Comparison of Visitors' Learning Scores by Country of Origin (Missing cases excluded)

	THAI		NON-THAI					
	Mean	**SD**	**Mean**	**SD**	**Mean difference**	**t**	***df***	**Sig**
Learning score[1]	8.3	2.2	9.4	2.0	-1.10	-6.935	697	**.000***

[1] Score ranges from 0 (none correct) to 12 (all correct)

* Significant at $p < 0.05$ (2 tailed t-test)

6.4.2 Visitors' Observations of Behaviour

Differences between Thai and Non-Thai visitors with respect to observations of behaviours that may impact reefs were determined using a chi square test. Results indicate that for 11 out of the 14 scenarios listed (78%), there are statistically significant differences in the percentage of respondents who indicated that they witnessed the behaviour (Table 6.14). In most cases, a higher percentage of Non-Thai respondents indicated that they observed the behaviour. Exceptions include observations of snorkelers touching marine mammals, and tourists feeding fish.

TABLE 6.14 Behaviours Observed by Respondents While Snorkeling or Traveling to Snorkeling Sites: A Comparison of Thai and Non-Thai Visitors (Missing cases excluded)

	RESPONSE (%)				
Behaviour observed? "Yes"	**THAI**	**NON-THAI**	**Sig***	χ^2	*df*
Snorkelers resting their feet on the reef	40.8	68.0	**.000***	52.0	1
Snorkelers touching the reef with their hands	32.9	50.1	**.000***	21.1	1
Snorkelers kicking the reef with their feet	17.2	20.4	.287	1.13	1
Snorkelers breaking off a piece of coral	5.7	10.7	**.017***	5.66	1
Snorkelers diving deeper for a closer look	48.0	70.0	**.000***	34.6	1
Snorkelers touching marine animals	45.5	32.8	**.001***	11.7	1
Garbage on the sea floor	44.4	37.7	.074	3.19	1
Tourists collecting sea shells	26.0	36.1	**.004***	8.23	1
Boats anchoring on top of the reef	13.6	29.2	**.000***	24.8	1
Boats using mooring buoys	26.9	33.9	**.046***	3.99	1
Tourists disposing of garbage in the water	21.7	19.6	.418	.655	1
Boat operators disposing of garbage in the water	10.0	15.4	**.032***	4.61	1
Tourists feeding fish	87.6	79.6	**.005***	8.01	1
Boat operators feeding fish	30.2	52.6	**.000***	35.7	1

*Significant at $p < 0.05$ (chi-square, 2-tailed)

6.4.3 Visitors' Perceptions of Impact, and Visitors' Willingness to Contribute to Marine Conservation

Table 6.15 examines the influence of culture on respondents' perceptions of the impact of snorkeling on coral reefs in Koh Chang. T-test results show that mean evaluations are statistically different between Thai and Non-Thai snorkelers. Thai snorkelers perceive the impact to be smaller than do Non-Thai snorkelers.

TABLE 6.15 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang: A Comparison of Thai and Non-Thai Visitors (Missing cases excluded) [a]

Level of specialization	Mean	SD	t	Sig*	*df*
Thai	2.2	1.07	28.579	**.000***	1
Non-Thai	2.6	1.18			

[a] Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"
*Significant at $p < 0.05$

A chi square test was performed to determine whether there are significant differences between Thai and Non-Thai visitors' willingness to contribute to marine conservation. The differences between the two groups are not significant (Π^2=0.057, *df*=1, p=.811).

PART B: VISITORS' PERCEPTIONS OF THE SOCIAL IMPACTS OF USE

This section looks at visitors' evaluations of the social conditions in greater detail through an examination of visitor expectations, perceptions of actual use levels, perceived crowding, and encounter norms. Encounter norms will be used to formulate standards of quality to help manage crowding in the study area. Results are first summarized at the aggregate (Section 6.5) and disaggregate (Sections 6.6, 6.7) level.

6.5 AGGREGATE RESULTS

6.5.1 Visitors' Expectations, and Perceptions of Actual Use Levels

A number of questions were developed to evaluate visitors' perceptions and attitudes towards social conditions. Visitors' expectations of use levels can influence perceptions of crowding, and so visitors were asked to indicate how many snorkelers they expected to see (compared with how many snorkelers they actually saw) (Table 6.16). Forty-one percent (*n*=287) responded "less than I actually saw", 19.9% (*n*=141) responded "about as many as I actually saw", and 20.4% (*n*=144) responded "more than I actually saw). Nineteen percent (*n*=135) of the sample responded "I didn't know what to expect". These results indicate that a majority of respondents expected to see fewer people snorkeling than were actually observed. Visitors were also asked to indicate how many snorkelers they remembered seeing

on their snorkeling trip. The results, summarized in Table 6.16, indicate that a majority of the sample (n=244, 34.5%) recalled seeing more than 49 other snorkelers.

TABLE 6.16 Number of Snorkelers That Respondents Expected to See (Q25), **and Recalled Seeing** (Q25), **While Snorkeling** (Missing cases excluded)

	(%)	(*n*)
"I expected to see..."		
Less snorkelers than I actually saw	40.6	(287)
About as many snorkelers as I actually saw	19.9	(141)
More snorkelers than I actually saw	20.4	(144)
Didn't know what to expect	19.1	(135)
Total	100.0	(707)
"I remember seeing..."		
0-9 snorkelers	5.0	(35)
10-19 snorkelers	9.0	(64)
20-29 snorkelers	14.0	(99)
30-39 snorkelers	18.0	(127)
40-49 snorkelers	14.8	(105)
More than 49 snorkelers	34.5	(244)
Not sure / can't recall	4.7	(33)
Total	100.0	(707)

6.5.2 Perceived Crowding

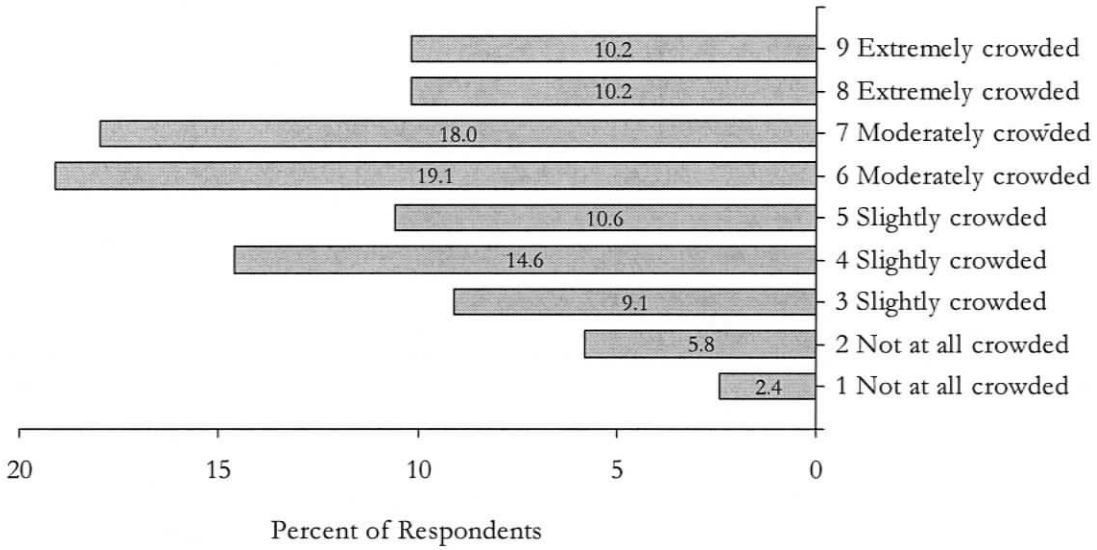
Table 6.17 shows the percentage of snorkelers who evaluated encounters with other snorkelers, boats, and mooring buoys as "too many". At the aggregate level, 52.7% (n=377) of respondents felt there were too many other people snorkeling, 49.7% (n=356) felt there were too many other boats at the snorkeling sites, while only 14.2% (n=102) felt there were too many mooring buoys in the water.

TABLE 6.17 Encounters Experienced with Others (Q27) (Missing cases excluded)

	RESPONSE (%)		
Encounter	**Too few**	**About right**	**Too many**
The number of other people snorkeling was...	3.8	41.8	52.7
The number of tourists on the boat was...	2.1	63.7	32.5
The number of other boats at the snorkeling sites was...	2.8	45.5	49.7
The number of mooring buoys in the water was...	20.0	57.4	14.2
The number of staff on the boat was...	7.5	88.0	3.1

Figure 6.5 summarizes visitors' perceptions of crowding measured using Heberlein & Vaske's (1977) 9-point scale. Aggregate results indicate that an overwhelming majority of visitors felt crowded in the water, with 91.8% (n=647) of snorkelers reporting a score of "3 slightly crowded" or higher. More than 20% (n=143) of the sample felt "extremely crowded", while only 8.2% (n=58) of the sample felt "not at all crowded". The average crowding score for the sample was 5.7, but with a SD of 2.1, there is considerable variability in response.

FIGURE 6.5 Level of Crowdedness While Snorkeling (Q26) (Missing cases excluded)



Chi square tests were used to explore the relationship between perceptions of crowding, and 1) visitors' expectations for the number of other snorkelers, 2) the number of other snorkelers respondents recalled seeing, and 3) the behaviour of tour operators and other snorkelers. The results, summarized in Table 6.18, indicate visitors who felt "extremely crowded" were more likely to report having seen more people than expected. This finding is consistent with the recreation research literature, where expectations tend to show a more consistent effect on crowding than density/interaction measures or preferred contacts (Manning, 1986).

TABLE 6.18 The Influence of Visitors' Expectations, Observed Use Levels, and Behaviours on Perceptions of Crowding

	LEVEL OF CROWDEDNESS (%)						
	Not at all crowded	Slightly crowded	Moderately crowded	Extremely crowded	Sig*	χ^2	*df*
"I expected to see..."							
Less snorkelers than I actually saw	4.5	23.3	38.3	33.8			
About as many snorkelers as I actually saw	11.5	46.0	38.1	4.3	**.000***	90.69	9
More snorkelers than I actually saw	7.0	34.3	38.5	20.3			
Didn't know what to expect	14.2	46.3	32.8	6.7			
"I remember seeing..."							
Less than 40 snorkelers	13.0	41.3	37.3	8.4			
More than 40 snorkelers	4.0	27.5	37.0	31.5	**.000***	71.08	6
Not sure/ Can't recall	6.3	40.6	37.5	15.6			
Behaviour observed? "Yes"						-	
Snorkelers resting their feet on the reef	6.3	28.2	37.6	27.9	**.000***	36.91	3
Snorkelers touching the reef	6.2	29.8	35.3	28.8	**.000***	22.91	3
Snorkelers kicking the reef	3.0	22.2	38.5	36.3	**.000***	33.49	3
Snorkelers breaking off coral	6.7	18.3	40.0	35.0	**.007***	12.06	3
Snorkelers diving deeper	7.0	30.9	38.8	23.3	**.001***	11.10	3
Snorkelers touching marine animals	5.9	31.4	40.6	22.1	.082	6.70	3
Garbage on the sea floor	6.3	30.2	39.6	23.9	**.035***	8.61	3
Tourists collecting sea shells	5.0	33.9	35.7	25.3	**.043***	8.13	3
Boats anchoring on the reef	6.4	25.0	36.5	32.1	**.000***	19.11	3
Boats using mooring buoys	7.5	31.6	34.0	26.9	.055	7.59	3
Tourists disposing of garbage in the water	3.4	31.7	35.2	29.7	**.004***	13.19	3
Boat operators disposing of garbage	5.6	27.0	39.3	28.1	.133	5.59	3
Tourists feeding fish	7.2	33.4	38.3	21.1	**.027***	9.19	3
Boat operators feeding fish	7.2	30.7	36.7	20.8	.125	5.73	3

*Significant at $p < 0.05$

Results in Table 6.18 also show that a significantly greater percentage of visitors who perceived the conditions as "moderately" or "extremely" crowded recalled seeing more than 40 snorkelers. Visitors' who witnessed depreciative behaviours were also more likely to perceive the conditions as more crowded than visitors who did not. This finding is also consistent with the recreation literature, where the number of disruptive encounters is found to be a more consistent predictor of perceived crowding than any other measure, including perceived density (Manning, 1986).

6.5.3 Snorkelers' Crowding Norms

Image capture technology (ICT) was used to measure visitors' encounter norms. The "number of snorkelers" indicator was measured with 6 above-water photographs depicting 0, 7, 15, 23, 33, and 49 snorkelers (Figure 3.3, Chapter 3). Respondents were asked to rate the acceptability of each photograph using a five-point Likert scale, where 1="very unacceptable" and 5="very acceptable". For purposes of analyses, these results were recoded as -2="very unacceptable" to +2=very acceptable. Mean acceptability ratings were used to display the social norms of respondents using Jackson's (1965) original model (Figure 6.6). The 'number of other snorkelers' indicator is shown on the x-axis, and the evaluative judgments or acceptability of the use levels is shown on the y-axis.

At the aggregate level, ratings of crowding acceptability by respondents generally decreased as the number of snorkelers depicted in the images increased. Respondents felt that zero, seven, and 15 snorkelers was acceptable, but when respondents were presented with photographs of 23, 33 and 49 snorkelers, they felt that these conditions were unacceptable. The optimal or preferred condition (the highest point on the curve) was seven snorkelers, while the least preferred condition (the lowest point on the curve) was 49 snorkelers at any one time (Table 6.19). This suggests that visitors found some use of coral reefs preferable to no use. The minimum acceptable condition, where the norm curve crosses the neutral line, was 22 snorkelers, and this represents the standard of quality for the indicator. The range of acceptable conditions was 0-22 snorkelers at any one time. These numbers are quite small in relation to the number of snorkelers that are regularly experienced at snorkeling sites in Koh Chang.

Respondents do not feel particularly strong about this indicator of quality, as shown by the relatively low norm intensity or salience (the height of the norm curve), calculated at 2.7 out of a possible value of four (Table 6.19). A flat curve indicates "few people will be upset", while a curve that "declines sharply and remains negative indicates that violation of the norm will have more impact on visitors" (Vaske, Donnelly et al., 1996, pg.22). This norm curve is relatively flat, with no sharp increases or decreases in mean acceptance values as the number of snorkelers increases, suggesting few repercussions might occur if the norm is violated.

FIGURE 6.6 Social Norm Curve for Number of Other Snorkelers Indicator (Q28)
(Missing cases excluded)

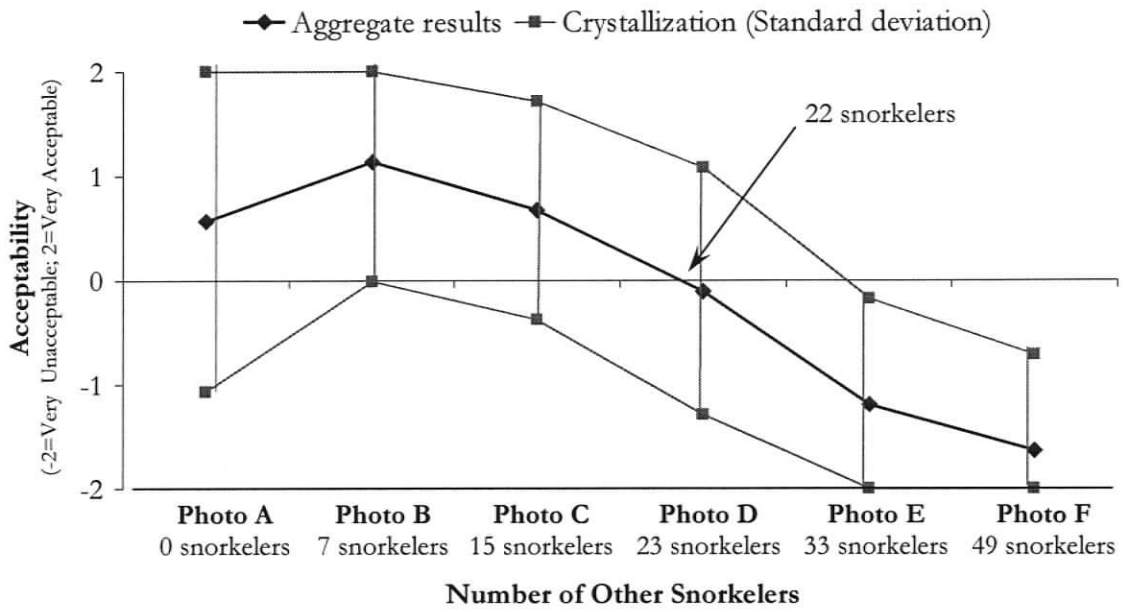


TABLE 6.19 Social Norm Curve Characteristics for the Number of Other Snorkelers Indicator

Social norm curve characteristics	Aggregate Response
Norm intensity (max.=4)	2.7
Range of acceptable conditions	0-22
Minimum acceptable condition	22
Crystallization of minimum acceptable condition	1.16
Optimal condition	7

There is considerable variation in the responses regarding Photos A, B, D, E and F (Table 6.20), and this is reflected in the low crystallization at the minimum acceptable condition (SD=1.16). The measure of consensus, or crystallization about the norm is an important consideration in normative research. A social norm is most useful in establishing a management standard when there is consensus among respondents. A large standard deviation implies that there is a low degree of consensus among the respondents regarding the acceptability of the impact.

TABLE 6.20 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28) (Missing cases excluded)[a]

Number of snorkelers	RESPONSE (%)						
	Very unacceptable	Somewhat unacceptable	Not sure	Somewhat acceptable	Very acceptable	Mean	SD
Photo A (0 snorkelers)	21.4	7.7	9.2	12.7	46.8	0.6	1.64
Photo B (7 snorkelers)	3.5	11.2	3.5	30.0	49.6	1.1	1.14
Photo C (15 snorkelers)	3.5	15.1	8.0	54.6	16.3	0.7	1.04
Photo D (23 snorkelers)	12.0	32.1	13.1	34.4	5.7	-1.1	1.18
Photo E (33 snorkelers)	48.5	31.6	7.8	8.0	2.0	-1.2	1.02
Photo F (49 snorkelers)	80.9	8.0	3.6	3.5	2.7	-1.6	0.92

[a] Mean responses were re-calculated using re-coded response categories, where -2= very unacceptable, +2=very acceptable

Table 6.21 shows the association between the number of snorkelers in each photograph and the acceptability ratings for each condition. Results show a statistically significant, moderately strong negative correlation for the number of other snorkelers. In theory, visitors' perceptions of crowding (measured here using "acceptability") should be most heavily influenced by use levels, but previous research consistently shows, at best, only moderate levels of association between density and crowding (Abser, 1981; Ditton et al., 1983; Manning, 1985). Findings reported here indicate that the number of other snorkelers is a significant, but not very powerful predictor of crowding responses, as the number of other users accounts for only 37% of crowding perceptions. Other factors that may or may not be apparent in the photographs are influencing crowding norms.

TABLE 6.21 Correlation Between Number of Snorkelers and Acceptability[a]

	Number of Snorkelers[b] (n=4296)[c]
Pearson's R: Number of other snorkelers/ Acceptability	-0.61
R^2	0.37
Sig.	.000

[a] Response categories are -2= "very unacceptable" to +2= "very acceptable"

[b] Number of snorkelers ranges from 0-49

[c] The sample sizes are 6 times larger than the actual sample sizes because there are 6 photographs (of increasing numbers of snorkelers for each situation) and subsequent acceptability ratings for each respondent.

6.6 DISAGGREGATE RESULTS – HIGH, MEDIUM, AND LOW SPECIALIZED SNORKELERS

The previous section looked at the influence of visitors' expectation and user behaviour on perceptions of crowding, but personal characteristics can also influence crowding norms. Perhaps one of the most widely studied personal characteristic thought to influence crowding norms is experience (e.g., Graefe, Donnelly, & Vaske, 1985; Kuentzel & McDonald, 1992; Needham, 1999, 2005; Randall, 2003; Tarrant et al., 1997). Experience level is thought to affect normative definitions of crowding either through refinement of tastes, or by virtue of exposure to lower density conditions as a result of earlier participation (Manning, 1986). The next section of this chapter explores the relationship between snorkelers' level of specialization and their crowding norms. Self-reported level of experience was used to identify high (advanced/expert snorkelers), medium (intermediate snorkelers), and low (novice snorkelers) specialized snorkelers. The implications of the findings for park managers and tour operators will be discussed in Section 6.8.

6.6.1 Visitors' Expectations, and Perceptions of Actual Use Levels

Chi square results indicate that encounter expectations varied by level of specialization (Table 6.22). When asked to indicate how many snorkelers participants expected to see, 56.3% of high specialized snorkelers responded "less than I actually saw", compared with 45.2% and 34.5% of medium and low specialized snorkelers, respectively. Compared with high and medium specialized groups, a greater percentage of low specialized snorkelers expected to see "more snorkelers than they actually saw", and many (27.2%) "didn't know what to expect". Specialization groups did not vary significantly in their observations of the number of other snorkelers they remembered seeing (Table 6.22).

TABLE 6.22 The Number of Snorkelers That Respondents Expected to See (Q24), **and Recalled Seeing** (Q25), **by Level of Specialization** (Missing cases excluded)

	RESPONSE (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
"I expected to see..." (Q24)						
Less snorkelers than I actually saw	56.3	45.2	34.5			
About as many snorkelers as I actually saw	19.5	26.8	16.1	**.000***	51.00	6
More snorkelers than I actually saw	14.9	19.3	22.3			
Didn't know what to expect	9.2	8.8	27.2			
"I remember seeing..." (Q25)[a]						
0-9 snorkelers	2.3	4.8	5.7			
10-19 snorkelers	8.1	8.7	9.6			
20-29 snorkelers	15.1	14.0	13.7			
30-39 snorkelers	24.4	17.9	16.6	.491	11.44	12
40-49 snorkelers	16.3	14.0	15.3			
More than 49 snorkelers	33.7	36.7	32.9			
Not sure / can't recall	0.0	3.9	6.2			

[a] 2 cells have an expected count of <5

*Significant at $p < 0.05$ (chi-square, 2-tailed)

6.6.2 Perceived Crowding

Differences among specialization groups with respect to visitors' evaluation of encounters with others were tested using a chi square test, and results indicate that evaluations are statistically different between groups, with the exception of the number of tourists on board the boat (Table 6.23). Crowding perceptions do not appear to be affected by the number of tourists or staff on board the boat, as a majority of respondents in each specialization group evaluated their encounters as "about right", although a slightly greater proportion of low specialized snorkelers felt there was not enough staff members on board. With the exception of "the number of staff on board the boat", the percentage of visitors who responded "too many" increased as specialization increased.

TABLE 6.23 Encounters Experienced While Snorkeling (Q27) **by Level of Specialization** (Missing cases excluded)

	RESPONSE (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
The number of people snorkeling was...						
Too few	3.5	3.1	4.2			
About right	33.7	34.8	49.0	**.002***	16.59 [a]	4
Too many	62.8	62.1	46.9			
The number of tourists on the boat was...						
Too few	2.3	1.3	2.6			
About right	61.6	62.3	67.2	.439	3.76 [a]	4
Too many	36.0	36.4	30.2			
The number of boats at the snorkeling site was...						
Too few	4.7	1.3	2.9			
About right	34.9	42.9	51.0	**.017***	12.07 [a]	4
Too many	60.5	55.8	46.1			
The number of mooring buoys in the water was...						
Too few	20.8	20.9	22.2			
About right	54.5	58.7	66.7	**.007***	14.22	4
Too many	24.7	20.4	11.4			
The number of staff on the boat was...						
Too few	5.7	6.1	9.1			
About right	90.8	88.2	89.4	**.040***	10.02 [a]	4
Too many	3.4	5.7	1.6			

[a] At least one cell has an expected count of <5

* Significant at $p < 0.05$ (chi-square, 2-tailed)

Crowding perceptions, as measured by Heberlein & Vaske's (1977) 9-point scale, varied by level of specialization, with more experienced snorkelers rating the conditions as extremely crowded (Figure 6.7). Mean crowding scores for high, medium, and low specialized groups were compared using ANOVA (Table 6.24); mean values are statistically different, with mean crowding responses increasing as specialization increases.

FIGURE 6.7 Level of Crowdedness While Snorkeling (Q26) **by Level of Specialization** (Missing cases excluded)

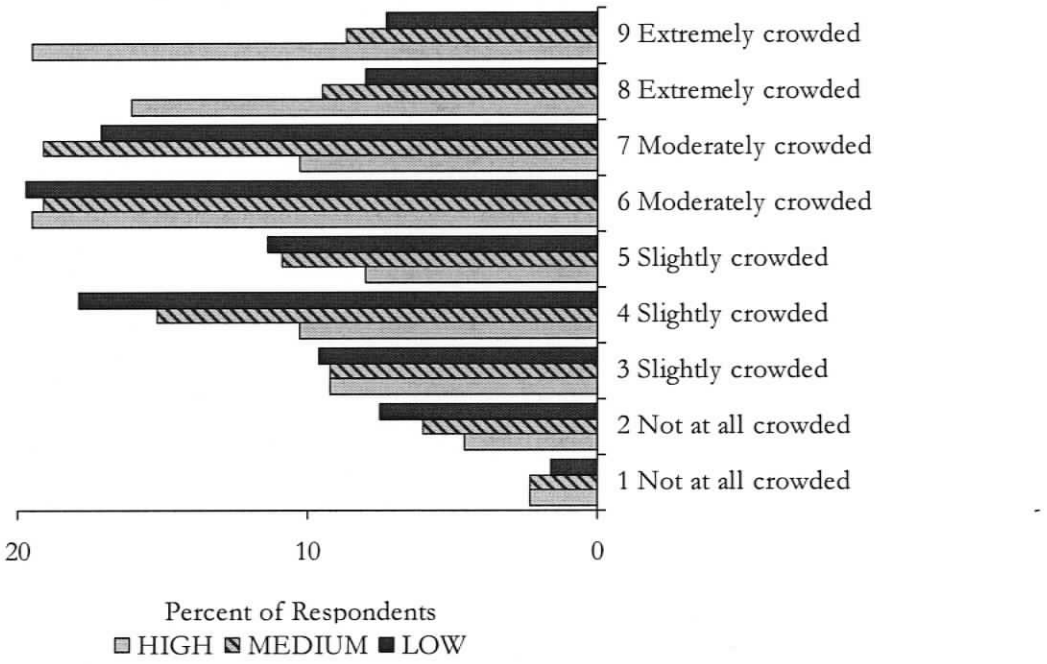


TABLE 6.24 Crowding Perceptions (Q26) **by Level of Specialization** (Missing cases excluded)

	Perceived crowding level[a]					Bonferroni comparisons*		
Level of specialization	**Mean**	**SD**	**Sig***	**F**	***df***	**H-M**	**M-L**	**L-H**
High	6.1	2.27						
Medium	5.9	2.11	**. 001***	6.785	2		*	*
Low	5.4	2.02						

[a] Crowding scale ranged from 0-9, where 0= "not at all crowded", 3= "slightly crowded", 6= "moderately crowded", 8= "extremely crowded"

*Significant at $p < 0.05$

6.6.3 Crowding Norms

Figure 6.8 and Table 6.25 examine the influence of specialization on respondents' normative evaluations of the number of other snorkelers. Mean acceptability ratings were used to display the social norms of high, medium, and low specialized respondents (Figure 6.8). The norm curves show that as specialization increases, acceptability for crowding decreases. These findings support the notion that more experienced users are more sensitive to higher

use levels. High, medium, and low specialized snorkelers prefer a standard greater than zero, as the optimal or preferred condition for all three groups is seven snorkelers (Table 6.25). As might be expected, high specialized snorkelers report the lowest minimum acceptable condition. The standard of quality reported by high specialized visitors is 20 snorkelers, compared with 22 and 23 for medium, and low specialized visitors, respectively. Table 6.25 shows that norm intensity increased as specialization increased, indicating that the indicator is more important for high specialized snorkelers than for medium and low specialized snorkelers. The crystallization of the minimum acceptable condition for high, medium, and low specialized snorkelers is 1.19, 1.11, and 1.18, respectively, suggesting that there is still considerable variation in responses. Specialization then, does not explain all of the variation in responses reported at the aggregate level.

FIGURE 6.8 Social Norm Curves for the Number of Other Snorkelers Indicator by Level of Specialization (Missing cases excluded)

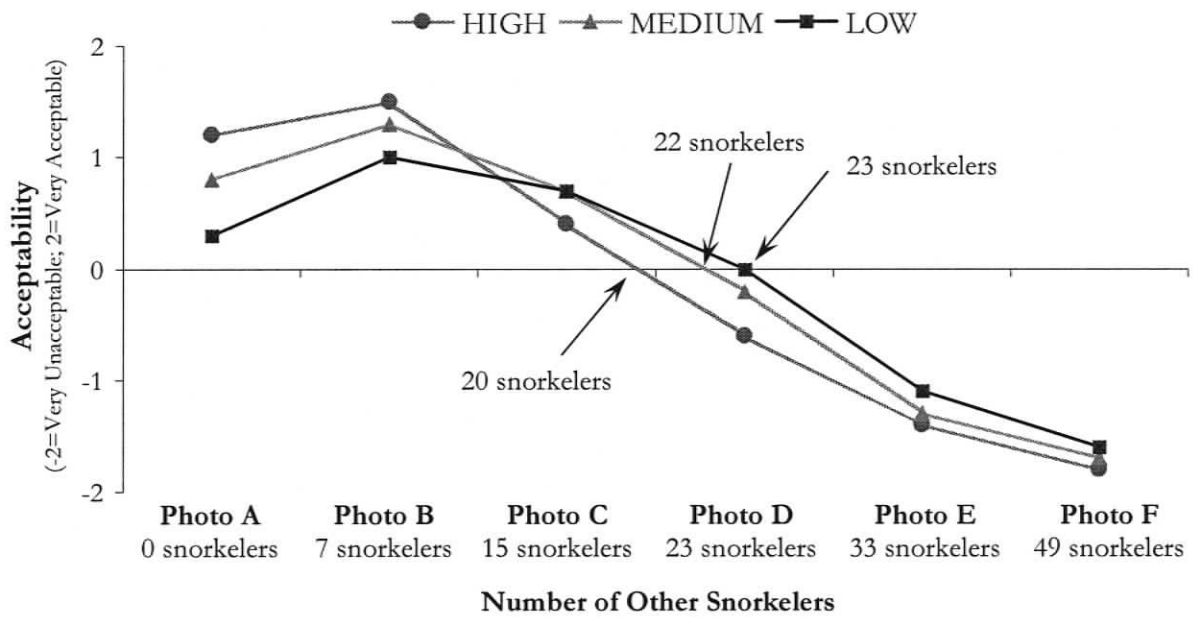


TABLE 6.25 Social Norm Curve Characteristics for the Number of Other Snorkelers Indicator by Level of Specialization (Missing cases excluded)

Social norm curve characteristics	Aggregate Response	HIGH	MEDIUM	LOW
Norm intensity (max.=4)	2.7	3.1	2.5	1.9
Range of acceptable conditions	0-22	0-20	0-22	0-23
Minimum acceptable condition	22	20	22	23
Norm crystallization	1.16	1.19	1.11	1.18
Optimal condition	7	7	7	7

ANOVA was performed to determine whether there are significant differences between high, medium, and low specialized snorkelers' mean acceptability ratings for each of the six photographs. The results are summarized in Table 6.26. Visitor norms for the number of other snorkelers indicator seem to be related to specialization, as mean scores are significantly different for all photographs except one (Photo C, 17 snorkelers).

Table 6.26 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28) **by Level of Specialization** (Missing cases excluded)

	HIGH		MEDIUM		LOW				
Number of snorkelers	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***
Photo A (0 snorkelers)	1.2	1.35	0.8	1.61	0.3	1.64	**.000***	15.53	2
Photo B (7 snorkelers)	1.5	0.97	1.3	1.12	1.0	1.69	**.000***	10.77	2
Photo C (15 snorkelers)	0.4	1.23	0.7	0.96	0.7	1.03	.083	2.49	2
Photo D (23 snorkelers)	-0.6	1.13	-0.2	1.15	0.0	1.18	**.000***	11.27	2
Photo E (33 snorkelers)	-1.4	0.94	-1.3	1.01	-1.1	1.04	**.005***	5.27	2
Photo F (49 snorkelers)	-1.8	0.60	-1.7	0.94	-1.6	0.95	**.038***	3.27	2

	Bonferroni comparisons*		
	H-M	**M-L**	**L-H**
Photo A		*	*
Photo B		*	*
Photo C			
Photo D	*	*	*
Photo E			*
Photo F			

* Significant at $p < 0.05$ (2-tailed t-test)

6.7 DISAGGREGATE RESULTS – THAI AND NON-THAI RESPONDENTS

Recreation research has focused considerable attention on the influence of specialization on crowding norms, but recent studies have begun to explore norms reported by international groups. The objective of the next section is to explore the similarities and differences between foreign and domestic visitors' crowding norms. The implications of the research findings will be discussed in Section 6.8.

6.7.1 Visitor Expectations and Perceptions of Actual Use Levels

Chi square results indicate that encounter expectations varied by country of origin (Table 6.27). When asked to indicate how many snorkelers participants expected to see, 58.6% (n=211) of Non-Thai snorkelers responded "less than I actually saw", compared with only 19.9% (n=66) of Thai snorkelers. Thai and Non-Thai samples also varied significantly in their observations of the number of other snorkelers they remembered seeing (Table 6.27).

TABLE 6.27 The Number of Snorkelers That Respondents Expected to See (Q24), **and Recalled Seeing** (Q25): **A Comparison of Thai and Non-Thai Visitors** (Missing cases excluded)

	THAI		NON-THAI				
	(%)	(*n*)	(%)	(*n*)	Sig*	χ^2	*df*
"I expected to see..." (Q24)							
Less snorkelers than I actually saw	19.9	(66)	58.6	(211)			
About as many snorkelers as I actually saw	15.7	(52)	23.6	(85)	**.000***	164	3
More snorkelers than I actually saw	32.0	(106)	10.0	(36)			
Didn't know what to expect	32.3	(107)	7.8	(28)			
"I remember seeing..." (Q25)							
0-9 snorkelers	7.6	(25)	2.8	(10)			
10-19 snorkelers	13.0	(43)	5.8	(21)			
20-29 snorkelers	13.3	(44)	14.7	(53)			
30-39 snorkelers	13.9	(46)	22.5	(81)	**.000***	64.1[a]	6
40-49 snorkelers	10.6	(35)	18.3	(66)			
More than 49 snorkelers	32.0	(106)	35.6	(128)			
Not sure / can't recall	9.7	(32)	0.3	(1)			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

[a] 2 cells have an expected count of <5

6.7.2 Perceived Crowding

When respondents are segmented into groups based on country of origin, results indicate that Thai and Non-Thai snorkelers evaluate encounters very differently. There are significant differences between Thai and Non-Thai visitors' evaluations of encounters with other snorkelers, boats, and mooring buoys (Table 6.28). More than twice as many foreign visitors evaluated the number of other snorkelers and the number of other boats as "too many", compared with Thai visitors. The number of tourists on board the boat does not appear to influence perceptions of crowding for either Thai or Non-Thai respondents.

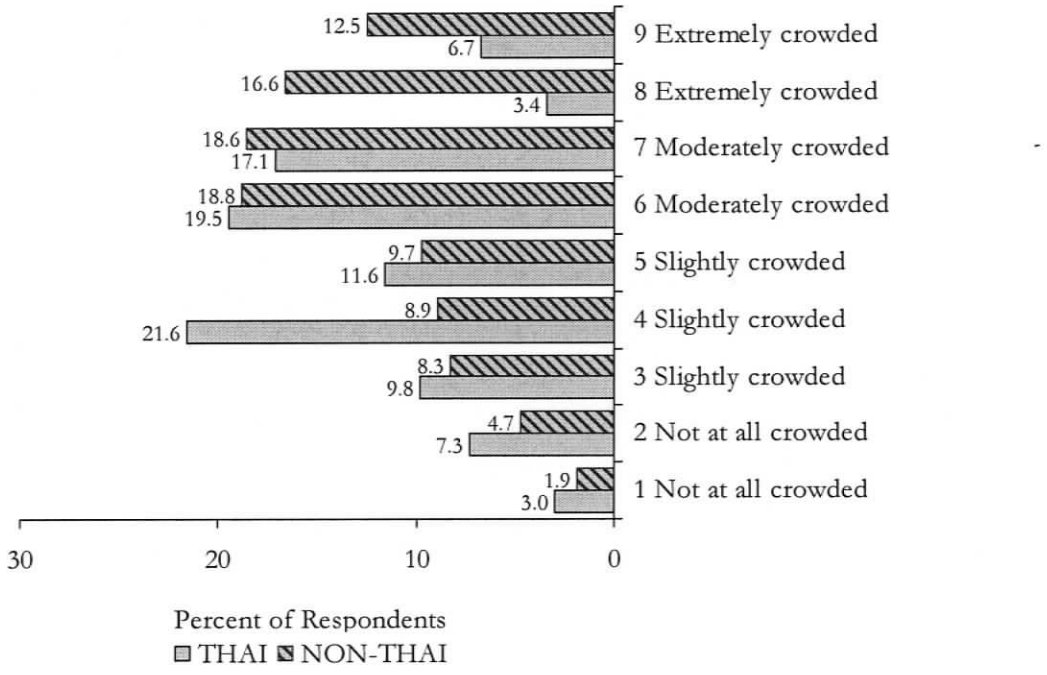
TABLE 6.28 Encounters Experienced While Snorkeling (Q27)**: A Comparison of Thai and Non-Thai Visitors** (Missing cases excluded)

	THAI		NON-THAI				
	(%)	(*n*)	(%)	(*n*)	Sig*	χ^2	*df*
The number of other people snorkeling was...							
Too few	6.7	(22)	1.1	(4)			
About right	62.5	(205)	25.6	(92)	**.000***	126	2
Too many	30.8	(101)	73.3	(263)			
The number of tourists on the boat was...							
Too few	2.1	(7)	2.2	(8)			
About right	67.1	(222)	62.2	(222)	.403	1.82	2
Too many	30.8	(102)	35.6	(127)			
The number of other boats at the snorkeling site was...							
Too few	3.9	(13)	2.0	(7)			
About right	63.6	(210)	31.5	(112)	**.000***	79.9	2
Too many	32.4	(107)	66.6	(237)			
The number of mooring buoys in the water was...							
Too few	31.4	(103)	12.7	(40)			
About right	61.6	(202)	63.5	(200)	**.000***	55.1	2
Too many	7.0	(23)	23.8	(75)			
The number of staff on the boat was...							
Too few	13.6	(45)	2.2	(8)			
About right	83.4	(276)	94.4	(339)	**.000***	31.4	2
Too many	3.0	(10)	3.3	(12)			

* Significant at $p < 0.05$ (chi-square, 2-tailed)

Crowding perceptions, as measured by Heberlein & Vaske's (1977) 9-point scale, varied by country of origin. In general, Non-Thai snorkelers reported feeling more crowded than Thai snorkelers, with 29.1% (n=105) of Non-Thai visitors feeling "extremely crowded" compared with 10.1% (n=33) of Thai visitors (Figure 6.9). Independent samples t-test results reveal that mean crowding scores were significantly higher for foreign visitors (Mean=6.1, SD=2.1) than for domestic visitors (Mean=5.1, SD=2.0) (t=-5.957, df=685, p=.000).

FIGURE 6.9 Level of Crowdedness While Snorkeling (Q26): A Comparison of Thai and Non-Thai Visitors (Missing cases excluded)



6.7.3 Crowding Norms

Figure 6.10 and Table 6.29 examine the influence of country of origin on respondents' normative evaluations of the number of other snorkelers. The optimal condition for Non-Thais is seven snorkelers, compared with 17 snorkelers for Thais. Thais clearly prefer higher levels of use, and actually evaluate no use as unacceptable. Solitude may not be very important for Non-Thai visitors either, as they prefer some level of use over no use. Non-Thai and Thai snorkelers report different standards of quality - the minimum acceptable condition is lower for Non-Thai respondents. The crystallization of the minimum acceptable condition for both Thai and Non-Thai respondents suggests that there is still considerable

variation in responses. Country of origin then, does not explain all of the variation in responses reported at the aggregate level.

FIGURE 6.10 Social Norm Curves for the Number of Other Snorkelers Indicator: A Comparison of Thai and Non-Thai Visitors (Missing cases excluded)

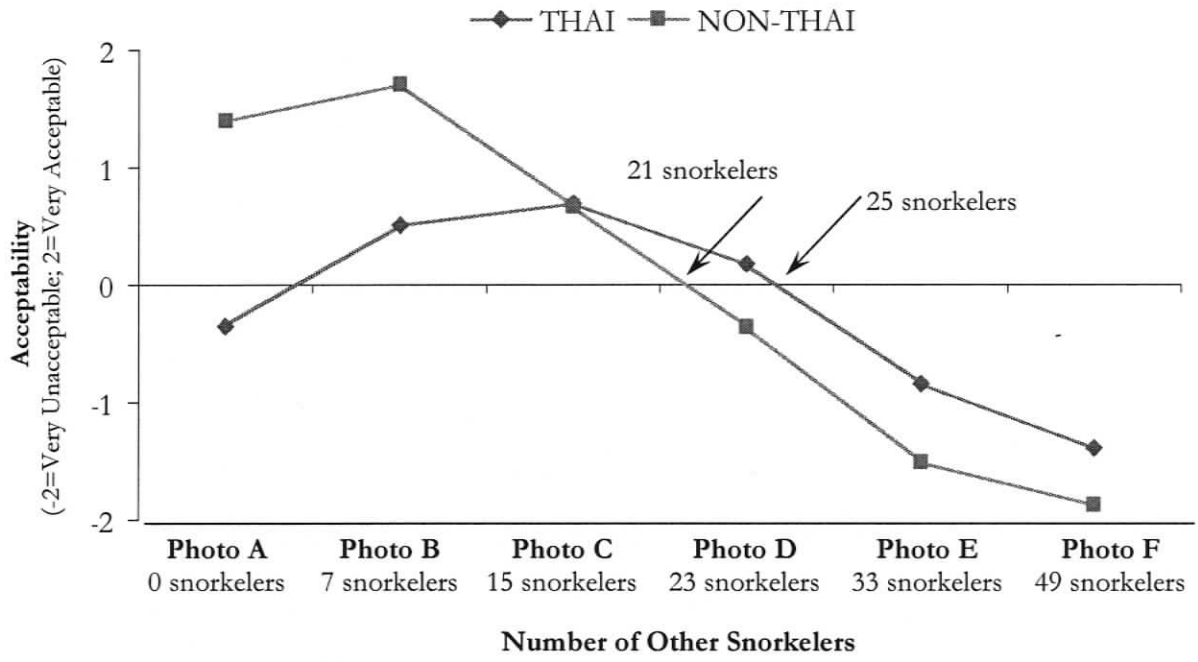


TABLE 6.29 Social Norm Curve Characteristics for the Number of Other Snorkelers Indicator: A Comparison of Thai and Non-Thai Visitors (Missing cases excluded)

Social norm curve characteristics	Aggregate Response	THAI	NON-THAI
Norm intensity (max.=4)	2.7	2.1	3.0
Range of acceptable conditions	0-22	6-25	0-21
Minimum acceptable condition	22	25	21
Norm crystallization	1.16	1.13	1.13
Optimal condition	7	17	7

A t-test was performed to determine whether there are significant differences between Thai and Non-Thai snorkelers' mean acceptability ratings for each of the six photographs. Results of this analysis reveal significant differences between the two groups for all of the conditions except for Photo C (17 snorkelers) (Table 6.30).

Table 6.30 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28)**: A Comparison of Thai and Non-Thai Respondents**

	THAI		NON-THAI				
Number of snorkelers	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Photo A (0 snorkelers)	-0.3	1.54	1.4	1.23	**.000***	-16.5	682
Photo B (7 snorkelers)	0.5	1.21	1.7	0.71	**.000***	-15.9	683
Photo C (15 snorkelers)	0.7	1.00	0.7	1.05	.790	0.267	679
Photo D (23 snorkelers)	0.2	1.12	-0.4	1.18	**.000***	6.22	679
Photo E (33 snorkelers)	-0.8	1.17	-1.5	0.73	**.000***	9.05	682
Photo F (49 snorkelers)	-1.4	1.13	-1.9	0.56	**.000***	7.13	688

* Significant at $p < 0.05$ (2-tailed t-test)

6.8 Summary and Discussion of Major Findings

Protection of Koh Chang's environment and the provision of high quality visitor experiences is a shared responsibility between park managers and tour operators, and so one of the objectives of this chapter was to provide an indication of tour operators' degree of impact awareness, and to gauge the level of support for management options to limit the negative impacts of use. Since an effective and comprehensive management plan for a park must incorporate an understanding and appreciation of the unique perceptions of a range of stakeholders, this chapter also sought to investigate visitors' knowledge of coral reef ecosystems and minimal impact behaviours, visitors' perceptions of the impacts of snorkeling on the reef environment, and behaviours witnessed by survey respondents that may have negative impacts on the quality of the visitor experience and the natural environment. A perceptions-based approach was used to investigate the social impacts of use, while a visual approach was used to define normative standards of quality for the number of other snorkelers. The major findings are outlined in the next section, along with a discussion of the implications of these findings for marine conservation and visitor experiences. Where appropriate, results from personal observations and informal interviews with government representatives and tour operator staff will be incorporated into the discussion.

Tour operators are quite perceptive of the impacts of various marine-based activities and behaviours on coral reef ecosystems, although in some instances, tour operators are not aware of the effects of their own behaviour on the marine environment.

All of the tour operators felt that standing and anchoring on top of the coral reefs were high impact activities, and a majority of tour operators (62.5% – 87.5%) also felt that garbage disposal, sewage disposal, commercial fishing, and touching coral were high impact activities. Strong negative evaluations of the perceived impact of these behaviours/activities might indicate that tour operators have seen evidence of damage to benthic organisms and/or changes in the abundance or diversity of marine life resulting from these activities and behaviours.

Operators are aware of the negative impacts of anchoring on top of coral reefs, but tour operators were observed not using the mooring buoys at sites where they were provided (Koh Kra, Koh Thain). Mooring buoys are not available for use at Koh Tong Lang, one of the most popular snorkeling sites, and so boat staff tie rope to rocks or coral boulders to "anchor" the boats in place. On one occasion, sudden winds pushed the boats too close to shore resulting in boat groundings, which can damage the reef structure, damage local benthos, leave anti-fouling paint on the reef, and increase risk of an oil spill (Harriott, 2002). Although the installation of moorings has the potential to cause minor damage to the surrounding area, the presence of mooring buoys greatly reduces anchor damage (Harriott, 2002) and may help prevent accidental boat groundings, and so additional moorings in heavily used sites should be provided.

Tour operators appear to understand the impact of commercial fishing on reef ecosystems (mean impact rating= 3.1), but interestingly, recreational fishing at reef sites – an illegal activity - is perceived as having a relatively low impact (mean=1.9). Commercial fishers have a direct effect on fish assemblages via the harvest of target species, bait, and by-catch, but even recreational fishing can be a threatening process for rare and endangered species (Lynch et al., 2004). On more than one occasion, tour operators made formal complaints to staff at the Sustainable Tourism Development Office regarding commercial fishing activity at snorkeling and dive sites (Tuchai, 2005, pers. comm.), but several tour operators fish recreationally in the area, catching up to 10 fish at one reef site with 30 minutes of fishing effort. Tour operator staff catch, cook and serve the same fish that tourists pay money to view underwater. Since the quality of the natural environment (e.g.,

undamaged snorkeling sites, abundance and variety of fish) adds significant value to the snorkeling experience, any amount of recreational or commercial fishing should be considered a threat to the sustainability of the snorkeling industry. Maintaining reef quality – coral diversity and fish abundance – is crucial to the long-term success of the industry. Comments from tour operators suggest that the problem of illegal fishing is not insignificant:

> "How is it possible that on the same site there are divers/snorkelers at the same time people on the next boat are fishing??? Are there no rules regarding this?"
>
> "Should control fishing along the park area. During the Songkran Festival I saw three fishing boats fishing near the shores. Though it was holidays so the park staff didn't work. That day many fish should be caught and sea water wasn't clear, very dusty. Saying this not because want the clear water only but don't won't to see fishing boats near the shore like that!"
>
> "Fishers put nets around dive sites, five metres from coral reefs. They are fishing almost every day. Fishers are not targeting certain fish, just using large nets to fish everything and anything. Fishers are catching grouper, sharks, red snapper. They show me what's being caught on the pier."
>
> "Fishing is a big problem. They used to fish outside, away from the corals but now they're taking everything. Fishing boats with drag nets are affecting the coral."
>
> "Boats are overfishing, coming too close to the reefs. I can't say anything, I have no power. Fishing cages are thrown in the water right on the reefs. I used to see juvenile black tip sharks at Bang Bao pier; I haven't seen any in years."
>
> "Fish traps on the reef used to be a problem; they are still there occasionally, but now not as frequent."
>
> "Fishers are fishing next to reefs during the day. They use drag nets 50-100 m."
>
> "Six, seven, eight years ago there were big schools of tuna, sharks; now there are only small fish."
>
> "Fishing boats should not operate in the park but no one enforces the rules."

Tour operators are aware that sewage discharge can have a large impact on the reef (mean impact score= 3.1), however, none of the high-capacity vessels have holding tanks to prevent discharge of raw waste over the reefs, suggesting that tour operators may not consider themselves to be part of the problem. Staff on one tour boat reminded tourists to avoid use of the restroom facilities when the boat was not in motion, but tourists were not informed as to why the "rule" was in place, and the rule was not consistently communicated.

Tour operators perceive the impact of SCUBA diving (mean= 2.5) on coral reefs to be larger than the impact of snorkeling (mean= 1.7). Since individuals tend to stay on the surface of the water when snorkeling, tour operators may perceive the likelihood of snorkelers impacting the reef by kicking or touching coral as low compared with divers who can swim close to coral colonies. However, boat staff and tourists were regularly observed standing on boulder corals, holding on to corals for support, breaking bits of coral off, kicking corals with their feet and fins, and diving deeper to touch hard and soft corals. When tour operators intentionally come in contact with corals and other marine organisms, they unwittingly show tourists that this behaviour is acceptable. Although the impacts of one snorkeler are typically very small, the cumulative effects of many snorkelers can have significant long-term consequences on park resources (Marion & Rogers, 1994).

Feeding fish is another activity that was viewed as having a low impact on Koh Chang's coral reef ecosystems. Boat staff regularly throw food (bananas, rice, bread, watermelon) into the water to attract aggregations of fish, and the staff encourage tourists to do the same. Negative impacts on fish behaviour, health, and community composition arising from regular fish feeding have been documented elsewhere (Milazzo et al., 2005; Orams, 2002; Shackley, 1998), but relative to the effects of fishing or anchoring on the reef, for example, the impacts of fish feeding may be minor.

Results of this study indicate that tour operators' perceptions of impact are close to those defined in the recreation ecology literature, with perhaps the exception of recreational fishing (existing knowledge suggests the impacts of this activity on reef fish populations and the reefs can be large, but tour operators generally had a different perception of the impact of fishing). However, tour operators may not be aware of the impact of their own behaviour on the marine environment (e.g., sewage discharge, improper garbage disposal, intentional reef contact, etc.), and so tour operators (and reefs) could benefit from an education programme that focused on the impacts to reefs arising from recreational use. If increased

knowledge does not prompt more environmentally responsive behaviour, park managers will need to consider imposing and enforcing rules and regulations to prohibit or restrict behaviour that is detrimental to the natural environment.

A majority of tour operators would support the collection of an additional fee from snorkelers towards protection of the marine environment.

Over 60% of tour operators would support the collection of a fee levied on tourists for protection of the marine environment. This is a significant finding, as it suggests that tour operators recognize the need to improve protection of the marine environment, and would support "taxing" visitors to achieve added protection. In Australia's Great Barrier Reef Marine Park, an "Environmental Management Charge" of AU$4 per visitor per day (as of 2002) is collected to support education, research, and the cost of park management (Harriott, 2002), and a similar fee could be collected by tour operators in Koh Chang to support various park management initiatives.

Tour operators would not support any management strategies that influence the amount of use, but they would support several management actions that influence the type of visitor use, the location of visitor use, and visitor behaviour.

When tour operators were asked to indicate their level of support for a range of management strategies that would help protect both ecological and aesthetic values of the marine park, 75.0% indicated that they would not support park management strategies that place restrictions on recreational fishing, or the number of boats and snorkelers allowed to visit the reefs per day. However, there is an appetite for the introduction of some park management strategies that may enhance the quality of the visitor experience. For example, 100.0% of tour operators support opportunities for improved interpretive services, restricted access to reefs showing signs of degradation, and prohibitions placed on commercial fishing inside park boundaries. Not surprisingly, support for individual park management strategies seems to correlate with perceived impacts (Table 6.31).

TABLE 6.31 Comparison of Tour Operators' Perceptions of the Impact of Various Activities with Support for Park Management Strategies

Impact	Perceived impact: Large/Very Large (%)	Management Strategy	Tour operator support: Somewhat/Strongly (%)
Anchoring	100.0	Provide more mooring buoys	100.0
Commercial fishing	62.5	Prohibit commercial fishing	100.0
SCUBA diving	42.9	Manage number of divers	71.4
Boating	37.5	Manage number of boats	25.0
Recreational fishing	12.5	Prohibit recreational fishing	40.0
Snorkeling	12.5	Manage number of snorkelers	25.0

This information is useful for formulating strategies to manage visitor use, as it provides an indication of which management approaches tour operators are likely to endorse. Restrictions placed on the number of snorkelers would be unpopular, but a majority of tour operators would support management actions that influence the type of visitor use (e.g., no commercial fishing), the location of visitor use (e.g., restricted access to reefs showing signs of degradation), and visitor behaviour (e.g., interpretation). The level of compliance with park regulations will be higher for rules and regulations that are supported by industry, and operators are more likely to directly participate in efforts to resolve impacts resulting from visitor use (e.g., interpretation) if they support government's approach. In addition, the relationship between perceptions of impact and support for management strategies and actions (Table 6.31) suggests that an education programme targeted at tour operators may help build cooperation for a wider range of actions designed to control resource impacts (e.g., enforcement of recreational fishing rules, regulations to address impacts from sewage discharge, etc.).

Overall, visitors demonstrate a good understanding of the reef environment, but more visitors responded correctly to questions concerning appropriate behaviour than to questions concerning coral reef ecology.

Respondents scored surprisingly well on the knowledge quiz. Over 63% of the sample scored 70% or higher on the quiz, and only 12% of respondents did not pass (i.e., they scored less than 50% on the quiz). Generally, more visitors responded correctly to questions concerning appropriate visitor behaviour than to questions concerning coral reef ecology. These research findings serve as a useful indication of where park managers and/or tour

operators should focus interpretation effort. Results discussed in Chapter 5 indicated that many respondents (particularly foreign visitors) are dissatisfied with the information provided by tour operator staff and the opportunity to learn more about coral reefs. An interpretation program that focuses on providing more information about coral reef ecology would improve the quality of the visitor experience, and help prevent or reduce negative impacts of recreational use. Visitors snorkeling in Koh Chang are receptive to receiving more interpretive information, and park managers should seize this opportunity to raise awareness and educate visitors about the reefs and appropriate visitor behaviour.

There are numerous examples of the effectiveness of interpretation programmes in increasing visitors' knowledge of the natural environment. Madin & Fenton (2004), for example, assessed the effectiveness of environmental interpretation programmes in the Great Barrier Reef by testing visitors' self-reported knowledge and understanding of basic reef ecology and human impacts on the reef environment. The results showed that visitors not yet exposed to an interpretation programme scored highest on questions relating to human impacts on the reef and reef health, and respondents demonstrated lower mean scores for questions relating to reef tourism (e.g., attitude towards amount of tourism that should be allowed and managers' role in tourism regulation) and reef knowledge (e.g., ability to name types of coral, fish, and other marine animals). Following exposure to an interpretive programme, respondents demonstrated significantly greater levels of reef environmental knowledge, indicating that the interpretive programme was an effective means of affecting visitors' perceived knowledge of the reef environment.[2] The effectiveness of interpretation in increasing visitors' knowledge of the attractions they visit is also supported by results from a study conducted by Orams (1997).

Despite evidence that education and interpretation can increase visitors' knowledge, there is some debate over the effectiveness of interpretation in recreational settings, probably because there is a lack of empirical research into the relationship between interpretation and behavioural change (Kuo, 2002; Orams, 1995). The difficulty of demonstrating whether a change in behaviour is the outcome of participating in an interpretation programme should

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[2] The authors surveyed independent pre-exposure and post-exposure groups of visitors in order to eliminate the possibility of respondents' selective acquisition of information on topics covered in the pre-exposure questionnaire items. Large sample sizes of both groups allowed a high degree of confidence in assuming that the discrepancy in scores was not due to individual differences, but rather to actual changes in perceived knowledge levels.

not, however, detract from the effort of interpretation. Visitors' knowledge will accumulate progressively from exposure to interpretation activity, and if visitors already possess the knowledge of appropriate behaviour, interpretation will reinforce the existing knowledge (Kuo, 2002). In addition, if the nature-based tourism industry wants to make a positive contribution to the conservation of the natural environment, park managers and operators can adopt carefully designed educational programmes that incorporate lessons from the educational psychology fields (Orams, 1995, 1997). Results from a study conducted at Tangalooma, Australia showed that a structured educational programme, based on educational psychology, *can* prompt tourists to become more 'green' and adopt more environmentally responsible practices, adding weight to the argument that education should receive greater emphasis in tourism management (Orams, 1997).

An alarming percent of visitors witnessed a variety of behaviours that pose a significant threat to the long-term health and preservation of Koh Chang's reefs.

There is no list in the recreation literature that ranks recreation activities (or behaviours associated with recreation activities) in order of likely impact, but based on recreation ecology literature (e.g., see Allison, 1996; Hawkins & Roberts, 1997; Hawkins, Roberts, Kooistra, Buchan, & White, 2005; Rogers et al., 1988; Salm, 1986), anchoring on the reef can be considered a high impact activity, as can snorkeling under certain conditions.

Twenty-two percent of visitors observed boats anchoring on top of the reef, suggesting that improper anchoring is a serious issue in need of immediate address. The immediate and cumulative effects of anchor damage can be significant, and corals can take years to recover.

The impact of snorkeling on reef ecology is dependent upon a number of factors, including snorkeler behaviour. If tourists stay on the surface of the water while they snorkel, the opportunity to accidentally damage coral diminishes. However, behaviours witnessed by visitors suggest that snorkelers are not staying on the surface of the water:

- 59% of visitors saw snorkelers diving deeper for a closer look,
- 54% of visitors witnessed other snorkelers resting their feet on the reef,
- 41% witnessed other snorkelers touching the reef with their hands,
- 38% saw other snorkelers touching marine animals,
- 19% witnessed other snorkelers kick the reef with their feet, and
- 8% saw snorkelers break off a piece of coral.

On a daily basis, reefs are being touched, abraded, kicked, and stepped on by snorkelers. These inappropriate, depreciative behaviours can cause considerable damage to benthic organisms and the aesthetic appeal of the reefs, and so they are a serious management issue in need of immediate attention.

Other behaviours or activities observed by visitors that may have negative impacts on reef ecology and the quality of the visitor experience include improper disposal of garbage, fish feeding, and the collection of sea shells. Twenty-one percent of respondents observed other visitors throwing garbage overboard, and 12% witnessed boat staff doing the same. Since the amount of litter is often cited as an influential indicator of wilderness quality (Noe et al., 1997; Roggenbuck et al., 1993), park managers and tour operators should take swift action to try and reduce the amount of garbage that ends up in the ocean.

Eighty percent of survey respondents observed other tourists feeding fish, and 41% observed boat operators feeding fish. Some visitors may appreciate the viewing opportunities facilitated by feeding, but for others pursuing a "natural" experience, fish feeding may detract from the snorkeling experience. Thirty percent of visitors also witnessed other snorkelers collecting sea shells. This activity might also detract from the visitor experience, but more importantly, it is prohibited inside park boundaries. However, tourists may not be aware of the park's rules since they are not communicated.

Several visitors used available space on the questionnaire to provide additional commentary about the inappropriate behaviours and negative impacts they observed while snorkeling:

> "Educate snorkeling operators to not anchor over coral reefs for at the rate that the coral gets damaged at the moment, in 5 years there is nothing going to be left. And to have someone else on the boat that speaks English to do a brief to snorkelers about not touching coral and not to stand on it."
>
> "Snorkeling companies get too close to the reef and drop anchors right onto the reef."
>
> "I was upset to see a boat guide playing with a marine animal - sea cucumber - like it was a toy."
>
> "Some coral reefs in Koh Chang have been destroyed but I have no idea why. I have seen ropes in the sea flowers and no one paid attention to pull them out or maybe I didn't see, but [the ropes] are for sure from humans. I didn't pull the ropes off because I can't swim. I saw some plastic bags on some beaches."

"Corals have been destroyed a lot. There is garbage in the sea, and tourists step on the reefs. People lack the knowledge (how to do); there should be someone taking better care so that the tourists will not break the corals. Overall the trip was impressive but worried about the corals."

"I went on two snorkeling trips with my husband, and we are glad that we got to see the coral reefs and the variety of animals in the sea - BUT - we firmly believe that if the tourism industry, including snorkeling operators, is not quickly made subject to strict policies based on preserving the environment, there will not be any environment left to protect."

"Snorkelers should not step on, or touch the corals and marine animals. Snorkelers should not throw garbage in the sea."

"I want the coral reefs not to be destroyed. There shouldn't be a lot of boats at the snorkeling sites."

"Garbage is disposed of in the sea."

"Keep the ocean more clean!"

"Beautiful and diversity. But, anyway, it needs to be protected cause I thought some of it might be disturbed by human beings. How about the oil/fuel of the boat when it stops to let passengers get down to snorkeling, is it gonna disturb the aquatic ecosystem? I saw some fuel on the surface (a few, a very few for one boat)."

"Preserve the marine natural resources. Do not stop boats too close! Check condition of boats often to guard against pollution. Be strict about keeping environment clean!"

"I saw some people standing on the coral reefs and break it/destroy it. So sad. The boat should also stop far from the snorkeling sites. Some boats also tie the boats to the corals."

"There were too many people in the water feeding the fishes so that all except for the tiger fish disappeared."

"I think its very important that the coral is protected. You see, I saw quite a lot of dead coral, and that makes me want to stop snorkeling. I hope the government will protect it well."

Several visitors who viewed negative impacts commented on the importance of education to prevent such occurrences:

"I think the staff on the boat should educate their passengers better when it comes to conservation of the reefs. Both staff and passengers were standing on the coral and some people were breaking bits off. The boat staff should make it their responsibility that this doesn't happen."

"It's important that tourists should help to conserve and there should be training for the staff on boats to help in extending coral reef conservation, so that they can help tourists understand the value of the beautiful marine ecosystem."

"Having previously snorkeled in Thailand I feel on this trip not enough information was given on what to do and not to do. For instance, when snorkeling previously we were told not to touch or stand on the coral as this damages it. Also not to feed the fish or take sea shells as souvenirs. None of this information was given on this trip!"

"The damaging effects of touching/breaking coral was never stressed to tourists."

"Information provided by the tour operators and other organizations is necessary to help the tourists be more aware of the value of nature. There should be information provided before going to snorkel."

"Tourists should know how to protect corals before snorkeling."

"There should be officers teaching basic techniques in snorkeling that will not harm nature and what to do to not get into danger or endanger the environment."

"The local Thai people I met on the boat were very friendly. They were snorkeling for the first time - there was no information given to them about the importance of the coral reef and how to look after it."

"More information on corals should be given during snorkeling. More information on coral conservation techniques before snorkeling is needed."

"I have noticed a lack of awareness related to environment issues. Local residents should be aware of the importance of a clean environment. A clean and well preserved environment will bring tourists to the island and will bring the money they need. Local government should be working towards sustainable development in the area."

These findings provide a useful indication of the prevalence of high-impact behaviours, how these behaviours are perceived by tourists, and how park managers may resolve the impacts resulting from visitor use. Immediate action should be taken to reduce high-impact behaviour, otherwise, visitors with high expectations of environmental quality will move on to explore other areas, and the industry will suffer unnecessary financial loss. Since "much impact is undoubtedly caused by well-intentioned visitors whose behaviour is destructive because of their inexperience and lack of low-impact practices" (Marion & Rogers, 1994, p.161), park managers and tour providers should develop an interpretation program to inform visitors of management concerns and teach low-impact practices. Visitors are calling for more information on coral conservation techniques, and government and tour operators should heed the call.

Over half of respondents perceive the impact of snorkeling on Koh Chang's coral reefs to be large, suggesting that tourists are aware of the environmental impacts associated with this activity. Witnessing inappropriate behaviours while snorkeling or traveling to the snorkeling sites has a significant influence on perceptions of impact.

Almost 55% of respondents perceive the impact of snorkeling on Koh Chang's coral reefs to be "large" or "very large", while 30% perceive the impact to be "small". Visitors who observed inappropriate behaviours were more likely to feel that snorkeling has a negative impact on the reefs than visitors who did not observe inappropriate behaviours. This finding is consistent with the findings reported for a study in Phuket, Thailand, where divers who witnessed impacts were more likely than other divers to agree that diving has a negative impact on fish and coral (Bennett, 2002; Dearden et al., 2007).

Visitors' willingness to recommend snorkeling to other tourists visiting Koh Chang is influenced by perceptions of impact.

Respondents who perceive the impact of snorkeling on the environment to be "large/very large" are less likely to recommend snorkeling to other tourists visiting Koh Chang. This finding is important because it demonstrates that perceptions of impact can affect the sustainability of the snorkeling industry. If park managers and tour operators can alter visitors' perceptions of impact by affording the reefs greater protection from the range of threats identified by tour operators and visitors, the snorkeling industry serves to benefit from increased business. It is not unusual for tourists that are new to the area to seek advice from other tourists on what to see and do while on vacation, and as a result, tour operators should seek to nurture a positive image for the snorkeling industry to maximize economic return.

These findings are similar to those reported by Dearden et al. (2006), where divers who witnessed damage were significantly less likely to return to Phuket, Thailand for a dive holiday in the future, compared with those who did not witness damage. Results reported here, and by Dearden et al. (2006), suggest that solutions to recreation management problems may be linked to how visitors view the severity of environmental impacts, since perceptions can negatively affect the economic viability of marine tourism. Environmental issues become critical when they negatively impact user satisfaction, and when they change tourist location choice.

Some visitors are willing to pay extra for protection of the marine environment. However, visitors' willingness to contribute to marine conservation is not influenced by perceptions of impact, or visitors' observations of inappropriate behaviour.

Forty-three percent of survey respondents indicated a willingness to make an additional monetary contribution towards protection of the marine environment and the snorkeling sites they visited. Visitors are willing to contribute, on average, less than US$5. In Doi Inthanon, a national park in Thailand, ecotourists showed a much stronger interest in conservation, and, on average, were willing to contribute US$16.52 (Hvenegaard & Dearden, 1998). Although potential financial contributions to conservation in Koh Chang are comparatively low, these results are encouraging because they provide some indication of visitors' awareness of the problems created by tourism activities and the acceptance of responsibility for the consequences. The results also provide an indication of the park's capacity to generate revenue for marine conservation from snorkelers through user fees. Even a small fee collected from tourists could make a significant contribution towards addressing some of the issues identified by visitors and tour operators.

Interestingly, visitors' willingness to contribute to marine conservation is not influenced by their perceptions of impact, or their observations of behaviours that could impact the reef ecologically or aesthetically (e.g., anchoring on the reef, littering, tourists breaking off coral, etc.). These results depart from findings reported by Dearden et al. (2007), where divers who witnessed diver damage were significantly more likely to indicate an interest in participating in a reef-monitoring project. Additional research is required to understand why this is the case, but one possible explanation is that visitors snorkeling in Koh Chang may not feel that an extra monetary contribution will protect the reefs from threat. Alternatively, visitors may not feel that it is their responsibility to protect the environment, but rather the responsibility of government and/or business.

Specialization has a strong influence on visitors' awareness of coral reefs, their observations of the behaviours of others, and their perceptions of the impact of snorkeling on reefs.

As snorkelers' level of experience or specialization increases, mean quiz scores increase, suggesting that experience has an influence on visitors' knowledge and awareness of reef ecology and the impacts of human use on the environment. This finding supports Bryan's (1977) assertion that the more specialized visitors "tend to have high knowledge…as an

outgrowth of high time and skill commitment to the sport generally" (p.186). Specialization also influenced visitors' observations of the behaviour of others, with the percentage of visitors witnessing inappropriate behaviours increasing as specialization increased. This suggests that more specialized snorkelers are more alert and sensitive to the behaviour of other snorkelers and tour operators. Low specialized snorkelers who have little or no prior experience may be more preoccupied with issues of safety, compared with medium and high specialized snorkelers who have reached a level of comfort with the marine environment that permits greater awareness of the conditions and activities around them. Not surprisingly, perceptions of impact also increased as specialization increased, possibly because visitors with more experience are better at assimilating all the information required to connect depreciative behaviours with environmental impacts.

Bryan (1977) hypothesized that high specialists are more likely than low specialists to be concerned with conservation, but in this study, recreation specialization has proven to be of little value in predicting attitudes towards conservation. High, medium, and low specialized snorkelers do not differ with respect to willingness to make an additional monetary contribution towards protection of the marine environment.

Country of origin has a strong influence on visitors' awareness of coral reefs, their observations of the behaviours of others, and their perceptions of the impact of snorkeling on reefs.

Non-Thai visitors scored significantly higher on the learning quiz compared with Thai visitors, indicating that foreign visitors have a better understanding of the reef environment than domestic visitors do. Non-Thai visitors were also more likely than Thai visitors to witness inappropriate behaviours, and to perceive the level of impact of snorkeling as "large/very large". Differences in environmental awareness and perceptions of impact between visitors with different nationalities were also observed in a study by Baysan (2001). The author of this study looked at perceptions of how tourism affected the environment, what effects stem from tourism activities, whether the tourists are willing to pay for the protection and maintenance of the environment, and whether nationality plays an important role in differentiating the impacts of tourism on the environment. Results revealed statistically significant associations between German, Russian, and Turkish tourists and several variables relating to environmental awareness and behaviour.

The results of this study and the one conducted by Baysan (2001) confirm that country of origin seems to have a powerful influence on environmental perceptions and observations of environmental conditions. Various demographic, cultural, material, and experiential differences between tourists segmented on the basis of nationality may explain why visitors differ. Prior experience, for example, may be one possible explanation for the observed differences between Thai and Non-Thai visitors. Results reported in Chapter 4 (Table 4.5) showed that a significantly greater percentage of Non-Thai visitors are categorized as high or medium specialized, compared with Thai visitors. A majority of Thai snorkelers may not have been exposed to coral reef interpretive programs prior to visiting Koh Chang, and they may not have been aware of the kinds of behaviours that can negatively impact coral reefs, making it difficult to link observed behaviours with perceptions of impact. Specialization may therefore be a more powerful influence on environmental knowledge and perceptions of impact than country of origin.

Crowding is a problem that warrants immediate management attention.

Survey results indicate that a significant percentage of visitors are negatively affected by the number of other people around and the presence of human-made structures. Fifty-three percent of the sample felt there were too many other people snorkeling, 50% felt there were too many other boats at the snorkeling sites, and 32% felt there were too many other tourists on board the boat. The number of mooring buoys influenced perceptions of crowding for 14% of respondents who felt there were too many buoys in the water, while the number of staff on board the boat did not heavily influence perceptions of crowding, as only 3% of the sample felt there were too many staff members. By way of comparison, in Saltzer's (2002) study of visitors to the Great Barrier Reef Marine Park, 20% of respondents evaluated the number of other people as "too many", and only 4% of respondents evaluated the number of boats as "too many".

Over 90% of respondents reported a score of "3 slightly crowded" or higher on Heberlein & Vaske's (1977) 9-point scale, and over 20% felt "extremely crowded". Crowding is clearly a significant issue in Koh Chang. Shelby & Heberlein (1986) suggest that "locations or activities where more than 80% of the visitors feel crowded have high use levels and use impact problems" (p.285). Crowding is definitely a problem in Koh Chang, but how does it affect visitors' experiences? Researchers consistently find low correlations

between perceived crowding and overall satisfaction (Graefe et al., 1984; Manning, 1986; Shelby & Heberlein, 1986), and results reported in this study also suggest that a majority of snorkelers in Koh Chang have positive experiences regardless of the crowded conditions - 25% of visitors are "very satisfied" overall with the environment and setting conditions, and 49% are "somewhat satisfied". Several factors may help to explain why snorkelers are crowded yet satisfied:

- The social conditions were rated by respondents as some of the least influential on visitors' experiences – less than one-third of respondents rated the 'number of boats' and the 'number of other snorkelers' as "extremely important". Features related to the natural conditions (e.g., variety/abundance of marine life, variety of coral, etc.) were rated as more influential on visitors' experiences.

- Visitors who felt crowded may have adjusted their expectations and/or altered their activity patterns.

- Recreation behaviours are voluntary and therefore self-selected. Users choose activities in accord with their normative idea of a "good time", so satisfaction levels remain high regardless of the conditions (Shelby, 1980). Individuals may rationalize their experience and report high levels of satisfaction to reduce internal conflict (Manning & Valliere, 2001).

- Visitors, particularly those who are new to the activity, may not have developed strong preferences or expectations for the experience (Inglis et al., 1999).

- Visitors bothered by heavy use of the area may move to less crowded areas and be "displaced" by those more tolerant of high use levels. Group composition changes, and therefore aggregate satisfaction remains high (Shelby, 1980).

- Increasing use levels may change the nature of the recreation experience. This "product shift" raises "appropriate" levels of encounter, and satisfaction remains high (Manning & Valliere, 2001; Shelby, 1980).

- Less than preferable social conditions may still lead to highly satisfactory experiences due to the low cost of snorkeling trips. On average, visitors to Koh Chang pay only US$12.50 for a snorkeling day trip. By comparison, visitors to the Virgin Islands pay US$75 for a day of snorkeling (Big Beard's Tours, 2007), and visitors to the Great Barrier Reef Marine Park pay US$110 for a day of snorkeling (Cairns Visitor Centre, 2007).

Visitors' who feel crowded still report high levels of satisfaction, and so the immediate response might be, "why not increase use levels?". Marine protected areas have the dual mandate of conserving natural resources, as well as providing opportunities for recreation and tourism. To meet the first part of this mandate, park managers must balance park uses with the capabilities of the resource to sustain such use indefinitely (Manning, 1986; Marion & Rogers, 1994). Although the impacts of any single reef visitor are typically very small, the cumulative effects of many visitors can have significant long-term consequences (Marion & Rogers, 1994). Coral reefs have a high capacity to accommodate recreational use, provided visitors practice low-impact behaviour (Marion & Rogers 1994). But personal and visitors' observations of snorkeler and tour operator behaviour suggest that reef users are *not* practicing low-impact behaviour, which may be diminishing the capacity of the reefs to sustain high levels of use.

Marine park managers can reduce impacts substantially through educational and interpretive approaches, which can also improve the visitor experience. These "soft" approaches to manage visitor use are generally preferred over more direct regulatory and enforcement approaches, but regulations (e.g., limitations placed on use levels) may be necessary to respond to resource threats if park managers do not seek alternative actions. In absence of influence over the levels, type, and location of use and visitor behaviour, overuse, misuse, and abuse of the resource are likely to occur over time, and if such problems continue, the resource is likely to suffer irreparable damage to the point at which ecological integrity will be threatened (Boyd & Butler, 1996; Duffus & Dearden, 1990).

To meet the second part of their mandate (the provision of recreation and tourism opportunities), managers may be required to manage park uses to provide for a range of recreation experiences and opportunities. In the absence of efforts to regulate use, by default the opportunities available will shift toward the higher density, higher development end of the recreation opportunity spectrum (Manning & Valliere, 2001; Shelby et al., 1988). This may lead to "the systematic elimination of opportunities at the low density end of the spectrum, an undesirable outcome if agencies are committed to providing a full range of recreation choices" (Shelby et al., 1988, p.286). Given the number of visitors who report feeling crowded in this study, it may be wise for managers to deliberately design and maintain recreation opportunities that serve the needs a wider variety of visitors to avoid the displacement of visitors and, ultimately, declines in tourism demand. If numbers of tourists

become excessive and the tourist experience declines, visitor numbers may decline because of the unattractive nature of the setting, but by this time, it may be too late to restore the area to an attractive state (Boyd & Butler, 1996).

Perceptions of crowding are influenced by visitors' expectations, observed levels of use, and the behaviour of others.

A greater percentage of visitors perceived the conditions as crowded when the number of actual encounters exceeded the number of encounters expected. This is consistent with the recreation literature, which suggests that judgments of crowding are influenced by visitors' encounter expectations (e.g., Ditton et al., 1983; Manning, 1986; Schreyer & Roggenbuck, 1976). Visitor expectations are influenced by several factors, including prior experience:

> "...[E]xpectations are based on the setting of the first encounter. Presumably, if a person first experiences a place at a certain level of use, this will condition subsequent experience evaluations. Upon returning to find the area (or a similar place) at a much higher level of use intensity, the latter condition will be evaluated more negatively than if the visitors' initial exposure had been to such higher levels already" (Absher & Lee, 1981, p.236).

As reported in Chapter 4 (Table 4.4), almost 60% of visitors have snorkeled at least once in Thailand before visiting Koh Chang, and 46% have snorkeled outside of Thailand. These results show that a significant number of visitors have experienced snorkeling conditions in other places, and this prior experience may have influenced evaluations of use levels in Koh Chang. Tourism providers can influence visitor expectations by providing customers with accurate information about the snorkeling conditions. For example, operators can show tourists photographs that depict a range in use levels to help manage expectations and, ultimately, reduce perceptions of crowding.

Without any previous direct experience, visitors' expectations may be shaped by the range of images presented by the media and tourism industry in brochures, guidebooks, videos, and magazines. Media descriptions are often highly contrived and idealized, and so visitors are presented with a distorted or false image of place (Fenton, Young, & Johnson, 1998). "...[O]nce ideal images of place are developed and assimilated by the reef visitor, they become an important comparative standard for evaluating the experience of the reef environment" (Fenton et al., 1998, p.189). This suggests that park mangers should give

greater consideration to how the natural environments in Koh Chang (and elsewhere) are presented to tourists.

Perceptions of crowding also increased when the number of snorkelers visitors' remembered seeing exceeded 40. This is similar to the finding reported by Roman (2004) in a study of snorkelers in Koh Chang, where perceptions of crowding increased markedly when the number of snorkelers at a site exceeded 35. In this study, personal on-site observations estimate the mean maximum number of snorkelers at 86, significantly higher than the threshold value identified by Roman (2004).

Since visitors' crowding perceptions appear to be influenced by use levels, restrictions on use may have to be imposed. In this case, normative crowding standards of visitors, discussed in greater detail in the next section, can be useful in informing managers about appropriate use levels. However, research results also show that the observation of objectionable or depreciative behaviour by other users plays an significant role in visitors' perceptions of crowding. This is an important finding because it implies that actions other than simply restricting the number of other users are required. Educational programs designed to modify visitor behaviour, for example, may be an effective approach for dealing with crowding. Results from this study help identify the specific behaviours that managers should focus on modifying to best reduce the environmental and social impacts of use.

Visitors have normative standards for appropriate use levels.

To help determine the point at which the number of other users becomes unacceptable to visitors, this study used a normative approach. The norm curve for the number of other snorkelers showed that ratings of crowding acceptability by respondents generally decreased as the number of snorkelers depicted in the photographs increased. The shape of the norm curve, however, was somewhat uncharacteristic, as the total absence of other snorkelers was not the optimal or preferred condition, suggesting that visitors find some use preferable over no use. This suggests that feelings of solitude may *not* be an important component of the experience sought by visitors, and this could be based on concerns for safety in the marine setting (Inglis et al., 1999).

The range of acceptable conditions is 0-22 snorkelers at any one time. Since 67% of visitors recalled seeing more than 29 other people while snorkeling, the norm for the number of other snorkelers was often violated. As expected, perceptions of crowding

increased when the encounters with others exceeded the norm (Table 6.19). This finding is consistent with other studies that compare perceptions of crowding with encounter norms (e.g., Manning et al., 1996; Needham, Rollins, & Wood, 2004; Vaske et al., 1996; Vaske et al., 1993; Vaske et al., 1986). Interestingly, the range of acceptable conditions reported here is the same as that which was reported by Inglis et al. (1999), for a series of above-water snorkeling images in a case study of crowding norms on the Great Barrier Reef. More research is needed, but perhaps this standard of quality for the number of other snorkelers is generalizable to other tropical reef settings.

Data from respondents' normative evaluations of use levels suggest that one possible approach for avoiding unacceptable levels of crowding would be to establish and monitor standards of quality between zero and 22 snorkelers. However, crowding norms are only useful in formulating standards of quality when norm intensity and crystallization are high (Manning et al., 1996). The relatively low norm intensity or salience (2.7 out of 4) indicates that respondents do not feel particularly strong about this indicator of quality, which might be expected given the low mean score for the importance of the 'number of other snorkelers', as reported in Chapter 5 (Table 5.1). The minimum acceptable condition for the indicator is 22 snorkelers, but a low crystallization (SD=1.16) suggests that there is little consensus among snorkelers for setting the standard of quality at the minimum acceptable condition.

The manager's task is made easier if there is broad agreement, or consensus, on what are the acceptable conditions, but if there is large variation in opinions, then the manager might try to meet different visitor needs in different zones (Roggenbuck et al., 1993). In this study, the wide range of visitor opinions about acceptable use levels is an important finding, as it calls attention to the diversity of standards that must be responded to if tour operators and park managers want to maintain or improve the quality of the recreation experience. If managers set the standard for the maximum number of other snorkelers at 22 for *every* reef, many visitors will be restricted or displaced from the marine park. In addition, use restrictions can be difficult and costly to enforce, and there is very little support from Koh Chang's tour operators for placing limits on the number of snorkelers permitted to use the area. Furthermore, setting the standard at 22 snorkelers may reduce crowding and improve experiences for *some* visitors, but for others, this standard will be too low. Options such as altering the patterns of use through zoning and/or increasing visitor interpretation

programmes to affect visitor behaviour may be more feasible for reducing encounters and crowding, and managing standards of quality. Since social impacts of use are a function of the amount of use, the type of use, visitor behaviour, use distribution, and timing of use, a number of different management approaches will be needed to manage visitor use.

Encounter expectations, perceptions of crowding, and encounter norms are influenced by specialization.

Since visitors' expectations are based, in part, on prior experience, it is not surprising that high specialized snorkelers had different expectations for the number of other snorkelers compared with medium and low specialized snorkelers. A greater percentage of high and medium specialized snorkelers reported seeing more snorkelers than expected, suggesting that high specialized snorkelers have snorkeled in places where use levels were lower, or at a time when use levels were lower in Koh Chang. This is supported by data analyzed and presented in Chapter 4 (Table 4.6) – compared with low specialized snorkelers, high and medium specialized snorkelers have more prior experience snorkeling in Thailand, have more prior experience snorkeling outside of Thailand, and snorkeled more times in the year prior to survey administration. High and medium specialized snorkelers have had the experience necessary to formulate expectations, and as a result, they may be less satisfied with use levels than low specialized snorkelers. High and medium specialized snorkelers also remembered seeing more users than low specialized snorkelers, which may indicate that they are more sensitive to, and aware of, other people.

With the exception of the 'number of tourists on board the boat', there are significant relationships between snorkelers' specialization level and evaluations of encounters with the number of other people, the number of boats, the number of mooring buoys, and the number of staff on the boat. Consistent with the recreation specialization concept, high specialized snorkelers perceived the conditions as more crowded than low specialized snorkelers.

Normative standards are also influenced by specialization. As skill level increases, acceptability towards increasing numbers of other snorkelers decreases. All three specialization groups prefer some use over no use, but high specialized snorkelers have stronger preferences for the condition with no other snorkelers compared with medium and low specialized groups. High specialized snorkelers report a lower minimum acceptable

condition and a smaller range of acceptable conditions, indicating that more experienced snorkelers are more sensitive to higher use levels. Relatively high standard deviations around the minimum acceptable conditions for high, medium, and low specialized snorkelers indicate that specialization does not explain all of the variation in mean responses reported at the aggregate level, but nevertheless, the findings have implications for how visitor use should be managed.

With the exception of the photograph depicting 15 snorkelers, mean acceptability scores for each photo were significantly different for high, medium, and low specialized snorkelers, suggesting that there is an important relationship between recreationists' crowding norms and degree of specialization. These findings depart from those reported by Inglis et al. (1999), who also examined the influence of experience on snorkelers' crowding norms. The authors found that respondent groups were "remarkably consistent" in how they rated the photographs of the number of other snorkelers. Differences among experienced recreationists, locals, tourists, and novices were almost exclusively confined to slides that had no people in them, with the strongest preference held by experienced recreationists who favoured the total absence of people over all other settings. The crowding norm was also strongest for experienced recreationists, who "tended to use extreme values at the very acceptable end of the scale for images with no snorkelers in them and used the negative extreme – very unacceptable – when the largest density of people (N=60 snorkelers per image) and the line of buoys was depicted" (p.375). This particular finding is similar to a finding of this study, where high specialized snorkelers rated the acceptability of the absence of other snorkelers significantly higher than did low specialized snorkelers, and high specialized snorkelers rated the acceptability of the photograph with the highest number of snorkelers significantly more negatively than did low specialized snorkelers. Additionally, both studies report a stronger crowding norm (norm intensity) for more experienced snorkelers.

Results reported here, and in the study by Inglis et al. (1999), show that there is diversity in the settings preferred by different visitors to coral reefs that is related to past experience. Insufficient levels of interaction may be just as unacceptable to some visitors (e.g., low specialized snorkelers) as excessive levels are to other visitors (e.g., high specialized snorkelers). Park managers will therefore need to provide a diverse set of recreation opportunities to increase the probability of meeting more visitors' needs and preferences.

The needs of low specialized visitors who prefer higher levels of use will be easiest to meet because regulations on use levels are not required. However, if use levels are allowed rise unabated, then specialized visitors who are sensitive to crowding may be displaced to alternative locations and replaced by visitors who are less sensitive to crowding. Opportunities to cater to the needs of high specialized snorkelers should be preserved, because specialists tend to have a smaller footprint than generalists. Specialists are generally more aware of the impacts of marine tourism on the reef and so they behave accordingly, and they place fewer demands on park resources since they tend to require little infrastructure or interpretive facilities (Duffus & Dearden, 1990). If specialists are replaced by generalists, "there will be a concomitant demand for more facility development, more mediation and increased pressure on both the social system and the ecosystem of the host area" (Duffus & Dearden, 1990, p.222). Furthermore, as the number of generalists visiting the park increases, the severity of the environmental impact of use will also likely increase (Boyd & Butler, 1996). For these reasons, park managers should seek to preserve a wide range of conditions and use characteristics. In this way, more snorkelers' preferences can be met, and the negative social and environmental impacts resulting from use can be reduced.

Encounter expectations, perceptions of crowding, and encounter norms are influenced by culture.

Results of this study indicate consistent patterns between Thai and Non-Thai visitors regarding crowding-related norms and associated measures. A significantly greater percentage of Non-Thai respondents evaluated the number of other snorkelers, the number of boats, and the number of mooring buoys as "too many". Almost 30% of Non-Thai visitors reported feeling "extremely crowded", compared with 10% of Thai visitors. Clearly, Non-Thai visitors are more negatively affected by other people and the presence of human-made structures than are Thai visitors.

Normative judgments of the acceptable number of other snorkelers also differed significantly between Thai and Non-Thai visitors. Differences between the two groups were most pronounced for scenes with zero and seven snorkelers, with Non-Thai visitors exhibiting the strongest preference for the absence of others. Thai visitors actually evaluated the photograph with zero snorkelers as unacceptable, suggesting that feelings of solitude may not be an important part of the experience. Snorkeling involves skills that must be

mastered for individuals to see and enjoy the environment, and inexperienced visitors may be less inclined to seek opportunities for solitude if they are not confident about their skill level (Inglis et al., 1999). In this study, Thai visitors' generally appeared to be uncomfortable in the water and were typically observed snorkeling in large groups, forming "human chains" in the water to navigate around snorkeling sites. This behaviour suggests a preference for the presence of others, and offers an explanation for Thai respondents' crowding norms.

Thai and Non-Thai visitors' mean acceptability ratings converged at Photo C (17 snorkelers), and diverged again as use increased. Thai respondents felt that the optimal condition for the indicator was 17 snorkelers, considerably higher than the optimal condition of seven snorkelers identified by Non-Thai respondents. The standard of quality for Thais (25 snorkelers) is also significantly higher than for Non-Thai respondents (21 snorkelers), although the difference may have more academic than managerial appeal. The crystallization at the minimum acceptable condition is the same for both respondent groups (SD=1.13); these standard deviations are lower than those reported at the aggregate and disaggregate level for high and low specialized groups, suggesting that cultural background may be a useful way to segment visitors.

There is a relatively large body of work on norms in outdoor recreation, but only recently have researchers begun to examine crowding-related norms across different cultures or nationalities (Budruk & Manning, 2002). Conjectures prevalent in the literature suggest that adaptability to high levels of density is subject to cultural differences, and that Asians are more tolerant than Europeans of high density situations (Anderson, 1972; Gillis et al., 1986). Results from this study support the notion that visitors vary across cultures regarding their acceptability of high use levels, and that Asians are more accepting of high use levels. Roman (2004) also examined the relationship between cultural background and perceptions of crowding, and found that "Caucasian foreigners" were more sensitive to crowding than Thais. Other, related studies however, have found few differences in norms between visitor sub-groups. Budruk & Manning (2002), for example, examined crowding norms reported by U.S. visitors and International visitors for 13 sites in 5 U.S. national parks and related outdoor recreation areas, and found that crowding perceptions did not vary between U.S. and international visitors, and differences regarding crowding-related norms were inconsistent. Where significant differences emerged, they tended to be associated with "preferences" and number of visitors "typically seen". Vaske et al. (1996) examined the

relationships among norms, reported encounters, and perceived crowding reported by visitors from five different countries of origin – Canada, United States, Japan, Germany, and England. The authors found few apparent differences for perceived crowding levels, despite comparable levels of reported encounters. Cultural diversity in outdoor recreation remains an important area for future research, particularly given the major demographic shifts that many parks and protected areas are undergoing as access and mobility improves (Shinew et al., 2006; Simcox, 1993).

This study has improved understanding of the range of opportunities sought by visitors with different cultural backgrounds, and the way in which different visitors perceive resource conditions. This understanding is essential to resolving social impacts of use, particularly since park managers and tour operators almost certainly have a limited understanding of client groups with dissimilar backgrounds. To fulfill the diverse needs of both Thai and Non-Thai visitors, park managers and tour providers will need to initiate change in how the snorkeling environment and experience is managed. Fortunately, actions taken to meet the needs of Non-Thai snorkelers may also appease high and medium specialized snorkelers, who are also negatively affected by current levels of visitor use. The provision of a diversity of recreation opportunities will satiate multiple segments of park users, and this is a useful finding when it comes time to designing and implementing appropriate visitor management strategies. Diversity in recreation opportunity settings is an issue that is revisited in the recommendations section of Chapter 7.

Chapter 7 Summary, Conclusions, Recommendations

The overall goal of this research was to establish a baseline understanding of the social dimensions of the snorkeling industry in Koh Chang, and to recommend a suite of management actions for marine park managers and snorkeling tour operators that will sustain economic benefits while still yielding the benefits of protecting aesthetic and biological values. This chapter presents a summary of the major findings and conclusions. Recommendations that may enhance the quality of the visitor experience and the sustainability of the snorkeling industry are then presented, followed by a discussion of the strengths and limitations of the study, and suggestions for future research.

7.1 Summary of Major Findings

Findings of this study lend support to several previously published research on marine-based tourism in reef settings, and suggest some new conclusions concerning snorkelers' environmental and experiential preferences and their perceptions of the environmental and social impacts of use. The main findings of the thesis are:

- **Coral reefs in Koh Chang are a major tourist attraction.** High-capacity vessel-based operators take between 28,500 and 44,850 visitors snorkeling on an annual basis, and these visitors directly contribute an estimated US$357,300 – US$561,500 to the local economy.

- **Visitors who snorkel in Koh Chang have similar demographic characteristics to reef visitors in other parts of the world** (e.g., Inglis, Johnson, & Ponte, 1999; Roman, 2004; Saltzer, 2002; Shafer, Inglis, Johnson, & Marshall, 1998). However, there are significant differences between sub-groups of visitors within the sample.

- **Features of the snorkeling environment and experience that have the greatest potential to add to, or detract from visitor experiences are related to the quality of the natural environment.** Snorkelers rated undamaged snorkeling sites, variety of marine life, variety of coral species, abundance of marine life, and good underwater visibility as among the most important features of their snorkeling trip. This is consistent with other studies conducted on snorkelers and divers in coral reef settings (e.g., Bennett, 2002; Roman, 2004; Shafer et al., 1998).

- **The social conditions – number of other people, and boats – were rated among the least important influences on visitors' experiences.** This is consistent with findings reported by Shafer et al. (1998) for snorkelers in the Great Barrier Reef Marine Park, but in terrestrial environments, the number of people at one time (POAT) is an important indicator of quality of the visitor experience (Manning, 1986; Roggenbuck et al., 1993).

- ***Overall*, visitors are generally satisfied with the physical, natural, and social conditions, but the degree of satisfaction varies among snorkeling trip features.** The lowest levels of satisfaction are expressed for the social conditions (number of other snorkelers, number of boats), and several features related to the quality and condition of the natural environment, particularly the abundance of large fish, unique underwater formations, undamaged snorkeling sites, and variety of marine life. The highest levels of satisfaction are expressed for the weather, and sea state. Results from this study and Roman's (2004) seem to indicate that reef quality in Koh Chang is generally in poor condition.

- **Overall, visitors are generally dissatisfied with the service conditions.** Low levels of satisfaction are expressed for a number of service features including the information provided by boat crew, the boat crew's commitment to the environment, safety procedures on board the boat, and the variety of snorkeling trips available. Services were identified by Bennett (2002) as a major strength of the dive industry, and the services provided by operator staff also had a high positive influence on users in the Great Barrier Reef (Shafer & Inglis, 2000; Shafer et al., 1998). Tourism providers in Koh Chang must make improvements to the services offered to ensure the park remains attractive to tourists, particularly those who have experience recreating in other marine parks with higher qualities of service.

- **Depreciative behaviours witnessed by the principal investigator, tourism providers, and visitors indicate that the environmental impacts of use may be significant.** This finding has important implications for reef conservation and the sustainability of the snorkeling industry. Immediate management attention is needed to address impacts resulting from use to avoid further deterioration of the natural resources and the visitor experience.

- **Tour operators' perceptions of impact are close to those defined in the recreation ecology literature, but tour operators may not be aware of the impact of their own behaviour on the marine environment.**

- **Tour operators would be willing to support management actions that influence the type of visitor use, the location of visitor use, and visitor behaviour to achieve desired social- and resource-setting attribute conditions.** A majority of tour operators also believe that tourists should be required to contribute an additional fee towards protection of the marine environment.

- **Crowding is a serious issue in need of immediate attention, as over 90% of visitors report feeling at least slightly crowded.** The social conditions were rated as un-important to most visitors, but park managers should still be concerned about use levels since the capacity of reefs to accommodate snorkelers is not unlimited, and some visitors bothered by heavy use of the reefs may be displaced to other parks or seek alternative recreation activities. Crowding perceptions were influenced by visitors' expectations, observed levels of use, and the behaviour of other users, a finding which is consistent with the recreation literature (e.g., see Ditton et al., 1983; Manning, 1986; Schreyer & Roggenbuck, 1976).

- **Visitors have normative standards for appropriate use levels.** A normative approach was used to measure visitors' acceptance for different levels of use, and results indicated that ratings of crowding acceptability by respondents generally decreased as the number of snorkelers increased. The range of acceptable conditions for the number of other snorkelers was 0-22, the same range reported by Inglis et al. (1999) for snorkelers in the Great Barrier Reef. A low crystallization around the minimum acceptable condition of 22 snorkelers indicates considerable variability in visitors' crowding norms.

- **Snorkelers are not a homogenous group.**

    - Differences between visitors' level of commitment to snorkeling and the underwater world are apparent between specialists and generalists, and this finding is consistent with the recreation specialization framework. Compared with low specialized snorkelers, high and medium specialized snorkelers are more experienced, participate in the activity more often, demonstrate a greater financial commitment to the activity, and place a higher value on coral reefs as a tourist attraction. Research findings are consistent with previous studies on specialization that suggest that more-specialized users differ from less-specialized users in a number of ways, including environmental preferences, sensitivity to environmental impact, knowledge and awareness, perceptions of crowding, and encounter norms (e.g., Dearden et al., 2006; Inglis et al., 1999; Randall, 2003).

    - Visitors with different cultural backgrounds have significantly different participation characteristics. Compared with Non-Thai snorkelers, Thai visitors are less familiar

with snorkeling, marine environments, and coral reefs, and they invest less money in the activity. Cultural differences also influence visitors' evaluations of the snorkeling conditions, perceptions of the impact of use, knowledge of reef ecosystems, awareness of other users' behaviour, and encounter norms. Results from this study demonstrate that attitudes about levels of use are subject to cultural differences, and support other studies that suggest that Asians can tolerate or adapt to higher levels of encounters better than others (Anderson, 1972; Gillis et al., 1986; Hall, 1966; Homma, 1990).

- **Importance-Performance analysis of the physical, natural, managerial, and social conditions suggests that a high level of action is needed to improve the quality of the visitor experience.** Results from the segmented I-P grids indicate that researchers and managers must pay attention to how the attributes within the quadrants differ across visitor segments, otherwise, visitors may be alienated or displaced.

- **Several condition items appear to meet desired Limits of Acceptable Change criteria for "good" indicators.** Condition items that might be selected as good indicators of quality visitor experiences include:

    - number of other snorkelers,
    - number of boats,
    - variety of snorkeling trips available,
    - undamaged snorkeling sites,
    - variety of marine life,
    - abundance of marine life,
    - abundance of large fish,
    - information provided by boat crew,
    - safety procedures on board the boat,
    - cost of snorkeling trip, and
    - learning opportunities.

- **The marine park provides a single, uniform type of snorkeling experience.** There is little variation between snorkeling environments and experiences with respect to access, on-site management, infrastructure, social interaction, and degree of regimentation. The snorkeling setting can be characterized as natural/undeveloped, with low levels of regimentation and moderate to high levels of use.

7.2 Conclusions and Recommendations

The tradeoffs between protection and use are evident in Koh Chang, where the consequences of unplanned and mismanaged recreational use are now apparent. Research results identified several imminent threats to the quality of the visitor experience, reef conservation, and/or the sustainability of the snorkeling industry, including:

- low visitor satisfaction with many elements of the snorkeling environment and experience;
- reef user behaviour, such as anchoring on top of reefs, pollution, harassment of marine animals, recreational fishing on the reefs, and intentional and unintentional contact with coral resulting in coral breakage and abrasion;
- crowding;
- a passive management approach, a laissez faire regulatory environment, poor enforcement of existing park rules and regulations, and an "invisible" park management authority;
- conflicting use of space – commercial and recreational fishers, snorkelers, divers, kayakers, and boaters all use the same reefs, at the same time; and
- the provision of one recreational opportunity that offers all snorkelers the same physical setting, social setting, and managerial setting.

As the popularity of snorkeling and other recreation activities increases, it becomes ever more important to maintain a balance between the use and conservation of marine resources. Active environmental planning and resource protection programs are essential for effective management to balance park uses with the capabilities of the resource to sustain such use indefinitely (Marion & Rogers, 1994). By permitting unlimited and unregulated recreational use of the park's reef ecosystems, managers and tourism providers will continue to erode the very values which contributed to marine park designation. Low levels of visitor satisfaction, tour operators and visitors' evaluations of the perceptions of impact, and the prevalence of user behaviour that is known to have a negative impact on reefs suggests that regulation of recreation use and growth cannot be left to market forces, and that resource protection measures are now urgent to ensure the long-term maintenance of high quality coral reef environments.

To stretch the capacity of the reefs to withstand high levels of use, and to improve the quality of the visitor experience, the following recommendations are offered:

Implement a reef education and awareness program.

There is an urgent need for a better and more structured environmental and interpretation program to make the visitors' experience richer and more enjoyable, and to improve tour operators' and visitors' understanding of reef ecosystems and how they are impacted by human activities. Through appropriate education and interpretation programs, park managers can reduce such behavior problems as intentional reef contact, littering, improper anchoring, recreational fishing, and harassment of marine animals. Boats take over one hour to reach snorkeling destinations from point of departure, which is plenty of time to deliver short briefings and convey safety and conservation messages. A variety of interpretational materials should be used, including brochures, posters, information boards, videos, identification keys, and codes of practice. Learning programmes will need to be delivered in both Thai and English to service the majority of visitors who snorkel in the park.

Park managers may also wish to give serious consideration to construction of a visitor information centre located at Ban Bao pier, where a majority of dive and snorkel tour operators depart. Support for coral reef protection programmes will only come through public knowledge and understanding of the park's resources and management goals, and the public must be knowledgeable about potential resource impacts and their causes before they can participate in helping to alleviate those impacts (Harriott, 2004; Tilmant, 2000).

Park managers should also consider training tour operators and park rangers, particularly in matters pertaining to visitor management and relations, and educate operators and rangers to increase general knowledge and conservation awareness of the marine environment. A training and education programme targeted at tour operators will help ensure that the right messages are communicated to visitors, will encourage involvement in reporting violations, promote compliance and stewardship of coral reef resources, and help build cooperation for a wider range of actions designed to manage impacts. Implementation will require time, effort, and cooperation between government and tour operator staff.

Improve on-site management.

To protect the marine environment from negative impacts, reduce crowding, and protect the safety of tourists, the following improvements to on-site management are offered:

- **Install additional mooring buoys at heavily-used sites.** Moorings are essential to prevent damage from boat grounding and anchors. The feasibility of installing mooring buoys at heavily used sites, such as Koh Tong Lang, should be investigated, and the position of existing moorings evaluated for effectiveness. Additional moorings may be required to meet demand at popular snorkeling sites. Park managers must also be vigilant at enforcing use of buoys to protect reef life.

- **Address sewage and other pollution problems.** Sewage disposal should be regulated to avoid potential water pollution and local nutrient enhancement. Discharge of human waste at sea should be avoided, although since proper sewage treatment may not be available on land, tour operators should at least ensure that sewage is not released directly on the reefs. Holding tanks should be installed on all boats, or washroom facilities closed until the boat has moved an appropriate distance from the reef. Leftover food should not be discarded onto the reefs, and fish feeding should be regulated to minimize the potentially adverse effects of supplemental feeding.

- **Create more responsible reef users.** Tour operators should be encouraged to intervene when they see snorkelers intentionally damaging the reef. Careless reef users should be warned of the damage they are causing, and fined if necessary. Managers might want to consider offering financial rewards for reporting inappropriate or illegal behaviour, or undertaking desired behaviour. The use of economic strategies to modify behaviours is not common in marine parks, but considerable potential exists (Orams, 1999).

- **Regulate access to control and mitigate environmental and social impacts.** Reefs that may be particularly vulnerable to trampling (e.g., see Roman, 2004; Rouphael & Inglis, 1997) should be identified, and a minimum skill level established to snorkel at these sites. Informal reef closures to snorkeling activity for specified periods of time should be made formal to reduce cumulative impacts and allow for recovery. Managers might also want to formally allocate specific areas for intensive use in order that other sites remain relatively undamaged. Tour operators should work together to arrive at snorkeling sites at different times and anchor certain distances away from one another, to help address the significant crowding problem. Park staff might also consider implementing a quota system to regulate access.

Limitations placed on snorkeling use levels will not be supported by a majority of tour operators, but limitations may become necessary to protect the quality of the visitor experience and the natural environment. Tour operators might recoup lost revenues with modest increases to snorkeling day-trip fees. Since there is already excess capacity in the industry, no new tourism operations should be permitted to start up.

- **Consider creating alternatives to snorkeling, such as glass-bottomed boat rides to relieve some of the pressure on the reefs.** Many of the low specialized visitors (particularly Thais) cannot swim and so their potential for reef damage is high. A glass-bottomed boat provides an alternative way of viewing reefs, and combines the pleasures of fresh air, boating, and reef watching (Salm, 1985). The quality of viewing will depend in large part on visibility, and boats will need to be kept away from strong currents, shallows, and uneven reefs with large coral heads (Salm, 1985).

- **Increase presence and effectiveness of marine park staff.** Park managers need to focus much more effort on enforcement to obtain compliance with park regulations within the protected area, to deter future violations, and to remedy problems that are occurring. Existing regulations on anchoring, fishing, and coral and shell collection must be adhered to, and new regulations may be needed to manage fish feeding activities and pollution. Successful enforcement will require clear articulation of park rules and regulations, sufficient patrol presence to deter violations and to educate resource users about the importance of compliance, quick response to violations and emergencies, sufficient resources to ensure proper supervision and implementation, and a coordinated effort (Tilmant, 2000). Marine park staff generally do not liaise with tourism providers, but this will need to change. Tour operators are aware of the necessity for improved reef management and so they can be motivated into becoming a major force in reef conservation; this will require fostering closer cooperation between marine park staff and tour operator staff. Enforcement of park rules and regulations should eliminate conflict between the consumptive and non-consumptive uses of the reef.

- **Establish and/or enforce minimum standards for marine transportation.** At a minimum, boat operators should be required to have certified life guards on board the boat, appropriate first aid equipment, and enough life jackets on board for every tourist, and these regulations should be regularly enforced. On-site observations suggest that boat capacity is sometimes exceeded to accommodate tourists, a practice that seriously compromises passenger safety. International safety standards should be applied to all tourism operations, and non-compliance should be taken seriously

(Dearden et al., 2007). Other marine transportation standards may be required to ensure visitor safety and minimize environmental impact. For example, air and water quality standards could be set to reduce the impact of pollution on reefs (Dearden et al., 2007).

Diversify the recreation setting.

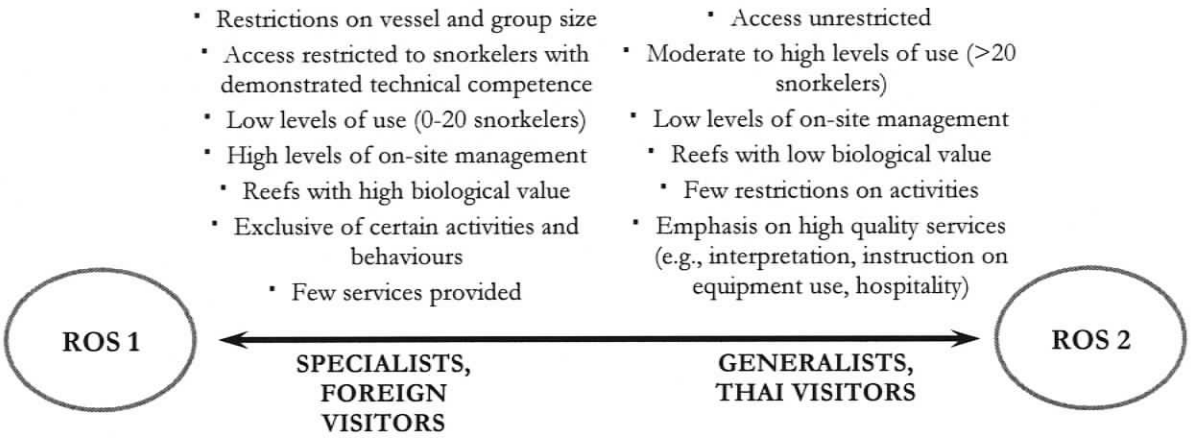
Results from this study suggest that vessel-based tour operators provide a single, uniform type of snorkeling experience, and that this uniform type of experience has left many snorkelers less than fully satisfied. Quality in outdoor recreation is best assured through the provision of a diverse set of opportunities to meet the range of tastes and preferences for recreational opportunities (Clark & Stankey, 1979), and so park managers and tour operators should seek to diversify the recreation experiences and settings offered to snorkelers in Koh Chang. Different park zones that designate level of use, type of use, amount of infrastructure, the services provided, and level of on-site management will provide for a range of snorkeling opportunities to suit the different experiences sought by visitors, and will help to protect the natural environment.

Dearden et al. (2006) proposed a "diver opportunity spectrum" to meet the diverse needs of generalist and specialist divers in Phuket, Thailand (Chapter 2, Figure 2.4). To cater to the needs of specialists, the most attractive dive sites would be zoned for low densities of divers and high management interventions to maintain these conditions. Less pristine sites would sustain higher diver densities and would require less restrictive management. Such areas might be suitable for medium specialized divers. A third recreation setting would cater to generalists, and require minimal management interventions.

A similar range of opportunity settings can be envisaged for Koh Chang, although the needs of a majority of snorkelers could be met with the provision of just two "snorkeler opportunity spectrums" (Figure 7.1). For example, high use areas accessed by high-capacity vessels could be zoned in reef areas that are already degraded, or areas that can better withstand the impacts of trampling. Such areas might be suitable for Thai and low specialized snorkelers who are less sensitive to crowding, and who place a greater level of importance on the provision of services than the quality of the natural environment. Reefs of high biological value might be zoned for low levels of use and high levels of on-site management that excludes certain types of activities (e.g., fish feeding) and behaviours (e.g., strict "no touch" policies). These areas would be suitable for Non-Thai and high and

medium specialized snorkelers who are more perceptive of environmental impacts, and more sensitive to crowding. Prohibited activities would require strict enforcement to maintain qualities of the natural environment that are valued by specialists and international visitors. The limit of acceptable change for the number of other snorkelers could be set at 20 (the standard of quality identified by high specialized snorkelers), and use levels monitored closely to avoid crowding. From these snorkeler opportunity spectrums ("SOS"), snorkelers can derive different satisfactions and experiences and, ultimately, benefits. Providing a wide range of settings varying in level of use, services offered, etc. ensures that the broadest segment of the public will find quality recreational experiences, both now and in the future (Clark & Stankey, 1979). Managers and tourism providers will need to provide specific information to potential visitors about the range of recreation opportunities available and the means of access, but not about the experiences visitors will derive so as not to raise expectations (Clark & Stankey, 1979).

FIGURE 7.1 An Example of Potential Snorkeling Opportunity Classes for Koh Chang Marine National Park



Establish monitoring programmes.

Park managers and tourism providers will need to monitor the effectiveness of strategies employed to address the environmental and social impacts of use, and visitors' satisfaction with the snorkeling experience. This study identified a variety of suitable indicators that should be used to monitor changes in visitors' satisfaction, but appropriate ecological

indicators to monitor reef health will also need to be developed. This study also identified a standard of quality for the number of other people that can be used to manage crowding and monitor use levels in recreation opportunity classes that are designated for low levels of use (ROS 1 in Figure 7.1). Park managers will need to specify standards that describe the acceptable and appropriate conditions for each indicator in each opportunity class. This will provide a means whereby it is possible for managers to evaluate where and what management actions are needed by permitting comparison of existing conditions, with those defined as acceptable for each indicator in each opportunity class (Stankey et al., 1985).

Implement a user fee.

Visitors pay a nominal fee to view terrestrial nature-based attractions on the main island of Koh Chang, but no fee is collected from coral reef users. The need for reef conservation measures is becoming increasingly important, but public funds are probably not enough to finance the management of visitor use. Results from this study revealed that visitors' willingness to pay for additional protection of the marine environment could be significant, and park managers should capitalize on this potential to help recover operating and maintenance costs. Marine parks in other areas of the world are either fully or partially self-financed from user fees levied on tourists (e.g., see Green & Donnelly, 2003; Hawkins et al., 2005), and there is no obvious reason why Koh Chang cannot achieve similar prosperity. However, no matter how much revenue it provides for park management, the tourism industry will not assure resource protection unless park managers dedicate fees collected from reef users directly towards reef conservation. Park managers must be held publicly accountable for how the money is spent.

There may be reluctance from managers to implement user fees, fearing negative impacts on the tourism industry (Dharmaratne, Sang, & Walling, 2000). However, a majority of tour operators would support a user fee, and without one, the natural resources upon which the tourism industry depends will deteriorate, and visitor demand will ultimately decline.

7.3 Strengths and Limitations of the Study

7.3.1 Strengths

This study supports the works of other researchers who have examined social science aspects of tourist and recreational use in coral reef environments, namely Bennett (2002), Dearden et al. (2006, 2007), Inglis et al. (1999), Shafer & Inglis (2000), Musa (2002), Roman (2004), and Saltzer (2002). Research findings presented here also advance the works of these authors and other recreation researchers by 1) adding to the very limited previous knowledge that exists in respect of visitors' perceptions of crowding in marine settings; 2) incorporating and testing the visual approach to normative theory, and identifying standards of quality for the number of other snorkelers; 3) identifying socially-valued indicators that meet a range of LAC criteria; 4) investigating the influence of specialization on visitors' evaluations of recreation settings, knowledge and awareness, perceptions of impact, and willingness to pay; 5) exploring the relationships between visitors' country of origin and evaluations of the physical, natural, managerial, and social conditions, something that has yet to receive any serious academic attention, even in terrestrial settings.

This study also investigated tour operators' perceptions of resource quality and impacts, their willingness to support visitor management strategies, and their behaviour. The focus of most recreation research is on the individual visitor (Ormsby et al., 2004), but, as demonstrated in this study, the attitudes and practices of tour operators can have a significant impact on the environment and visitors' satisfaction. Park managers who ignore the attitudes and perceptions of tour operators will have a challenging time developing and implementing successful management strategies. Additionally, this study examined visitors' environmental awareness and concern including visitors' knowledge of high impact behaviours, and perceptions of the human impacts of use. Issues in outdoor recreation are conventionally dichotomized into ecological concerns (e.g., environmental impacts) and social science concerns (e.g., crowding and conflicting uses), but by using a perceptions-based approach, this study integrated the two. Such an approach can provide valuable insight into visitors' sensitivity to the impacts of tourism, and, in the absence of biophysical data, can provide essential information about the quality of the natural environment.

7.3.2 Limitations

As with any study, there are methodological limitations associated with this research. First, the visual approach used to measure visitors' encounter norms does not capture the fluid nature of use across space and time (i.e., the photos provide a "snapshot" of conditions at one moment in time), and the photographs do not reveal possible objectionable behaviour or noise associated with increasing use levels. Inappropriate behaviour and noise are often influential on visitors' evaluations of use levels as crowded, but verbal descriptors were not included in the survey, which would have helped to incorporate dimensions of the recreation experience that are impossible to capture visually. Additionally, the presence of boats may have a significant impact on visitors' perceptions of crowding, but encounter norms for the 'number of boats' were not measured.

Second, evaluative standards were measured using "acceptability", but recent studies show that other measures such as "preferences" and "tolerances" may have substantially different meanings to respondents and may result in significantly different personal and social norms (Hall & Roggenbuck, 2002; Manning, et al., 1999). Future work should look at how methodological variations affect study findings.

Third, country of origin was used as an indicator of culture, but this indicator is an oversimplification of a complex social system (Vaske et al., 1996), and other indicators may have more accurately captured cultural diversity (e.g., ethnicity). In addition, although some cultures are quite homogeneous, all contain internal variation and contradiction. This study reports on the predominant patterns for two culture groups, but more diverse groups could have been sought to compare across nations and cultures, and to identify differences among subcultures. This limitation should not, however, undermine the importance of the cultural patterns which have been found.

Fourth, the survey instrument may not have captured all the condition items that influence visitors' satisfaction, and as a result, there may be a range of other unidentified attributes that were enjoyable or disappointing. Visitors were encouraged to list other important attributes in an open-ended question, but respondents may not have taken the time to reflect on their snorkeling experience to provide additional information. Additionally, some of the condition items listed could have been worded better to improve accuracy of interpretation. For example, it is difficult to know if expressed importance and

satisfaction for "cost of snorkeling trip" or "length of snorkeling trip" was based on a favourable or unfavourable evaluation.

Finally, this study only focused on vessel-based tour operators, but resort-based operators also have recreational interests in the area. Shafer et al. (1998) found significant differences in the types of experiences offered and visitors' satisfaction with those experiences across tour operators of different size. Similar differences may be apparent in Koh Chang, although on-site observations of recreation patterns suggest that resort-based operators visit the same snorkeling sites, and so visitors appear to experience similar settings regardless of tour operator size. This is surely a topic for future research.

7.3 Suggestions for Future Research

The following research considerations are advanced:

- The research described in this paper is clearly preliminary and needs to be expanded to other elements of park and recreation experiences, such as SCUBA diving and angling, and other tourism providers, such as private charters and resort-owned and operated tours. This research also needs to be extended geographically to incorporate other marine parks in Thailand, since it may not be feasible to provide a full spectrum of recreation opportunities in Koh Chang. Efforts to meet the needs of a broad range of park visitors may require a regional approach to recreation planning and management.

- Future research might focus on identifying normative standards for other impacts, such as the amount of reef damage, litter, number of large fish, and unique underwater formations. This information would help managers to define acceptable levels of change for other socially valued indicators that were identified in this study.

- Further research on disturbance by the behaviour of others should be conducted. This would help managers focus on modifying specific behaviours that could best reduce the effects of others' behaviour on perceptions of environmental quality and crowding. Additionally, research could help identify the techniques that are most effective in controlling human behaviour in marine settings.

- A detailed visitor management strategy for Koh Chang will require an enhanced understanding of the biophysical aspects of the reefs used by snorkelers and other recreationists, including general morphology, the amount and type of visible damage, species richness and diversity, and percentage of live and dead coral. Baseline data of this sort is essential for effective monitoring and the identification of ecosystem components that require management attention.

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APPENDIX A: Participant Observation Results

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Friday February 25, 2005 Number of tourists on boat: 21							
Koh Tong Lang	n/a	60	n/a	6	Slight	Easy	Boat staff and tourists observed feeding fish bread, rice. Tourists observed throwing food over side of boat while traveling between sites. More than 60 snorkelers observed in water at one time, but new boats keep arriving with more tourists. Man (with camera, fins) wearing shoes observed diving to touch soft coral 2x, observed walking on reef substrate 2x (mainly rocky substrate with encrusting corals); no major damage observed; stood on the reef for approx. 95 seconds to adjust gear.
Koh Loan	30	40	n/a	5	Slight	Easy	On another boat, boat staff and tourists observed feeding fish rice and bread.
Koh Kra	6	10	1	1	Calm	Easy	Coral on NE side very poor - about 70% mortality. Poor fish diversity. Coral on SE side in relatively good condition; higher diversity of fish. Few snorkelers at this site. Most tourists elected to sunbathe/relax on the beach, a 10 minute swim from the boat.
Koh Wai	n/a	10	n/a	7	Calm	Easy	Snorkeling not the main recreation activity - sun bathing, swimming, relaxing on the white sand beach. Boats moored at the pier. Boat tour operator feeding fish watermelon. More than 30 tourists on the beach. No interpretation provided to tourists.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Sunday February 27, 2005 No. of tourists on boat: 66							
Koh Wai	20	25	1	3	Calm	Easy	Introduction given to tourists. General information about the beach provided. Tourists asked not to touch the coral because if it breaks it takes a long time to grow back, 5cm/5yrs. Says "we want to conserve so please don't touch coral". Tourists warned that Koh Wai coral is not very beautiful but not to give up because the last stop is very beautiful.
Koh Kham	0	0	1	2	Calm	Easy	No snorkeling; all the coral is dead (blasted). Swimming only. Private island. Low abundance/diversity of fish.
Koh Tong Lang	20	25	1	2	Calm	Easy	Snorkeling conditions on S side of island somewhat hard, as current is strong. Tourists warned not to stand on the coral or step on it. Tourists warned about sea urchins. Approx. 20 tourists on board did not snorkel.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday March 1, 2005 No. of tourists on boat: 30							
Koh Tong Lang	20	90	1	6	Slight	Easy	Water clarity is poor. Large boat arrived, blowing black exhaust on reef. Engine left idling. Boat staff observed standing on reef with flippers for more than 2 minutes. While standing on the reef, tourist swam over and stood on same reef with fins; poor balance, clumsy. Friend of tourists grabbed onto him, pulling him on/off the reef. Fish feeding on banana peel in the water. Tourist on board stepped on sea urchin, injuring foot. On another boat, many Thai tourists observed swimming to island and sitting or standing on edge of reef (must climb over reef to get to rocks at water's edge). Music from boat very audible, detracting from nature-based experience. Boat staff observed bringing up sea cucumbers from reef for other tourists (in the water and on board the boat) to see. Tourists injured foot on coral.
Koh Loan	n/a	35	n/a	5	Slight	Easy	Tour operators consider this to be the best snorkeling site for coral and abundance of fish ("Many coral, many big fish".) For 25 BHT you can purchase bread to feed the fish. For 100 BHT you can rent a fishing rod. Tourists not given any information about the reefs, or what behaviour is appropriate. Boat staff observed bringing up sea urchin for tourists to see. 3 tourists observed standing on reef (observed from boat deck). Boat staff feeding fish bread. Staff member peeling mango fruit over water. Boat staff observed bringing sea cucumber up from sea floor to side of boat where tourist took it and showed other tourists on board. Tourist held sea cucumber for approx. 2-3 minutes before tossing it over the side of the boat.
Koh Ma Pring	n/a	15	n/a	3	Calm	Easy	Majority of tourists elected to take small dinghy to Koh Rang to relax on the beach and swim. Very few tourists snorkeling.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Wednesday March 2, 2005 No. of tourists on boat: 42							
Koh Tong Lang	34	70	1	4	Slight	Easy	Boat staff observed pulling sea urchin out of water for tourists. $ divers using site at same time. 5 people kayaking at snorkeling site. Using kayaks over reef where everyone is snorkeling; low skilled kayakers; towing snorkeler behind (Thai). Koh Chang Tour cranking American music, can hear music underwater. Sattra Tour also playing music but not too loud. Sattra Tour boat engine left idling. Atmosphere is akin to giant outdoor swimming poor. People screaming a lot (Thais). Tourists throwing rice over the side of the boat. Boats throw anchors over back of boat, not sure of substrate. Visibility generally poor.
Koh Kra	n/a	30	2	4	Slight	Easy	All boats from Koh Tong Lang moved to Koh Kra. Boats tie up about 120 ft from shore over the reef. Music and engines turned off. Visibility poor.
Koh Ma Pring	0	0	1	1	Calm	Easy	No snorkeling. Tourists all elected to take dinghy to beach to relax and swim.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Thursday March 3, 2005 No. of tourists on boat: 59							
							Atmosphere on boat - feels like a party - 50 Thai people, brought instruments, singing, drinking whisky (case of whisky brought on board). Very loud, everyone shouting, screaming.
Koh Tong Lang	n/a	60	2	7	Calm	Easy	50 Thais getting organized to get into the water = CHAOS. 6 Thais observed standing on the reef, including boat staff. 2 Thai tourists stepped on sea urchins. 10-15 Thais not taking snorkeling very seriously, just playing in the water, socializing. Thais cluster together in groups of 5-7 to snorkel. Thai tourists observed picking up sea cucumbers and passing it around while some Thais scream. Marine organism handled/passed very roughly. Kept up out of water for 2.5 minutes. Swimming around with cucumber, showing other tourists. Thai snorkelers very low skilled, most cannot swim. Another Thai tourist observed bringing sea star up from sea floor to show friends; brought organism to boat. Tourist observed with boat staff swimming up to boat to get bag full of sea water to deposit fish into bag. Tour boat staff holding fish. Lost nerve when noticed I was watching, and swam away from the boat with the fish. Tourist emptied bag of water. Unbelievable!
Koh Yak Lek	40	80	4	7	Calm	Easy	Abundance of fish good, diversity poor. 5-10 Thais observed standing on reef at any one time. Tourists fishing reef. While in water snorkeling, dodged banana peels, watermelon rinds, legs of other snorkelers. Tourists feeding fish loaf of bread purchased on board. Too many boats coming and going. Bumped into several other snorkelers. Also kept hitting rope used to tie up boats. Annoying. Not a relaxing trip.
Koh Ma Pring	0	0	n/a	1	Calm	Easy	No tourists snorkeling; opted to take dinghy to beach to relax. Swimming, sunbathing, drinking whisky main activities. On return to pier, tourists observed throwing garbage into water (plastic cups, wooden skewers from BBQ). General disregard for environment.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Monday March 7, 2005 No. of tourists on boat: 24							
							Forest fire burning - 500 rai. Boat staff cleaning fresh fish for lunch in water at Ban Bao pier, which is VERY polluted with garbage, fuel.
Koh Tong Lang	20	35	3	5	Slight	Somewhat hard	Visibility poor. Quiet day; boats carrying only 10-20 tourists. Water feels chilly; air temperature about 25 C. Snorkeling conditions somewhat hard because of current, waves. 5 people observed (from boat) standing/sitting on reef. No mooring buoys at Koh Tong Lang. Boats drop anchor off back of boat and/or tie boat up to rope attached to rock or coral on shoreline. Not sure what substrate is like where anchor is dropped, too deep to see.
Koh Loan	n/a	65	n/a	4	Calm	Easy	South side of island calm, easy conditions; north side of island slight/ moderate conditions. On north side, coral and fish abundance/diversity poor, but on south side, coral quality/diversity and fish abundance better. Abundance of small fish (particularly zebra fish, which congregate around snorkelers and boats for food), but low abundance of large fish. Tour operators say this site is "Number 1 in Thailand" or "Number 1 in Trat" for snorkeling. Boat playing loud music. Visibility only good on NW side of island; south side, water saturated with phosphorescent, making visibility poor. Also lots of garbage floating in the water.
Koh Ma Pring	n/a	0	n/a	1	Calm	Easy	Tourists elected to take dinghy to Koh Rang to relax on the beach.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday March 8, 2005 No. of tourists on boat: 32							
							Forest fire still burning, but now under control. Fire started to clear brush, but wind spread fire beyond control of property owner. Very hazy, boats having difficulty navigating. No instruments on board the boats (no GPS or other electronic equipment). Boat off course about 15-20 minutes.
Koh Tong Lang	n/a	60	n/a	4	Calm	Somewhat hard	Underwater visibility very poor. Tourists told to be careful of sea urchins, and asked to swim only on N side of island (S side the current is too strong). Current strong, making it difficult to snorkel. Very crowded - bumped into many other snorkelers and at one point I could not navigate around snorkelers to get to where I wanted to go (density of snorkelers high in one area, Thai snorkelers clustered). Had to swim away from coral reef to get around snorkelers. Overheard conversation: "Water not very clean. Many fish, but only small fish." Snorkeler observed trying to catch fish with his hands, and observed standing on reef. Pulled friend onto reef to stand beside him. 6 people observed standing on the reef, 1 tourist wearing fins. Tourists walking on reef.
Koh Loan	n/a	40	n/a	3	Calm	Easy	Underwater visibility very poor. While snorkeling, swam along side boat staff who touched reef many times and picked up organisms, ran hands through soft coral several times to try and scare out the clown fish to catch them. Succeeded in scaring the fish out but not catching them. Very disruptive. This behaviour is shown to other tourists who think it is okay to do the same. Tour operators also stand on the reef frequently, giving tourists the perception that its okay to do the same. Staff fishing at snorkeling site; caught 5 fish (6-8" long), cooked and given to tourists. Not supposed to be doing this. What kind of message does this send? Fish left in sun gasping for air, dying slowly. Water is very dirty today, very poor visibility. Slick of oil? It's greasy, smells like oil, but doesn't look like oil. 9 fishing boats anchored close to Koh Rang shoreline. According to boat staff, the fishers are sleeping. Thai music cranked. Its been difficult to remain anonymous this trip. Everyone seems interested in my study, asking for my opinion on health of coral, fish species identification, etc.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Wednesday March 9, 2005 No. of tourists on boat: 30							
Koh Thain	n/a	30	n/a	2	Calm	Easy	Underwater visibility v. poor. Tourists told to be careful of sea urchins and not to step on the rock (rock is sharp, dangerous). Music from neighbouring boat blasting. Current is strong on NW side of island, making it difficult to swim at times. Better diversity of fish than Koh Tong Lang. Visibility v. poor, suspended sediment or phosphorescent. Many small jellyfish in the water.
Koh Loan	15	45	4	6	Calm	Easy	Boat staff and tourists fishing off back of boat at coral reef site. Took photos. 14 fish caught. Fish baited with fresh squid. Fish flop around in tray, gasping for air. Fishing at the same site where people snorkeling seems counter intuitive. Fish not eaten in BBQ today; tourist took all fish and threw them into plastic bag to take home; some fish still alive when thrown into bag. Rang in size from 3" to 9" in length. Tourists feeding fish bread. Staff asked tourists not to touch the coral. First time I've heard this said (usually only a warning not to touch the rocks).
Koh Ma Pring	n/a	0	n/a	1	Calm	East	Tourists elected to take dinghy or swim to Koh Rang to swim/relax.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Friday March 11, 2005 No. of tourists on boat: 22							
							Staff asked me to talk to tourists to tell them 1) everyone must wear a life jacket at every snorkeling site, and 2) don't touch the rocks because they are very dangerous, sharp.
Koh Tong Lang	20	60	1	4	Calm	Easy	Boat operator observed picking up marine animals (shells, sea cucumbers) and passing them to tourists. Water clarity best its been in a long while. Visibility good
Koh Yak Yai	15	45	1	4	Calm	Easy	Tourists feeding fish watermelon after observing boat staff doing the same. Boat operator observed picking up sea cucumber and passing it to tourists. Boat staff tried to pass the organism to me, but I declined and he tossed it. Tourist brought up sea shell from coral reef on board to keep as a souvenir. Visibility good. Snorkelers spread out around island, so didn't feel crowded.
Koh Yak Lek	15	50	n/a	5	Calm	Easy	Visibility fair.
Koh Rang	n/a	n/a	n/a	1	Calm	Easy	No tourists snorkeling (only a small reef, but tourists don't seem to know about it); tourists relaxing on beach or hanging out on the boat.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday March 12, 2005 No. of tourists on boat: 23							
Koh Tong Lang	45	100	2	9	Calm	Easy	Snorkelers mostly on NE side of island. Snorkelers asked to stay off the island, off the rocks, and on the N side of island. Visibility good. Tourist stepped on sea urchin. Tour boat playing loud American music, can hear it underwater while snorkeling.
Koh Loan	10	20	n/a	2	Calm	Easy	Party on other boat, Thais drinking whisky. Tourists fishing. Tourists throwing plate fulls of food over board. Two boat staff spear fishing. Brought one fish 8-9" long on board, put it into plastic bag.
Koh Rang	n/a	n/a	n/a	9	Calm	Easy	1:15 - 5 boats at Koh Loan, so changed plan and went to beach first. Tourists relaxing on beach, no snorkeling.
Koh Yak Lek	n/a	40	n/a	7	Calm	Easy	Boat anchored over top of reef, maybe 5-8 ft from shore, our boat tied up next to this boat, maybe 5 ft from shore line. Tourists jumping out of the back, right onto the reef. Very dangerous for reef and snorkelers. Corals not getting sunlight for about an hour. Tourists observed snorkeling with food in hand to feed fish.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Sunday March 13, 2005 No. of tourists on boat: 49							
Koh Tong Lang	n/a	90	n/a	4	Calm	Easy	5 divers on boat + one dive master who says that speed boats are the biggest criminals, they drop anchors on the reef; he cuts and buries the anchors. Dive master delivered interpretive message to tourists on board at beginning of trip - itinerary, safety and conservation message. "This is a marine park, don't touch coral, don't take anything including shells from protected area - I am a park ranger." Points out services on boat, introduces staff (cook, lifeguards, captain). Referred to map on wall and indicated the sites to be visited. Says he does not allow anyone to trash the reef, but he's not on the boat everyday or on every boat. "Boat safety is what this trip is all about." Told tourists what to do if they got into trouble in the water. Visibility good. Dive Master says education is the answer; he tells ALL staff members not to fish, not to anchor on reef, and to permit sunlight to reach the reef. But staff observed doing all the opposite on previous trips. DM also thinks the park needs eco-certification program, and that this will solve many problems. Says he hides the anchors of boats that anchor on the reefs. Tourists told not to throw garbage overboard, not to throw cigarettes overboard. Tourists told again not to step on coral, not to break it, not to kill fish, to be careful of sea urchins, and to refrain from using the toilet at reef sites. Kuhn Tuchai says that the NP office on Koh Rang has 3 staff members; says people like to work at that office because they get money from fishers and pay no bills. Corruption. Too many tourists on boat, not enough places to sit comfortably. Difficult to move around on the boat. Tourist dropped snorkel while snorkeling, boat staff dove down to pick it up, held onto coral for balance and broke a large chunk off.
Koh Yak Yak	n/a	40	n/a	1	Calm	Easy	Snorkelers spread out around island, so doesn't feel too crowded. Tourists told not to stand on the coral if they can help it. Low abundance of large fish.
Koh Yak Lek	n/a	40	n/a	3	Slight	Somewhat hard	Saw first eel. On NS of island, snorkeling easy; on SE/S side, somewhat hard (big waves, water in snorkel). Visibility good.
Koh Rang	n/a	0	n/a	1	Calm	Easy	No tourists snorkeling, just relaxing on boat or on beach.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday March 15, 2005 No. of tourists on boat: 33							
							Koh Chang Tour blasting music again. Easy conditions on N side of island, but on S side somewhat hard, challenging. DM delivered interpretive program in English, but many Thais today. Safety (4 lifeguards today). Tourists asked not to use back platform because divers need to use this area. Tourists told to: put hand up and yell HELP if they have a problem; not to use toilet when the boat has stopped (only use it between islands, not on the reef - #1 okay, but no #2); don't throw anything over the side of the boat because the reef belongs to Thailand; if people jump on the reef, take things from the reef, break the reef, not good, because this reef is needed for the next generation; its okay to stand on the rocks, but be careful because of sea urchins; enjoy yourself; divers - no drinking before dives, if drink can't dive but after 2nd dive can drink; when you're swimming in the shallow water be careful of sea urchins, be careful where you're putting your arms, feet; don't take anything from the reef; if everyone takes on piece of coral there won't be anything left after a year; be safe, don't die because I (DM) will go to jail; take as many life jackets as you want, just don't step on the coral; location of first aid kits, oxygen. DM says that unofficially, a gentleman's agreement, the boats give one reef site (e.g. Koh Thain) a rest for one year, rotate the sites, but its unorganized and doesn't always work because the power boats don't abide. DM also says corruption is rampant, a big problem.
Koh Tong Lang	38	90	3	5	Slight	Easy	5 dives in 5m deep water; DM observed holding onto coral showing other divers things; divers do the same, trying to manoeuvre between tight spots, and divers observed kicking coral and breaking off pieces with their fins. DM holding onto hard coral while running hand over soft coral, teaching other divers to do the same. All 5 divers touched soft coral while diving. Manoeuvring around in small space difficult, making it easy to accidentally break coral. Visibility poor.
Koh Yak Lek	n/a	20	n/a	1	Slight	Somewhat hard	Water around Yak Yai is rough, so moved onto Koh Yak Lek. Saw significant anchor damage on brain coral.
Koh Yak Yai	n/a	10	n/a	1	Moderate	Somewhat hard	Quiet today, weather not good for snorkeling (cloudy, overcast, cooler than usual, rough sailing (white caps)). Waves too big for snorkeling. Boat should have stayed at pier.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Wednesday March 16, 2005 No. of tourists on boat: 14							
							In transit between sites, boat staff observed throwing plastic and beer caps overboard. Staff members drinking beer, which is not supposed to be allowed. One staff member drinking is on duty lifeguard.
Koh Tong Lang	19	110	3	9	Slight	Easy	On N side, waves smaller; on S side, white caps. Foreign tourist says to me "Is it always this crowded?"
Koh Yak Yai	n/a	10	n/a	15	Moderate	Challenging	White caps, strong surf; can't snorkel around island. Boat should not have gone out today. Visibility poor.
Koh Ma Pring	n/a	15	n/a	2	Moderate	Somewhat hard	Change in itinerary; conditions at Koh Yak Lek are too rough to snorkel. Stayed at Koh Ma Pring for 2 hours.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Friday March 18, 2005 No. of tourists on boat: 38							
Koh Tong Lang	30	35	n/a	5	Calm	Easy	Tourists asked not to touch the coral. Weather is overcast. Tourists fishing off stern of boat. Tourists observed with 2 large pieces of coral on board for souvenir (one piece size of my hand, other about size of fist). Visibility good, could see much more of outer reef. Swam around island, current on NW side of island between Koh Tong Lang and Koh Kra very strong; easy for someone to get exhausted swimming against the current. Dangerous without a life jacket.
Koh Loan	20	70	5	6	Slight	Easy	Boat staff and 5 tourists fishing off stern. Koh Chang Tour blasting music. Reef getting trampled by Thai tourists who: stand on the reef socialize and/or adjust their gear. Massive coral - top is severely damaged, lots of dead tissue. Very crowded around NW/SW side of island - many Thai tourists bunched together. Tourists observed kicking coral with fins, and feeding fish in water while snorkeling, as well as throwing food off the side of the boat. Soapy water used to clean dishes/cutlery thrown overboard onto reef. Soap suds in water attract fish. Boat staff on different boat observed teaching Thai snorkeler to snorkel while standing on top of massive coral. Tourists feeding fish potato chips, watermelon, rice. Visibility good
Koh Ma Pring/ Koh Rang	5	10	1	1	Calm	Easy	Majority of tourists took dinghy to Koh Rang to relax, sunbathe, socialize, swim.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday March 19, 2005 No. of tourists on boat: 121							
Koh Tong Lang	10	270	6	8	Calm	Easy	At end of trip, when all boats getting ready to depart, only 10 snorkelers but at beginning 175 snorkelers, and at peak 270 snorkelers! Everyone arrives/leaves at the same time - why don't they stagger it? Would be more enjoyable, less snorkelers at one time. About 100 Thai tourists on boat, less than 15 foreigners. Tourist asked me "is it always this bad?". Tourists wanted to know where to go to avoid other snorkelers. Overheard another tourist say "I'm going to get into the water now with the hundreds of other tourists. This is awful. Why do they all come at once? Why don't they go there? [pointing to Koh Kra]." What a zoo. Haven't seen this many snorkelers before. Over 200 people in the water, many more waiting to get in. Feels like a giant outdoor swimming poor. Also annoying to have so many people on the boat - makes it harder to move around, and have to wait to get in/out of water. Not enough places to sit on the boat. Safety concerns - how do all the boats keep track of so many tourists? Also, many Thais can't swim, wear life jackets - safety for tourists and reef. Lots of noise, lots of splashing, screaming, arms flailing about, horns blowing ,generators running. Very high impact today. Koh Kra getting busier - other boats arriving to area going there instead. Dutch couple were told when they signed up there was going to be 10-15 people max. on each tour. Tourist said she saw many people standing on the coral which irritated her.
Koh Yak Lek	45	100	n/a	7	Calm	Easy	Sea conditions are good - water clarity is good. But navigating around tourists on S side of island is not easy. All boats from Koh Tong Lang seem to have come to Koh Yak Lek. Visibility good.
Koh Ma Pring	n/a	30	n/a	2	Calm	Easy	Many tourists on boat didn't go snorkeling - sunbathing on upper deck instead.
Koh Wai	n/a	10	n/a	4	Calm	Easy	Tourists feeding fish bread from boat. Tourists observed collecting dead coral and shells from beach. One tourist collected bag of shells. Most tourists elected to relax on beach or swim. Coral quality here is poor - most of the reef is dead, covered in algae. Some parrot fish.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday March 22, 2005 No. of tourists on boat: 23							
							Boat is much more pleasant to be on when there aren't 100 tourists. Rainy and cold in transit. At snorkeling site, sunny, hot, 70% cloud cover.
Koh Tong Lang	25	70	2	2	Calm	Easy	Staff on another boat feeding fish bread around snorkelers to attract fish. Tourist says "I think this is a joke. How can there be so many people, so many boats?" Tourists and staff feeding fish. Many Thai tourists that don't know how to swim; lots of thrashing around in water. Tourists throwing lunch overboard. Koh Kra and Koh Thain snorkeling sites are empty - don't know why we don't stop at either spot.
Koh Yak Lek	15	30	2	3	Calm	Easy	Snorkelers scattered around island so doesn't feel too crowded today. But at Koh Tong Lang, more crowded because snorkelers concentrated (and boats) on N side of island. Here, boats and snorkelers are situated around N and S/SE side of island. Snorkeling more difficult around S side of island. Quality of snorkeling equipment is poor. 2 people kayaking where people are snorkeling.
Koh Ma Pring	10	15	2	2	Calm	Easy	2 tourists fishing off stern; no fish caught. Quiet, many tourists stayed on the boat, others went to beach to relax.
Koh Wai	n/a	10	n/a	4	Calm	Easy	Most tourists walked to beach to swim or relax.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Wednesday March 23, 2005 No. of tourists on boat: 29							
Koh Tong Lang	10	95	2	4	Calm	Easy	Music from Koh Chang Tour blaring. Observed small school of medium sized fish - first time here. Observed staff member of another boat swimming with a spear. Visibility good.
Koh Yak Lek	10	60	1	4	Calm	Easy	Can hear Koh Chang Tour before you see them. Staff from this boat spear fishing. Visibility good.
Koh Yak Yai	15	20	9	9	Calm	Easy	Tourists seem tired, reluctant to go into water. Tourists observed bringing a loaf of bread into water while they snorkel.
Koh Wai	n/a	n/a	n/a	5	Calm	Easy	Relaxing on beach, swimming.
Thursday March 24, 2005 No. of tourists on boat: 55							
Koh Tong Lang	60	80	5	7	Calm	Easy	Koh Chang Tour cranking dance music - super annoying, influences the experience of all snorkelers/tourists, not just the ones on their boat. Staff fishing off stern; tourists fishing off stern. Tourist on Sattra Tour feeding fish potato chips.
Koh Yak Lek	10	40	2	9	Slight	Somewhat hard	Looks crowded, with number of boats but doesn't look too crowded with number of snorkelers because they're spread around the island. Visibility good but snorkeling conditions not good - on S side of island a bit too rough for comfort. Staff and tourists fishing off stern on PPS. Staff fishing on Aittipol, caught fish but released it. Visibility good.
Koh Ma Pring	n/a	20	2	2	Calm	Easy	Most of tourists stayed on boat.
Koh Wai	n/a	n/a	n/a	4	Calm	Easy	Most tourists walked to beach. Snorkeling here stinks, but the beach is beautiful - white sand, turquoise water.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday March 26, 2005 No. of tourists on boat: 102							
							Rainy - trip delayed 1 hour because its pouring rain. So many tourists today they took 2 boats out.
Koh Yak Lek	60	130	5	6	Moderate	Somewhat hard	There is a dog on PPS. PPS took 2 boats out; PPS and Aittipol arrived at the same time - around 200 tourists. Tourists seem reluctant to get into the water; some are sea sick. Too cold to get wet? Sea is quite rough, no white caps but VERY rolly. This is the busiest I've seen this site. Everyone is bunched together; sea is rough, so people staying on S side of island. Many tourists on boat not snorkeling. Overheard tourist say "Too many people, water not too clear". At least 7 people on this boat are throwing up. Another tourists comments that there are "too many people". There are too many people on the boat, its annoying. A lot of people look miserable.
Koh Ma Pring	10	25	2	5	Slight	Easy	Raining again. BS on PPS teasing another staff member with a sea cucumber. The beach is busy. The situation here can only be described as chaos! 50 Thais moving about wanting to get on a different boat to go back to Bang Bao pier (1:40 pm, about 3 hours early). 4 foreigners gong too, not happy with experience, says there are too many people on boat and snorkeling. Second boat is getting full. Nobody on this boat is snorkeling. Many foreign tourists are unhappy. Tourists observed feeding fish bread.
Koh Wai	n/a	50	n/a	8	Calm	Easy	Many tourists feeding fish bread and rice around the pier and in the water. Interview with boat staff: Says he understands that foreigners don't like too many other people. Doesn't go to different site if busy because staff like to be with other boats. They like the noise, the number of people, says if about 200 people (threshold) at site, will go to a different site. Boats don't want to go to different sites from each other, want to be together. Says its not possible to stagger arrival at different sites, if it was they would have done it a long time ago. [Possible, they just don't want to.] Says he suggested it to boat staff on other boats, but they don't want to do it. If he asks for a boat not to come to a site, the other boat won't respect the request. Also said that there used to be no fish at the sites, but because tourists keep throwing bread in, the fish came.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Sunday March 27, 2005 No. of tourists on boat: 80							
							Boat staff talking a lot to Thai tourists, but not sure what's being said. Interpretive information? Thais drinking whisky. Staff using megaphone to talk to tourists. Thai tourist/interpreter says they [staff] asked tourists not to touch the coral and not to stand on the coral, to keep legs high.
Koh Tong Lang	60	75	4	5	Calm	Easy	Visibility on N side of island poor (where snorkelers are concentrated), but on E side its very good. Boat staff observed carrying a large clam while snorkeling. Tourists feeding fish bread, fruit. Boat staff observed with a speared sea urchin, showing tourists. Tourist caught small reef fish, put it into a plastic bag and brought it on board. Eventually he dropped the fish over the side of the boat.
Koh Yak Lek	10	40	1	4	Slight	Somewhat hard	Weather is not good - chilly breeze, black clouds. Too many people on the boat, chaotic. Lots of shouting. Boat staff walking around with a megaphone shouting in Thai; foreigners confused, wondering if they're missing out on something. Much more enjoyable when you can hear the surf crashing against the rocks instead of shouting. Garbage in water. Many tourists feeding fish bread. As we leave, Sattra tour arrives with ~30 tourists.
Koh Ma Pring	20	30	1	1	Calm	Easy	Some tourists snorkeling, many went to beach to relax, sunbathe, swim. Beach is very beautiful - white sand, turquoise water.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Monday March 28, 2005 No. of tourists on boat: 66							
Koh Tong Lang	30	80	4	6	Calm	Easy	Visibility poor. Power boats anchored on reef. Koh Chang Tour has music blared. 2 other big boats arrive within 10 minutes. Many people standing on the rocks to adjust equipment or rest. Crowded with boats and snorkelers, very noisy but Koh Kra empty and Koh Thain empty.
Koh Yak Lek	10	50	4	7	Slight	Somewhat hard	Visibility good on E side of island, poor everywhere else. Snorkelers observed touching marine animals. Snorkelers and boats fairly spread out so doesn't feel too crowded today.
Koh Ma Pring	0	0	n/a	1	Calm	Easy	Tourists elected to take dinghy to Koh Rang or to swim there to relax, sunbathe.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday March 29, 2005 No. of tourists on boat: n/a							
							Thai tourists shown how to use their equipment properly. No attempts by boat staff to communicate with foreign tourists.
Koh Tong Lang	10	60	4	10	Slight	Easy	Visibility poor. Speed boat very close to reef, 15ft from shore line. Other boats not here too long, no snorkelers in the water when we arrive. Dogs barking on Koh Chang Tour but no music yet. Many boats today but fewer number of snorkelers, boats running far below capacity. Getting fed up with tourists feeding fish - don't like dodging banana peels in the water. When I picked up the peels and complained, asking the tourists in small power boat not to throw peels into the water, they didn't understand (both Thai and foreign tourists) and handed me a banana, thinking I liked the idea. Power boats anchored too close to shore. Annoying to navigate around the many boats, the ropes, and the people. Boat parked right in "path" of reef. Music on Koh Chang tour now blaring, but the dog stopped barking.
Koh Yak Lek	10	50	6	12	Calm	Easy	Visibility poor. Staff asked tourists not to touch the coral (looked at me and smiled when she said this - for my benefit?). Snorkelers spread out around island. Boat staff observed holding sea cucumber, showing it to tourists. Water clarity is poor, water feels chilly today.
Koh Thain	0	15	1	1	Slight	Easy	No other boats, no other snorkelers - very pleasant. Boat drifted right over coral, then backed up and hit coral - could hear bottom of our large boat scraping the coral. Not anchored off stern, so boat drifted too close to reef. Now we aren't tied up at all, just drifting over coral. I don't understand.
Koh Rang	n/a	n/a	1	1	Calm	Easy	Went to beach on NW side of island (instead of NE side), where there is a very beautiful, small white sand beach. Used to be coral here, but looks like its all been blasted. Have to clamour over dead coral to get to beach. Tourists snorkeled, swam, or went on small dinghy to beach. Not sure why we came here, it is very unusual - typically go to other side, further south.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday April 2, 2005 No. of tourists on boat: 3 (myself, and 2 staff from the Sustainable Tourism Development Office)							
Koh Chang Noi	0	2	0	1	Calm	Easy	No other tourists here. Water is very warm, warmer than Koh Rang area. Traveled in small boat, with capacity of about 10. Coral reef is essentially dead - covered in algae, very few fish. About 80% of the reef appears dead. Visibility is VERY poor, can't see more than 1ft ahead. The water seems too warm. No mooring buoys here.
Koh Ma Pring (NW of Koh Chang)	2	10	1	2	Calm	Easy	2 mooring buoys. No other boats/tourists when we arrived, but after about 15 minutes, a small boat with 10 Thai tourists arrived to snorkel. ALL tourists standing on the reef. When Sustainable tourism office staff told tourist to get off the reef, the man replied "I don't live here, I'm not from here, so it doesn't matter to me". Nong Man not surprised by this reaction, says not uncommon. Kuhn Tuchai also says that even if you tell Thai people not to do something they'll do it anyways because they will do what they ant to do. They don't care. Fish diversity poor, coral quality poor, a lot of visible damage. I understand shy tourists don't come here anymore.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Sunday April 3, 2005 No. of tourists on boat: 80							
							Too many tourists on boat, not enough spots for everyone to site comfortably. PPS took out 2 boats today, mostly Thai tourists. Staff took rocks from Koh Kham on way to snorkeling sites. This is the second time - the last time they took about 20 rocks from the island, this time I only saw one. They claim these rocks are lighter than typical rocks. They are not supposed to remove anything from the park.
Koh Thain	15	80	3	3	Calm	Easy	Visibility good. Current very strong on E/SE side of island. Staff told tourists to be careful when standing, to check to the water before standing, and to be careful of seashells. At Koh Tong Lang the current is apparently strong today, so tourists are coming to Koh Thain. Boats not using mooring buoys. Very loud and chaotic. Diversity of fish seems to be the best out of Koh Kra, Tong Lang, Yak Lek, Yai Yai. Foreign tourist yelled at Thai tourist for fishing over side of boat where people were trying to get up onto the boat. Tourist feeding fish rice while snorkeling. Tourists observed standing on reef - hard coral - brain, tabular. Boat staff observed trying to dislodge large clam to show tourists but was not successful; staff also observed kicking coral with fins, touching marine animals, handling marine animals, and standing on coral with tourists.
Koh Yak Lek	30	100	3	6	Calm	Easy	Difficult to count number of snorkelers from boat because boat blocking view of water, but estimate given the number of boats is about 100. Clarity of water good on S side, poor on N/NW side. Boat staff observed playing with sea cucumber, brought it on board to tease child. More than 10 tourists are feeding fish.
Koh Ma Pring	n/a	10	n/a	1	Calm	Easy	Low tide; many sea urchins at the beach, making it dangerous to swim.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday April 5, 2005 No. of tourists on boat: 46							
							Nauseating exhaust in air for about 10 minutes now. While traveling to snorkeling sites, boat broke down (10 minutes into trip). Waiting for second boat to come, tourists will be transferred. Moved to new boat about 20 minutes later. When boat broke down, communication to Thai tourists about what's going on, but no effort to explain to foreigners. What would happen in an emergency situation? For safety, they should have someone who can speak some English. Back on route by 10:22.
Koh Thain	25	45	2	4	Slight	Somewhat hard	Rolling waves today, feeling a bit nauseated. Tourist puking guts out. As April marches on, I am seeing more unfamiliar boats at snorkeling sites. Boats not at Bang Bao pier, so maybe they are coming from Koh Kood. Boat staff fishing off stern. Visibility poor.
Koh Yak Lek	20	30	2	5	Slight	Easy	Difficult to count the number of snorkelers - boats blocking view. In front of PPS boat, ~25 snorkelers. Boat staff fishing off stern again; 4 fish caught. Baiting with fresh squid. Visibility good, particularly on SE side, NE side, S side. Visibility good.
Koh Ma Pring	n/a	10	n/a	1	Calm	Easy	Majority of tourists took small dinghy to beach to relax, swim.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Wednesday April 6, 2005 No. of tourists on boat: 18							
							Boats seem to be visiting Koh Thain instead of Koh Tong Lang recently; not sure why.
Koh Yak Lek	7	20	4	7	Calm	Easy	Visibility good. XX Scuba diving boat - small power boat, anchored right on top of reef - watched it drop anchor, heard it drop and scrape the coral. Told the captain and a diver that they were anchored on the reef, right on the coral, and diver told captain (Thai) and eventually they moved it - diver went down, pulled anchor up, moved it off reef. Boats not moored too close to shoreline today which is great - see much more of the reef, and the reef receives more sunlight. Better snorkeling experience when boats are away from outer reef, but tourists without experience won't know this. Got bitten 3 x by fish, grouping around me when I stop. Aggressive fish! 2 tourists with flippers observed standing on massive coral.
Koh Ma Pring	3	10	2	2	Calm	Easy	Visibility good. Saw fish that I haven't seen at the other sites. Water clarity good. Diversity, abundance of fish unremarkable. Boat staff fishing off stern, caught at least 2. PPS also fishing. Could this be why there are no fish to see while snorkeling?
Koh Kra	5	10	1	3	Calm	Easy	We were going to stop at Yak Yai, but then captain changed his mind - maybe because there were 4 large boats already there. Yak Yai popular for diving boats today. Overall a good experience today - felt more like a nature-based snorkeling experience.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Thursday April 7, 2005 No. of tourists on boat: 40							
							It's raining.
Koh Tong Lang	15	95	3	6	Slight	Somewhat hard	It's overcast, but some sun is breaking through. Music from Sattra tour loud. Tourists feeding fish bread, pineapple. Visibility good.
Koh Yak Lek	25	40	5	10	Slight	Somewhat hard	Didn't swim around island today, conditions make it difficult to swim. Visibility good.
Koh Ma Pring	0	20	0	2	Slight	Easy	Koh Chang Tour blaring its music beside us. Nothing too notable - 3 tourists and one boat staff fishing off stern, at least 2 fish caught.
Friday April 8, 2005 No. of tourists on boat: 44							
							Water is very calm today. Foreign tourists instructed on how to use snorkeling equipment (not everyone, just a random instruction) - Thai friend of boat staff.
Koh Tong Lang	10	50	1	5	Calm	Easy	Quiet today. Visibility fair on N side, good on S/E side. Water temperature - 29-30 C.
Koh Yak Lek	10	60	0	3	Slight	Somewhat hard	At arrival, no other boats or snorkelers. People standing on coral, touching coral - soft and hard. Water - 30 C. Boat staff from Aittipol and PPS fishing off stern. Visibility fair - better on S side, poor on W side. Visibility fair.
Koh Ma Pring	0	15	0	1	Calm	Easy	First boat to arrive. Some tourists didn't go snorkeling, elected to relax on board. Visibility poor.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday April 9, 2005 No. of tourists on boat: 64							
Koh Tong Lang	70	145	5	9	Slight	Somewhat hard	Visibility fair. Boat staff told tourists in English which island we are at, and long we'd be staying (Friend of staff). Difficult to navigate around boats and people - not fun. Tourist brought on board shell with live crab inside. Crab thrown back overboard from top deck when it started moving.
Koh Yak Lek	30	50	2	8	Slight	Somewhat hard	
Koh Thain	10	20	2	2	Slight	Somewhat hard	Tough crowd today - more difficult than usual to administer survey. Couple of people were accusatory.
Sunday April 10, 2005 No. of tourists on boat: n/a							
Koh Thain	0	35	0	3	Slight	Somewhat hard	Saw a small stingray - first time. Current running S--->N quite strong. Visibility fair.
Koh Yak Lek	20	40	4	7	Slight	Easy	All the snorkeling sites seem to be busy but boats are spreading out a bit more than usual. Makes for a better snorkeling experience when density of people and boats is lower. Visibility fair/good.
Koh Ma Pring	0	5	1	2	Calm	Easy	Most tourists stayed on boat, or went to beach to relax. Observed small octopus doing its thing - fascinating.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Thursday April 14, 2005 No. of tourists on boat: 95							
							Thai tourists received instructions on how to use snorkeling equipment. Similar instructions not given to Foreign tourists.
Koh Thain	40	220	5	10	Calm	Easy	Island hopper - usually a water taxi, but today a snorkeling boat. Very busy at snorkeling sites! Observed tourist snorkeling and hook and line fishing for squid right where snorkelers are swimming. Definitely a conflict, and a safety issue. Foreign tourists complaining about number of people and about snorkelers standing on the coral, damaging it.
Koh Ma Pring	40	50	1	12	Calm	Easy	About as far away from a nature-based experience as you can get. Noisy, too many people. Went past Koh Yak Lek because there were too many boats there already. About 80-100 snorkelers. Many unfamiliar boats.
Koh Yak Lek	140	170	11	15	Slight	Somewhat hard	3 inner tubes tied to corals for snorkelers to rest on.
Friday April 15, 2005 No. of tourists on boat: 100							
							Trip delayed 1 hour due to wind and torrential rains. Yesterday snorkeling tour operator boat captain called Kuhn Tuchai to report illegal fishing activity on reefs at Koh Wai. 3 of the high capacity vessels took out an extra boat to accommodate all the tourists today.
Koh Kra	50	140	8	9	Slight	Easy	Visibility fair.
Koh Ma Pring	15	50	1	3	Slight	Easy	Visibility fair. Low tide at beach; a lot of garbage in the shallow water, and many sea urchins make it unpleasant for snorkeling/swimming. Haven't seen this many urchins in one area on sandy substrate. Recreational fishing off stern; caught at least 2 fish about a foot long. Skipped Koh Yak Lek today because captain says the waves are too big.
Koh Wai	n/a	n/a	1	1	n/a	n/a	Raining, thunder/lightening storm. No visitors snorkeling.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday April 16, 2005 No. of tourists on boat: 112							
Koh Kra	80	190	7	15	Slight	Moderate	Raining; passed through a storm - it's quite chilly, windy. Tourists throwing bananas into the water. Over 100 people on the boat, all tryinig to get into the water at the same time - chaos! It's noisy, there are too many people, too many boats, too many tourists feeding fish bread, bananas, rambutan. There are only 2 foreign tourists on board, the rest are Thai. It's 11:15, and the raining has stopped. But temperature is still cool, and sky is overcast. Koh Tong lang is also very busy; may be the reason why captain took tourists to Koh Kra.
Koh Yak Lek	10	140	5	8	Moderate	Somewhat hard	3 big boats arriving at the same time. In additon to motorized boats, there are 2 kayaks and a dinghy navigating around snorkelers. Thais are getting towed around the reef in the dinghy. Same behaviour regularl observed: feeding fish, standing on coral, touching coral, picking up marine mammals, tourists cutting their feet on the sharp rocks and coral, tourists screaming. Only one thing missing - the loud music. Sun is finally peaking through the clouds, but it is still chilly.
Koh Ma Pring	5	20	1	3	Calm	Easy	
Tuesday April 19, 2005 No. of tourists on boat: n/a							
Koh Tong Lang	60	65	4	5	Slight	Easy	Temperature is cold. Visibility is fair/good.
Koh Yak Lek	5	45	1	4	Slight	Easy	Visibility is poor on north side of reef, fair/good on E/SE side. Raining again, chilly. The snorkeling experience is much more pleasant when there are fewer people (<50). Soapy water used to clean dishes thrown overboard on reef.
Koh Ma Pring	20	30	1	1	Calm	Easy	

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Thursday April 21, 2005 No. of tourists on boat: 35							
Koh Tong Lang	15	40	2	3	Slight	Easy	Temperature is quite chilly, sky is overcast; visibility is poor. Captain was headed to Koh Yak Lek, but changed his mind (after stopping briefly) because it's too busy (approx. 200 snorkelers).
Koh Ma Pring	-	-	1	1	Calm	Easy	
Koh Yak Lek	5	15	1	2	Slight	Somewhat hard	Visibility very poor today. Weather has improved. Snorkeling conditions on north side of island are 'slight', but moderate to rough on the south side.
Friday April 22, 2005 No. of tourists on boat: 31							
							Safety procedures on xxx are the best of any company - staff hands out life jackets to each tourist, life guards are identified, and tourists are warned about the danger of stepping on sea urchins and rocks. But no interpretive information provided (no information about marine life, land formations, etc.)
Koh Tong Lang	20	60	3	5	Calm	Easy	Busy today. Visibility is poor on north side of island. Where are all the fish? Swam to south side of reef, but current that crosses between Koh Tong Lang and Koh Kra is quite strong, making it dangerous for inexperienced swimmers. Evidence of coral bleaching on south side.
Koh Yak Yai	10	30	1	2	Slight	Easy	
Koh Yak Lek	10	40	1	5	Calm	East	Big boat leaving upon arrival. Tide is quite low. Visibility poor.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Saturday April 23, 2005 No. of tourists on boat: 50							
Koh Tong Lang	30	60	5	6	Slight	Easy (north) Somewhat hard (south)	
Koh Yak Lek	25	140	3	6	Slight	Somewhat hard	Small boat is anchored on top of the reef - swam to the boat to tell the driver, he denied it. Coral will break when anchor is pulled. Several Thais are standing on the reef, resting. 3 boats have tied a rope to a coral boulder, not the rocks, to moor. Rope is rubbing on coral in the current. Thais are hanging off the rope, bouncing on it.
Koh Ma Pring	20	30	3	3	Calm	Easy	Left Ma Pring at 3:30, Koh Yak Lek still busy. On Koh Rang beach, touruists throwing sea cucumbers around like they're toys, grinding them into the sand, pulling them out of the water, shoving them down people's clothing.
Sunday April 24, 2005 No. of tourists on boat: 33							
Koh Tong Lang	30	35	5	5	Calm	Easy	Visibility poor.
Koh Yak Yai	0	25	1	2	Calm	Easy	Large school (hundreds) of fish seen today - first time. Very beautiful.
Koh Yak Lek	40	50	3	4	Calm	Easy	Saw 2 sting rays today. Unusual.

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Tuesday April 26, 2005 No. of tourists on boat: 93							
Koh Tong Lang	30	200	7	9	Slight	Easy	On north side of island visibility is very poor; on south side, it improves but snorkeling conditions are challenging - current is quite strong. Too many snorkelers and boats - maneouvering around people and ropes from boats not easy. The boat is too crowded with tourists - disorganized chaos, and a lot of personal belongings on board make it difficult to move easily and safely.
Koh Yak Lek	5	100	4	6	Slight	Somewhat hard	Too many people! Tourist brought reef fish on board in plastic bag. Then he let the fish go by dropping it overboard from the upper deck, at least 10 feet above sea level - very disrespectful.
Koh Ma Pring	0	30	1	2	Calm	Easy	
Wednesday April 27, 2005 No. of tourists on boat: 59							
Koh Tong Lang	25	45	1	2	Slight	Easy	Visibility fair (better on south side, but no tourists go to the south side)
Koh Yak Lek	10	30	2	3	Slight	Somewhat hard	Visibility is very poor today. Current on south side of island is strong today, making it difficult to snorkel. Many snorkelers stayed on the north side where the quality of the coral is not great and visibility is very poor.
Koh Kra	0	35	1	1	Calm	Easy	Very pleasant snorkeling experience. Not too many people or boats, and it is quiet!

SITE	NUMBER OF SNORKELERS MIN.	NUMBER OF SNORKELERS MAX.	NUMBER OF BOATS MIN.	NUMBER OF BOATS MAX.	SEA STATE	SNORKELING CONDITIONS	OBSERVATIONS/ COMMENTS
Thursday April 28, 2005 No. of tourists on boat: 91							
Koh Tong Lang	10	80	3	4	Moderate	Somewhat difficult	Storm blowing in, temperature is cool. Dark clouds in the sky. Storm caused two big boats to ground up on the reef - we were stuck for a minute of two. It didn't sound good. The rope line snapped. Tourists in the water were trapped between the 2 boats, and scrambled to get out of the way. Bad for reef, bad for tourists. Boat sustained some damage on board when it scraped alongside another boat (bent pole).
Koh Yak Lek	10	90	2	4	Calm	Easy	Snorkeling conditions a bit rougher on east/southeast side of island where currents were a bit strong.
Koh Ma Pring	0	50	1	2	Calm	Easy	

A STUDY OF NATURE BASED MARINE TOURISM IN KOH CHANG MARINE NATIONAL PARK

Survey of Snorkeling Tour Operators in
Koh Chang Marine National Park, Thailand
April 2005

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Marine Protected Areas Research Group
Department of Geography
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PADI Project AWARE

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

Canada

The purpose of this study is to gain an understanding of the marine-based recreation services offered to tourists visiting Koh Chang Marine National Park. Please answer all of the following questions and return the completed questionnaire to the research attendant when you are finished.

Thank-you for taking the time to participate in this study.

ABOUT YOUR ORGANIZATION

Q.1 What is the name of your organization?

_____

Q.2 How long have you been operating in Koh Chang? (Please circle number.)

1. LESS THAN ONE YEAR
2. 1-2 YEARS
3. 3-4 YEARS
4. 5-6 YEARS
5. 7-10 YEARS
6. MORE THAN 10 YEARS

Q.3 Including yourself, how many people are employed with your organization?

_____ FULL TIME EMPLOYEES (working a minimum of 35 hours/week)

_____ PART TIME EMPLOYEES (working **less than** 35 hours/week)

Q.4 How much does a full day snorkeling trip cost tourists?

_____ BAHT FOREIGN TOURISTS

_____ BAHT FOREIGN TOURISTS

Q.5 On average, how many weeks in a year do you sell **snorkeling** trips to tourists?

_____ WEEKS

Q.6 How many tourists can your boat accommodate?

_____ TOURISTS

Q.7 Between the months of February and April, approximately how many visitors, **ON AVERAGE**, do you take snorkeling on a **DAILY** basis? (Please circle number.)

1. 1-10 VISITORS
2. 11-20 VISITORS
3. 21-30 VISITORS
4. 31-40 VISITORS
5. 41-50 VISITORS
6. 51-60 VISITORS
7. 60-70 VISITORS
8. MORE THAN 70 VISITORS

Q.8 On average, how many different **islands** do you take tourists to snorkel on **each trip**? (Please circle number.)

1. 1 ISLAND
2. 2 ISLANDS
3. 3 ISLANDS
4. 4 ISLANDS
5. MORE THAN 4 ISLANDS

Q.9 Which of the following **SNORKELING** sites do you take tourists to visit on a **regular** basis (3 or more times a week)? Please circle all that apply.

1. KOH CHANG NOI
2. KOH MA PRING (NORTH WEST OF KOH CHANG)
3. KOH SU WAN
4. KOH ROM
5. KOH YUAK
6. KOH PLI
7. KOH MAN NOK
8. KOH LAO YA
9. KOH WAI
10. KOH KHAM
11. KOH THONG LANG
12. KOH KRA
13. KOH THAIN
14. KOH YAK YAI
15. KOH YAK LEK/ KOH LON
16. KOH MA PRING (SOUTH EAST OF KOH RANG)
17. OTHER (PLEASE SPECIFY): _____
18. OTHER (PLEASE SPECIFY): _____

Q.10 Now thinking about **SCUBA diving**, between the months of February and April, approximately how many visitors do you take SCUBA on a **DAILY** basis? (Please circle number.)

1. ZERO VISITORS
2. 1-2 VISITORS
3. 3-5 VISITORS
4. 6-10 VISITORS
5. MORE THAN 10 VISITORS

Q.11 Do you offer scuba diving certification?

1. NO
2. YES → If YES, approximately how many tourists do you certify in **one week** during the high season (February to end of April)?

_____ TOURISTS

Q.12 We are interested in learning about the type of information tourists receive from staff members while on a snorkeling trip in Koh Chang Marine National Park. Please indicate whether or not your staff <u>are instructed to</u> provide the following types of information, by circling the appropriate number (for each language) in the table below.

		THAI Language		**English Language**	
Types of information		**NO** ⇩	**YES** ⇩	**NO** ⇩	**YES** ⇩
A	Safety procedures on board the boat	1	2	1	2
B	The names of the islands tourists will see en route to the snorkeling sites	1	2	1	2
C	The names of the islands tourists will visit	1	2	1	2
D	The length of time the boat will stop at each site	1	2	1	2
E	Safety procedures while snorkeling	1	2	1	2
F	Proper use of snorkeling equipment	1	2	1	2
G	The variety of corals tourists can see while snorkeling	1	2	1	2
H	The variety of fish tourists can see while snorkeling	1	2	1	2
I	The danger of stepping on rocks	1	2	1	2
J	The danger of standing on coral	1	2	1	2
K	The danger of touching/stepping on sea urchins	1	2	1	2
L	Marine Protected Area restrictions (e.g., collection of sea shells)	1	2	1	2

Q.13 While on a snorkeling trip, do tourists receive any other interpretive information about the marine environment in Koh Chang Marine National Park?

1. NO
2. YES → If YES, please use the back of the questionnaire to briefly describe what information tourists are given about Koh Chang Marine National Park.

THE CORAL REEF ENVIRONMENT

Q.14 Thinking about snorkeling in Koh Chang, please rate the **quality of the coral** at each of the snorkeling sites listed below. (Please circle the number that best reflects your feelings.)

		QUALITY OF THE CORAL				
Snorkeling site		**VERY POOR** ⇩	**POOR** ⇩	**GOOD** ⇩	**VERY GOOD** ⇩	**NOT SURE** ⇩
A	Koh Chang Noi	1	2	3	4	5
B	Koh Ma Pring (NW of Koh Chang)	1	2	3	4	5
C	Koh Man Nok	1	2	3	4	5
D	Koh Yuak	1	2	3	4	5
E	Koh Lao Ya	1	2	3	4	5
F	Koh Wai	1	2	3	4	5
G	Koh Kham	1	2	3	4	5
H	Koh Tong Lang	1	2	3	4	5
I	Koh Kra	1	2	3	4	5
J	Koh Thain	1	2	3	4	5
K	Koh Yak Yai	1	2	3	4	5
L	Koh Yak Lek/ Koh Lon	1	2	3	4	5
M	Koh Ma Pring (SE of Koh Rang)	1	2	3	4	5

Q.15 Still thinking about snorkeling in Koh Chang, please rate the **variety and abundance of marine life** at each of the snorkeling sites listed below. (Please circle number.)

		VARIETY AND ABUNDANCE OF MARINE LIFE				
Snorkeling site		**VERY POOR** ⇩	**POOR** ⇩	**GOOD** ⇩	**VERY GOOD** ⇩	**NOT SURE** ⇩
A	Koh Chang Noi	1	2	3	4	5
B	Koh Ma Pring (NW of Koh Chang)	1	2	3	4	5
C	Koh Man Nok	1	2	3	4	5
D	Koh Yuak	1	2	3	4	5
E	Koh Lao Ya	1	2	3	4	5
F	Koh Wai	1	2	3	4	5
G	Koh Kham	1	2	3	4	5
H	Koh Tong Lang	1	2	3	4	5
I	Koh Kra	1	2	3	4	5
J	Koh Thain	1	2	3	4	5
K	Koh Yak Yai	1	2	3	4	5
L	Koh Yak Lek/ Koh Lon	1	2	3	4	5
M	Koh Ma Pring (SE of Koh Rang)	1	2	3	4	5

Q.16 Please indicate how you feel about the **impact** of the following activities on Koh Chang's coral reef ecosystems (please circle number):

Activity		NO IMPACT ⇩	SMALL IMPACT ⇩	LARGE IMPACT ⇩	VERY LARGE IMPACT ⇩	NOT SURE ⇩
A	Snorkeling	1	2	3	4	5
B	Scuba diving	1	2	3	4	5
C	Boating	1	2	3	4	5
D	Swimming	1	2	3	4	5
E	Sea kayaking	1	2	3	4	5
F	Recreational fishing	1	2	3	4	5
G	Commercial fishing	1	2	3	4	5
H	Garbage disposal (in the water)	1	2	3	4	5
I	Sewage disposal (in the water)	1	2	3	4	5
J	Feeding fish	1	2	3	4	5
K	Touching marine animals	1	2	3	4	5
L	Touching coral	1	2	3	4	5
M	Standing on top of coral reefs	1	2	3	4	5
N	Anchoring on top of coral reefs	1	2	3	4	5

Q.17 Do you feel that tourists recreating in Koh Chang Marine National Park should be required to contribute an additional fee towards protection of the marine environment?

1. NO
2. YES

If YES, how much should the National Park collect from tourists towards conservation of the marine environment?

_____ BAHT for **Thai** tourists

_____ BAHT for **Foreign** tourists

MARINE PARK MANAGEMENT STRATEGIES

Q.18 To achieve a balance between marine conservation **AND** the provision of satisfactory recreation experiences for tourists, there are a variety of visitor management strategies that the National Park, Wildlife and Plant Conservation Department can introduce. Please indicate how strongly you oppose or support the following **POSSIBLE** management alternatives for marine recreation in Koh Chang by circling a number beside each statement, where 1 = STRONGLY OPPOSE and 5 = STRONGLY SUPPORT.

	Possible management alternatives	STRONGLY OPPOSE ⇩	SOMEWHAT OPPOSE ⇩	NEUTRAL ⇩	SOMEWHAT SUPPORT ⇩	STRONGLY SUPPORT ⇩
A	Improve opportunities for tourists to learn about coral reef ecosystems	1	2	3	4	5
B	Increase presence of park staff	1	2	3	4	5
C	Restrict access to coral reefs showing signs of degradation	1	2	3	4	5
D	Provide additional mooring buoys for boats	1	2	3	4	5
E	Manage the number of snorkelers allowed to visit the coral reefs per day	1	2	3	4	5
F	Manage the number of SCUBA divers allowed to visit the coral reefs per day	1	2	3	4	5
G	Manage the number of boats allowed to visit the coral reefs per day	1	2	3	4	5
H	Prohibit commercial fishing inside marine park boundaries	1	2	3	4	5
I	Prohibit recreational fishing inside marine park boundaries	1	2	3	4	5

Q.19 Are there any other management alternatives you feel Koh Chang marine park managers should consider? If so, please use the space below to write your comments.

Is there anything else you would like to tell us about your experiences operating a tour company in Koh Chang Marine National Park? If so, please use the space below to express your views.

Thank you for taking the time to complete this survey, as your opinions are important to us. PLEASE RETURN YOUR COMPLETED QUESTIONNAIRE TO THE RESEARCH ATTENDANT.

For office use only

SNORKELING TOUR

Location: _____ Notes:

Date: _____ /05
DAY MONTH DAY

Entered into SPSS: ◯ ◯

APPENDIX B-2 Tour Operator Survey Results

This Appendix summarizes the results for the Tour Operator Survey (n=8). Responses to open-ended questions are also included, along with any comments that were made in reaction to the close-ended questions. ***Note***: To protect the anonymity of respondents, the results of Q1 (What is the name of your organization?) are not summarized here.

TABLE 1 Number of Years Operating in Koh Chang (Q2)

Response	Responded (%)	Overall (%)	(*n*)
1-2 years	25.0	25.0	(2)
3-4 years	37.5	37.5	(3)
7-10 years	12.5	12.5	(1)
More than 10 years	25.0	25.0	(2)
Total	100.0	100.0	(8)

TABLE 2 Number of Full Time (Q3) **and Part Time** (Q4) **People Employed**

Response	Responded (%)	Overall (%)	(*n*)
Number of Full Time Employees			
1	12.5	12.5	(1)
2-3	25.0	25.0	(2)
4-5	12.5	12.5	(1)
6-7	25.0	25.0	(2)
11	12.5	12.5	(1)
15	12.5	12.5	(1)
Total	100.0	100.0	(8)
Number of Part Time Employees			
0	75.0	75.0	(6)
2	12.5	12.5	(1)
5	12.5	12.5	(1)
Total	100.0	100.0	(8)

TABLE 3 Cost to Visitors for a Full Day of Snorkeling (Q4)

Response	Responded (%)	Overall (%)	(*n*)
Cost to Thai Tourists			
300 baht	25.0	25.0	(2)
400 baht	37.5	37.5	(3)
450 baht	12.5	12.5	(1)
777 baht	12.5	12.5	(1)
800 baht	12.5	12.5	(1)
Total	100.0	100.0	(8)
Mean	**478**		
SD	**198**		
Cost to Foreign Tourists			
300 baht	12.5	12.5	(1)
350 baht	12.5	12.5	(1)
400 baht	37.5	37.5	(3)
450 baht	12.5	12.5	(1)
777 baht	12.5	12.5	(1)
800 baht	12.5	12.5	(1)
Total	100.0	100.0	(8)
Mean	**485**		
SD	**193**		

TABLE 4 Number of Weeks in a Year Tour Operators Sell Snorkeling Trips (Q5)

Number of weeks	Responded (%)	Overall (%)	(*n*)
14	14.3	12.5	(1)
16	14.3	12.5	(1)
20	14.3	12.5	(1)
28	14.3	12.5	(1)
30	14.3	12.5	(1)
36	14.3	12.5	(1)
48	14.3	12.5	(1)
Total	100.0	87.5	(8)
Missing		12.5	(1)
Mean	**36**		
SD	**28**		

TABLE 5 Number of Tourists Boats Can Accommodate (Q6)

Number of tourists	Responded (%)	Overall (%)	(*n*)
Less than 25	37.5	37.5	(3)
25-50	12.5	12.5	(1)
50-75	12.5	12.5	(1)
75-100	25.0	25.0	(2)
More than 200	12.5	12.5	(1)
Total	100.0	100.0	(8)
Mean	**69.4**		
SD	**70.0**		

TABLE 6 Average Number of Visitors Tour Operators Take Snorkeling on a Daily Basis Between February and April (peak season) (Q7)

Number of visitors	Responded (%)	Overall (%)	(*n*)
1-10	25.0	28.6	(2)
11-20	37.5	42.9	(3)
21-30	12.5	14.3	(1)
41-50	12.5	14.3	(1)
Total	100.0	87.5	(7)
Missing		12.5	(1)

TABLE 7 Number of Islands Tour Operators Take Tourists to Snorkel on Each trip (Q8)

Number of islands	Responded (%)	Overall (%)	(*n*)
3	37.5	37.5	(3)
3	50.0	50.0	(4)
More than 4	12.5	12.5	(1)
Total	100.0	100.0	(8)

TABLE 8 Snorkeling Sites Tour Operators Take Tourists on a Regular Basis (3 or times a week) (Q9)

	YES		NO	
Number of weeks	**(%)**	**(n)**	**(%)**	**(n)**
Koh Chang Noi	12.5	(1)	87.5	(7)
Koh Ma Pring (NW Of Koh Chang)	12.5	(1)	87.5	(7)
Koh Su Wan	0.0	(0)	100.0	(8)
Koh Rom	0.0	(0)	100.0	(8)
Koh Yuak	25.0	(2)	75.0	(6)
Koh Pli	0.0	(0)	100.0	(8)
Koh Man Nok	0.0	(0)	100.0	(8)
Koh Lao Ya	0.0	(0)	100.0	(8)
Koh Wai	50.0	(4)	50.0	(4)
Koh Kham	25.0	(2)	75.0	(6)
Koh Thong Lang	50.0	(4)	50.0	(4)
Koh Kra	37.5	(3)	62.5	(5)
Koh Thain	50.0	(4)	50.0	(4)
Koh Yak Yai	62.5	(5)	37.5	(3)
Koh Yak Lek/ Koh Lon	50.0	(4)	50.0	(4)
Koh Ma Pring (SE of Koh Rang)	0.0	(0)	100.0	(8)
Koh Klum	12.5	(1)	87.5	(7)
Koh Rang	12.5	(1)	87.5	(7)

TABLE 9 Average Number of Visitors Tour Operators Take Scuba Diving on a Daily Basis Between February and April (peak season) (Q10)

Number of visitors	**Responded (%)**	**Overall (%)**	***(n)***
Zero	83.3	62.5	(5)
3-5	16.7	12.5	(1)
Total	100.0	75.0	(6)
Missing		25.0	(2)

TABLE 10 Number of Tour Operators That Offer Scuba Diving Certification (Q11A) **and Average Number of Visitors Certified in one week between February and April** (peak season) (Q11B)

Response	Responded (%)	Overall (%)	(*n*)
No	80.0	50.0	(4)
Yes	20.0	12.5	(1)
Average number of tourists certified in a week	6		
Total	100.0	62.5	(5)
Missing		37.5	(3)

TABLE 11 Interpretive Information Boat Staff Are Instructed to Provide Tourists (Q12)

	Thai Language		English Language	
Response	**(%)**	**(n)**	**(%)**	**(n)**
Safety procedures on board the boat	100.0	(8)	62.5	(5)
The names of the islands tourists will see en route to the snorkeling sites	100.0	(8)	62.5	(5)
The names of the islands tourists will visit	100.0	(8)	62.5	(5)
The length of time the boat will stop at each site	100.0	(8)	62.5	(5)
Safety procedures while snorkeling	100.0	(8)	62.5	(5)
Proper use of snorkeling equipment	100.0	(8)	62.5	(5)
The variety of corals tourists can see while snorkeling	100.0	(8)	62.5	(5)
The variety of fish tourists can see while snorkeling	100.0	(8)	62.5	(5)
The danger of stepping on rocks	100.0	(8)	62.5	(5)
The danger of standing on coral	100.0	(8)	62.5	(5)
The danger of touching/stepping on sea urchins	100.0	(8)	62.5	(5)
Marine Protected Area restrictions (e.g., collection of sea shells)	100.0	(8)	62.5	(5)
Do you provide additional interpretive information?				
No	33.3		50.0	(2)
Yes	73.3		25.0	(4)
Total	100.0		75.0	(6)
Missing			25.0	(2)

Q13: While on a snorkeling trip, do tourists receive any other interpretive information about the marine environment in Koh Chang Marine National Park?

"Able to see coral reefs at Koh Rang, very beautiful. Tourists will be very impressive and corporate in preserving these resources."

"We will take tourists to the spots we think the most beautiful to make the tourists having a good time."

"Telling the name of beaches as we pass by."

"Telling the name of mountains and altitude."

"Big boats cannot stop close to the island – anchors are needed. Small boats can stop near the island – they give buoys for stopping."

"Garbage needs to be disposed of properly or taken back to hotels. There are trash cans provided on the boat."

"The corals and Koh Rang are very beautiful."

"We will explain everything to the tourists!"

TABLE 12 Tour Operators' Perceptions of the Coral Reef Environment (Q14, Q15)

	Quality of the coral						Variety and abundance of marine life					
	Very good / Good		Very poor / Poor		Not sure		Very good / Good		Very poor / Poor		Not sure	
Snorkeling site	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)
Koh Chang Noi	0.0	(0)	57.1	(4)	42.9	(3)	14.3	(1)	42.9	(3)	42.9	(3)
Koh Ma Pring (NW of Koh Chang)	14.3	(1)	28.6	(2)	57.1	(4)	0.0	(0)	42.9	(3)	57.1	(4)
Koh Man Nok	0.0	(0)	57.1	(4)	42.9	(3)	37.5	(3)	25.0	(2)	37.5	(3)
Koh Yuak	28.6	(2)	42.9	(3)	28.6	(2)	62.5	(5)	25.0	(2)	0.0	(0)
Koh Lao Ya	28.6	(2)	28.6	(2)	42.9	(3)	100.0	(8)	0.0	(0)	0.0	(0)
Koh Wai	100.0	(7)	0.0	(0)	0.0	(0)	57.1	(4)	0.0	(0)	42.9	(3)
Koh Kham	28.6	(2)	28.6	(2)	42.9	(3)	87.5	(6)	12.5	(2)	0.0	(0)
Koh Tong Lang	87.5	(7)	0.0	(0)	12.5	(1)	87.5	(7)	0.0	(0)	12.5	(1)
Koh Kra	87.5	(7)	0.0	(0)	12.5	(1)	75.0	(6)	12.5	(1)	12.5	(1)
Koh Thain	75.0	(6)	12.5	(1)	12.5	(1)	75.0	(6)	0.0	(0)	12.5	(2)
Koh Yak Yai	75.0	(2)	0.0	(0)	25.0	(2)	62.5	(5)	0.0	(0)	37.5	(3)
Koh Yak Lek/ Koh Lon	62.5	(5)	12.5	(1)	25.0	(2)	50.0	(3)	0.0	(0)	50.0	(3)
Koh Ma Pring (SE of Koh Rang)	28.6	(2)	14.3	(1)	28.6	(2)	14.3	(1)	28.6	(2)	50.0	(4)

TABLE 14 Tour Operators' Perceptions of the Impact of a Variety of Activities on Koh Chang's Coral Reef Ecosystems (Q16)

	No impact / small impact		Large impact / Very large impact		Not sure	
Activity	%	(*n*)	%	(*n*)	%	(*n*)
Standing on top of coral reefs	0.0	(0)	100.0	(8)	0.0	(0)
Anchoring on top of coral reefs	0.0	(0)	100.0	(8)	0.0	(0)
Garbage disposal (in the water)	12.5	(1)	87.5	(7)	0.0	(0)
Sewage disposal(in the water)	25.0	(1)	75.0	(6)	0.0	(0)
Commercial fishing	25.0	(2)	62.5	(5)	12.5	(1)
Touching coral	37.5	(3)	62.5	(5)	0.0	(0)
Scuba diving	42.9	(3)	42.9	(3)	14.3	(1)
Boating	62.5	(5)	37.5	(2)	0.0	(0)
Touching marine animals	62.5	(5)	37.5	(3)	0.0	(0)
Feeding fish	62.5	(5)	25.0	(2)	12.5	(1)
Snorkeling	87.5	(7)	12.5	(1)	0.0	(0)
Recreational fishing	87.5	(7)	12.5	(1)	0.0	(0)
Sea kayaking	100.0	(0)	0.0	(0)	0.0	(0)
Swimming	100.0	(8)	0.0	(0)	0.0	(0)

Comments in reaction to Q16: Please indicate how you feel about the impact of the following activities on Koh Chang's coral reef ecosystems.

"If anchor out of the area is okay, but speed boats go on top of the reefs."

"Most tour operators/managers do not go with staff especially speed boat staff, these people are not aware and irresponsible, just anchor. I used to tell them but they don't listen....even shout at me."

TABLE 15 Tour Operators Who Believe Tourists Should Be Required to Contribute an Additional Fee Towards Protection of the Marine Environment (Q17A, B)

Response	Responded (%)	Overall (%)	(*n*)
No	37.5	37.5	(3)
Yes	62.5	62.5	(5)
How much should the National Park collect from tourists towards conservation of the marine environment?			
20 baht	37.5	37.5	(3)
300 baht	12.5	12.5	(3)
500 baht	12.5	12.5	(1)
Total	100.0	100.0	(8)

Comments in reaction to Q17: Do you feel that tourists recreating in Koh Chang Marine National Park should be required to contribute an additional fee towards protection of the marine environment?

"Worry that if a national park fee is imposed on tourists it will reduce numbers of general visitors to Bang Bao. Koh Samet charges a fee but it is not used to benefit the island. We would prefer to control out own environment."

"If have to pay tourists should pay one time and can access everywhere in the park. Pay at 500 baht."

"Park staff should explain to the tourists why they are collecting the fee."

TABLE 13 Tour Operators' Support for a Range of Park Management Strategies (Q18) (Missing cases excluded)

	Strongly/ Somewhat oppose		Neutral		Somewhat / Strongly support	
Possible management alternatives	%	(*n*)	%	(*n*)	%	(*n*)
Improve opportunities for tourists to learn about coral reef ecosystems	0.0	(0)	0.0	(0)	100.0	(8)
Restrict access to coral reefs showing signs of degradation	0.0	(0)	0.0	(0)	100.0	(7)
Prohibit commercial fishing inside marine park boundaries	0.0	(0)	0.0	(0)	100.0	(7)
Increase presence of park staff	0.0	(0)	12.5	(1)	87.5	(8)
Provide additional mooring buoys for boats	0.0	(0)	12.5	(1)	87.5	(7)
Manage the number of SCUBA divers allowed to visit the coral reefs per day	28.6	(2)	0.0	(0)	71.4	(5)
Prohibit recreational fishing inside marine park boundaries	60.0	(3)	0.0	(0)	40.0	(2)
Manage the number of snorkelers allowed to visit the coral reefs per day	75.0	(6)	0.0	(0)	25.0	(2)
Manage the number of boats allowed to visit the coral reefs per day	75.0	(6)	0.0	(0)	25.0	(2)

Q19: Are there any other management alternatives you feel Koh Chang marine park managers should consider?

"Be more restrict about speed boats which like to stop and anchor on top of the reefs. This can cause much damage. As well as the speed boats are fast moving which may lead to accident. Most foreigners don't like this." (Mgmt)

"Some concerns about forest fires, it has been more and more…taking several days. Although Koh Chang has park staffs but seems did not work out within these 3 weeks. If not increase number of park staffs, they need to work harder…however not a balanced way."

BACK COVER: Is there anything else you would like to tell us about your experiences operating a tour company in Koh Chang Marine National Park?

"This business is attractive to both Thai and foreign tourists but during special events there will be many tourists, many boats are carrying too many tourists and pay less care about safety. The relevant agencies should organize some trainings about first aids to the tour operator staffs. As well as park staffs should keep eyes on everyday during high tourism

season such as checking the boats that stop too close to the reefs or anchor on top of the reefs."

"If every boat had one person able to give all relevant information and safety procedures. Garbage should be the responsibility of the boat captain or staff and disposal of upon return to Bang Bao. All boat trips to cease during low season to give the coral and fish a well deserved rest."

"Koh Chang environment is still in good condition. From what I see, there are only Thai tourists have inappropriate behaviours. They like to eat, drink on the beach and leave garbage all over. Should be a system to fine to stop the increase of this garbage…even cigarettes or tooth picks."

A STUDY OF NATURE BASED MARINE TOURISM IN KOH CHANG MARINE NATIONAL PARK

Survey of Visitors to
Koh Chang Marine National Park, Thailand
February – May 2005

University of Victoria
Victoria, British Columbia, Canada
V8W 3P5

Marine Protected Areas Research Group
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PO Box 3050 Victoria, BC
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PADI Project AWARE

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

Canada

Welcome to Koh Chang Marine National Park. The purpose of this study is to gain an understanding of visitor opinions concerning snorkeling opportunities in Koh Chang's coral reef ecosystems. **Your opinions and attitudes are very important,** and will be used to develop future management strategies for this marine park, and others in Thailand.

Please answer all of the following questions and return the completed questionnaire to the research attendant when you are finished. **Thank-you** for taking the time to participate in this study.

RECREATION ACTIVITIES AND EXPERIENCES

Q.1 Is snorkeling in Koh Chang (please circle number beside statement):

1. THE MAIN REASON FOR YOUR VISIT
2. A PLANNED ACTIVITY ON YOUR VISIT TO KOH CHANG
3. AN UNPLANNED ACTIVITY ON YOUR VISIT TO KOH CHANG

Q.2 While visiting Koh Chang Marine National Park, which of the following recreation activities will you be participating in (please circle all that apply)?

1. SNORKELING
2. SCUBA DIVING
3. SWIMMING
4. BOATING
5. SEA KAYAKING
6. HIKING/WALKING
7. CAMPING
8. BIRD WATCHING
9. ELEPHANT TREKKING
10. OTHER (PLEASE SPECIFY) _____

Q.3 About how many days in total will you spend in Koh Chang during this visit?

_____ DAYS

Q.4 While visiting Koh Chang, how many organized snorkeling trips will you participate in?

_____ TRIP(S)

Q.5 In total, approximately how much money will you spend to participate in an organized snorkeling trip in Koh Chang?

_____ BAHT

Q.6 How many previous snorkeling trips have you taken in Thailand?

_____ TRIP(S)

Q.7 Other than Thailand, where have you snorkeled (please circle all that apply)?

1. ELSEWHERE IN SOUTHEAST ASIA
2. AUSTRALIA/NEW ZEALAND
3. NORTH AMERICA
4. CARIBBEAN
5. MEDITERRANEAN
6. SOUTH AMERICA
7. INDIAN OCEAN
8. RED SEA
9. OTHER (PLEASE LIST) _____
10. I HAVE NOT SNORKELED ANYWHERE ELSE

Q.8 In the past year, about how many times have you snorkeled in a coral reef environment? (Please circle number.)

1. ZERO TIMES
2. 1-5 TIMES
3. 6-10 TIMES
4. 11-15 TIMES
5. 16-20 TIMES
6. 21-25 TIMES
7. MORE THAN 25 TIMES

Q.9 How would you describe your level of experience in snorkeling? (Please circle number.)

1. NOVICE
2. INTERMEDIATE
3. ADVANCED
4. EXPERT

Q.10 Do you own your own snorkeling equipment?

1. NO
2. YES

Q.11 How would you rate the importance of coral reefs as a tourist attraction for you? (Please circle number.)

1. NOT AT ALL IMPORTANT
2. SLIGHTLY IMPORTANT
3. VERY IMPORTANT
4. EXTREMELY IMPORTANT
5. NOT SURE/ UNDECIDED

THE SNORKELING ENVIRONMENT

Q.12 Please state how **IMPORTANT/ UNIMPORTANT** you feel the following features are to your snorkeling experience at Koh Chang. Please circle a number beside each statement that best reflects your feelings.

	Environment and setting features	NOT AT ALL IMPORTANT ⇩	SLIGHTLY IMPORTANT ⇩	QUITE IMPORTANT ⇩	EXTREMELY IMPORTANT ⇩	NOT SURE ⇩
A	Warm weather	1	2	3	4	5
B	Easy snorkeling conditions	1	2	3	4	5
C	Good underwater visibility	1	2	3	4	5
D	Attractive above water scenery	1	2	3	4	5
E	Undamaged snorkeling sites	1	2	3	4	5
F	Variety of marine life	1	2	3	4	5
G	Variety of coral species	1	2	3	4	5
H	Abundance of marine life	1	2	3	4	5
I	Abundance of large fish	1	2	3	4	5
J	Unique underwater formations	1	2	3	4	5
K	Number of other snorkelers	1	2	3	4	5
L	Number of boats	1	2	3	4	5

Q.13 Are there any other setting features that you feel are important to your snorkeling experience at Koh Chang? If so, please use the space below to write your comments.

Q.14 To help us understand what you liked or didn't like about the **snorkeling environment** at Koh Chang, please indicate how **SATISFIED** you were with the following aspects of your trip. Please circle a number beside each statement that best reflects your feelings.

	Environment and setting features	**VERY UNSATISFIED** ⇩	**SOMEWHAT UNSATISFIED** ⇩	**NEUTRAL** ⇩	**SOMEWHAT SATISFIED** ⇩	**VERY SATISFIED** ⇩
A	Warm weather	1	2	3	4	5
B	Easy snorkeling conditions	1	2	3	4	5
C	Good underwater visibility	1	2	3	4	5
D	Attractive above water scenery	1	2	3	4	5
E	Undamaged snorkeling sites	1	2	3	4	5
F	Variety of marine life	1	2	3	4	5
G	Variety of coral species	1	2	3	4	5
H	Abundance of marine life	1	2	3	4	5
I	Abundance of large fish	1	2	3	4	5
J	Unique underwater formations	1	2	3	4	5
K	Number of other snorkelers	1	2	3	4	5
L	Number of boats	1	2	3	4	5

Q.15 Taking into consideration all the environment and setting features **listed above**, how would you rate your **overall** level of satisfaction with the snorkeling environment in Koh Chang? (Please circle number.)

1. VERY UNSATISFIED
2. SOMEWHAT UNSATISFIED
3. NEUTRAL
4. SOMEWHAT SATISFIED
5. VERY SATISFIED

Q.16 Based on the quality of the **coral reef environment**, would you **return** to Koh Chang for snorkeling?

1. NO
2. YES

Q.17 Based on the quality of the **coral reef environment**, would you **recommend** snorkeling to other tourists visiting Koh Chang?

1. NO
2. YES

SNORKELING SERVICES

Q.18 Please state how **IMPORTANT/ UNIMPORTANT** you feel the following **services** are to your snorkeling experience at Koh Chang. (Please circle number.)

	Service	NOT AT ALL IMPORTANT ⇩	SOMEWHAT IMPORTANT ⇩	QUITE IMPORTANT ⇩	EXTREMELY IMPORTANT ⇩	NOT SURE ⇩
A	Information provided by boat crew	1	2	3	4	5
B	Commitment to the environment by boat crew	1	2	3	4	5
C	Safety procedures on boat	1	2	3	4	5
D	Length of snorkeling trips	1	2	3	4	5
E	Quality of marine transportation services	1	2	3	4	5
F	Variety of snorkeling trips available	1	2	3	4	5
G	Cost of snorkeling trip	1	2	3	4	5

Q.19 Now thinking about the services you enjoyed on your tour, please indicate how **SATISFIED** you were with each of the following (please circle number):

	Service	VERY UNSATISFIED ⇩	SOMEWHAT UNSATISFIED ⇩	NEUTRAL ⇩	SOMEWHAT SATISFIED ⇩	VERY SATISFIED ⇩
A	Information provided by boat crew	1	2	3	4	5
B	Commitment to the environment by boat crew	1	2	3	4	5
C	Safety procedures on boat	1	2	3	4	5
D	Length of snorkeling trips	1	2	3	4	5
E	Quality of marine transportation services	1	2	3	4	5
F	Variety of snorkeling trips available	1	2	3	4	5
G	Cost of snorkeling trip	1	2	3	4	5

Q.20 Taking into consideration the services **listed above**, how would you rate your **overall** level of satisfaction?

1. VERY UNSATISFIED
2. SOMEWHAT UNSATISFIED
3. NEUTRAL
4. SOMEWHAT SATISFIED
5. VERY SATISFIED

THE UNDERWATER WORLD

Q.21 Below are a series of questions about coral reef ecosystems. For each question, please indicate whether you believe the answer is 1 = TRUE, 2 = FALSE, or 3 = DON'T KNOW.

	Question	TRUE ⇩	FALSE ⇩	DON'T KNOW ⇩
A	Coral reef colonies can be hundreds of years old	1	2	3
B	Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	1	2	3
C	Sand stirred up from the sea floor can kill corals	1	2	3
D	Corals are animals	1	2	3
E	Coral bleaching is a result of rising sea temperatures	1	2	3
F	Park personnel should feed marine animals, because the animals are probably hungry	1	2	3
G	Tourism facilities on land can negatively impact coral reefs	1	2	3
H	Snorkelers should stand on the reef when they get tired	1	2	3
I	Boats can anchor on top of coral reefs without harming coral reef communities	1	2	3
J	Corals need sunlight to grow	1	2	3
K	Snorkelers do not harm corals when they touch them with their hands or feet	1	2	3
L	Coral reefs are threatened ecosystems	1	2	3

Q.22 How important is the opportunity to learn about coral reef ecosystems to you? (Please circle number.)

1. NOT AT ALL IMPORTANT
2. SLIGHTLY IMPORTANT
3. QUITE IMPORTANT
4. EXTREMELY IMPORTANT
5. NOT SURE

Q.23 How would you rate your opportunity to learn about coral reefs in Koh Chang Marine National Park?

1. VERY POOR
2. POOR
3. NOT SURE
4. GOOD
5. VERY GOOD

THE SOCIAL SETTING

Q.24 How many snorkelers did you expect to see during your snorkeling trip? (Please circle number.)

1. LESS THAN YOU ACTUALLY SAW
2. ABOUT AS MANY AS YOU ACTUALLY SAW
3. MORE THAN YOU ACTUALLY SAW
4. DIDN'T KNOW WHAT TO EXPECT

Q.25 About how many other snorkelers do you remember seeing on your snorkeling trip? (Please circle number.)

1. 0-9 SNORKELERS
2. 10-19 SNORKELERS
3. 20-29 SNORKELERS
4. 30-39 SNORKELERS
5. 40-49 SNORKELERS
6. MORE THAN 49 SNORKELERS
7. NOT SURE/ CAN'T RECALL

Q.26 Thinking about the total number of other snorkelers you encountered in the water today, please indicate on the scale how crowded you felt. (Please circle **ONE number** on the scale.)

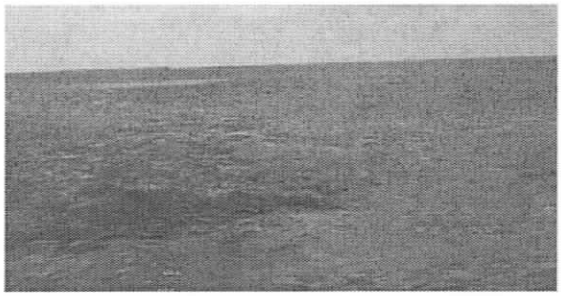
1	2	3	4	5	6	7	8	9
NOT AT ALL CROWDED		SLIGHTLY CROWDED			MODERATELY CROWDED			EXTREMELY CROWDED

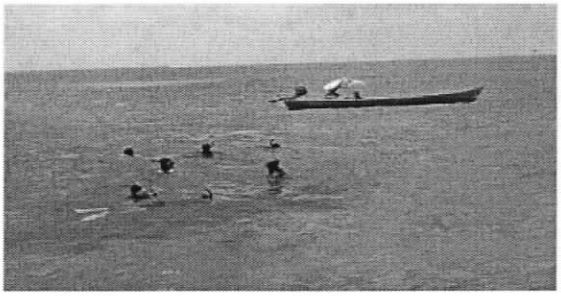
Q.27 Please indicate how you feel about the encounters you experienced on your snorkeling trip, by circling the appropriate number beside each statement.

	Did you feel that:	**TOO FEW** ⇩	**TOO MANY** ⇩	**ABOUT RIGHT** ⇩
A	The number of other people snorkeling was	1	2	3
B	The number of tourists on your boat was	1	2	3
C	The number of other boats at the snorkeling sites was	1	2	3
D	The number of mooring buoys in the water was	1	2	3
E	The number of staff on the boat was	1	2	3

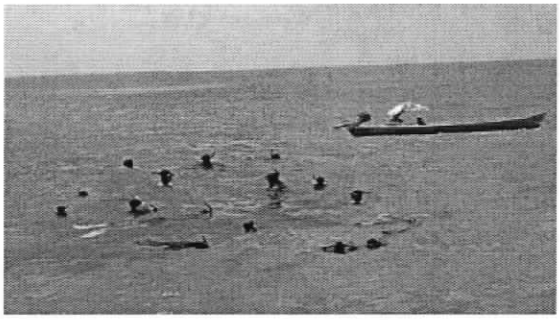
Q.28 The illustrations below portray different levels of contact with other snorkelers. Please rate how unacceptable or acceptable you feel the number of snorkelers shown in **each** photograph is to you by circling your response in the **table below**.

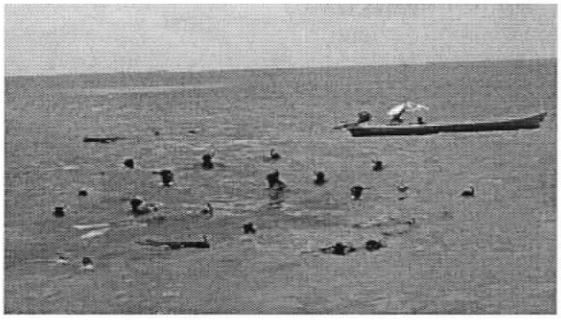
A.



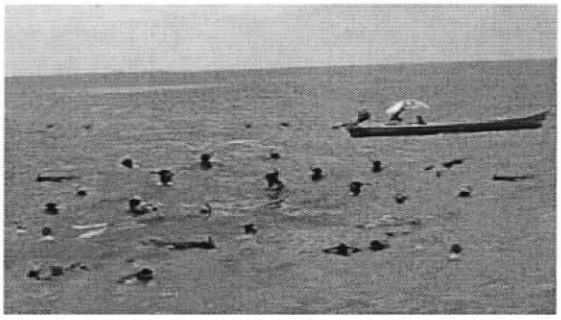


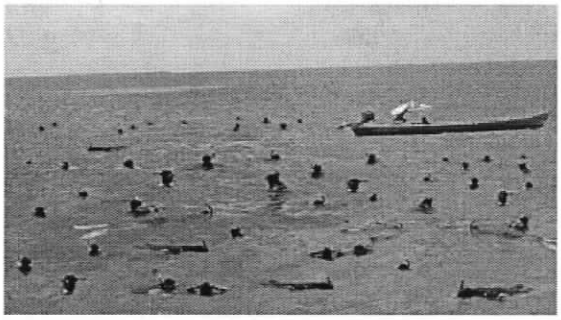
C.





E.





Photograph		VERY UNACCEPTABLE ⇩	SOMEWHAT UNACCEPTABLE ⇩	NOT SURE ⇩	SOMEWHAT ACCEPTABLE ⇩	VERY ACCEPTABLE ⇩
A	Photograph A	1	2	3	4	5
B	Photograph B	1	2	3	4	5
C	Photograph C	1	2	3	4	5
D	Photograph D	1	2	3	4	5
E	Photograph E	1	2	3	4	5
F	Photograph F	1	2	3	4	5

THE CORAL REEF ENVIRONMENT

Q.29 While snorkeling in Koh Chang, please indicate which of the following situations you noticed (please circle **all** that apply):

1. SNORKELERS RESTING THEIR FEET ON THE REEF
2. SNORKELERS TOUCHING THE REEF WITH THEIR HANDS
3. SNORKELERS KICKING THE REEF WITH THEIR FEET
4. SNORKELERS BREAKING OFF A PIECE OF CORAL
5. SNORKELERS DIVING DEEPER FOR A CLOSER LOOK
6. SNORKELERS TOUCHING MARINE ANIMALS
7. GARBAGE ON THE SEA FLOOR
8. TOURISTS COLLECTING SEA SHELLS

Q.30 While traveling to your snorkeling site(s) in Koh Chang, please indicate which of the following situations you noticed (please circle **all** that apply):

1. BOATS ANCHORING ON TOP OF THE REEF
2. BOATS USING MOORING BUOYS
3. TOURISTS DISPOSING OF GARBAGE IN THE WATER
4. BOAT OPERATORS DISPOSING OF GARBAGE IN THE WATER
5. TOURISTS FEEDING FISH
6. BOAT OPERATORS FEEDING FISH

Q.31 Overall, how much impact do you feel snorkeling has on coral reefs in Koh Chang? (Please circle number):

1. VERY LARGE IMPACT
2. LARGE IMPACT
3. SMALL IMPACT
4. NO IMPACT
5. NOT SURE

Q.32 Would you be willing to make an additional monetary contribution towards protection of the marine environment and the snorkeling sites you visited in Koh Chang?

1. NO
2. YES

If YES, how much would you be willing to contribute? _____ BAHT

ABOUT YOU

To help us understand your opinions, we are interested in learning a bit about you.

Q.33 Are you

1. MALE
2. FEMALE

Q.34 What is your country of origin? _____

Q.35 What is your age?

1. UNDER 25 YEARS
2. 25-35 YEARS
3. 36-45 YEARS
4. 46-55 YEARS
5. 56-65 YEARS
6. OVER 65 YEARS

Q.36 What is the highest level of education you have completed?

1. GRADE/ PRIMARY SCHOOL
2. HIGH SCHOOL
3. COLLEGE/ UNIVERSITY
4. TRADE OR APPRENTICESHIP
5. OTHER (PLEASE SPECIFY) _____

Q.37 Do you own an underwater camera?

1. NO
2. YES

↘ If YES, did you **use** your underwater camera while snorkeling **today**?

1. NO
2. YES

Q.38 Do you have your SCUBA diving certification?

1. NO
2. YES

↘ If YES, what year were you certified? _____

How many dives did you complete in the last year? _____ DIVES

Is there anything else you would like to tell us about your snorkeling experience at Koh Chang Marine National Park? If so, please use the space below to express your views.

Thank you for taking the time to complete this survey, as your opinions are important to us. PLEASE RETURN YOUR COMPLETED QUESTIONNAIRE TO THE RESEARCH ATTENDANT.

For office use only

Survey site location: _____ Notes:

_____

Tour Company: _____

Date: _____ /05
DAY MONTH DAY

Entered into SPSS: ◯ ◯

APPENDIX C-2 Visitor Survey Results

This Appendix summarizes the results for the Visitor Survey (n=716). Responses to open-ended questions are also included, along with any comments that were made in reaction to the close-ended questions.

TABLE 1 Importance of Snorkeling as a Reason for Visiting Koh Chang (Q1)

Response	Responded (%)	Overall (%)	(*n*)
Snorkeling was the main reason	11.0	10.8	(77)
Snorkeling was a planned activity	62.6	60.9	(436)
Snorkeling was an unplanned activity	26.4	25.7	(184)
Total	100.0	97.3	(697)
Missing		2.7	(19)

TABLE 2 Activities Engaged In (Q2)*

Activities engaged in	Responded (%)	Overall (%)	(*n*)
Snorkeling	93.7	93.3	(668)
Swimming	80.4	80.0	(573)
Boating	46.4	46.2	(331)
Sea kayaking	29.3	29.2	(209)
Hiking / walking	20.3	20.3	(145)
Elephant Trekking	17.4	17.3	(124)
Scuba diving	8.0	8.0	(57)
Bird watching	4.2	4.2	(30)
Other	6.1	6.0	(45)
Camping	2.9	2.9	(21)
Total			(712)
Missing		0.5	(4)

* Totals do not equal 100% due to multiple response

TABLE 3 Number of Days Spent in Koh Chang (Q3)

Number of days	Responded (%)	Overall (%)	(*n*)
1-3 days	42.5	42.1	(301)
4-6 days	28.3	28.0	(200)
7-9 days	12.8	12.7	(91)
10-12 days	8.7	8.6	(62)
13-15 days	5.6	5.6	(40)
More than 15 days	2.1	2.0	(15)
Total	100.0	99.0	(709)
Missing		1.0	(7)
Mean			5.8 days
Median			4.0 days
SD			5.14 days

TABLE 4 Number of Organized Snorkeling Trips on This Vacation (Q4)

Trips	Responded (%)	Overall (%)	(*n*)
1 trip	76.0	73.7	(528)
2 trips	13.2	12.8	(92)
3 trips	4.9	4.7	(34)
4 trips	4.8	4.6	(33)
More than 4 trips	1.1	1.1	(8)
Total	100.0	97.1	(695)
Missing		2.9	(21)

TABLE 5 Amount of Money Spent Participating in an Organized Snorkeling Trip ($US) (Q5)

Response	Responded (%)	Overall (%)	(*n*)
$0-$10	37.5	36.2	(259)
$11-$20	50.4	48.6	(348)
$21-$30	5.9	5.7	(41)
$31-$40	2.0	2.0	(14)
More than $40	4.2	4.0	(29)
Total	100.0	96.5	(691)
Missing		3.5	(25)
Mean			$15
Median			$12
SD			$16

TABLE 6 Number of Previous Snorkeling Trips Taken in Thailand (Q6)

Trips	Responded (%)	Overall (%)	(*n*)
0 trips	41.4	40.2	(288)
1-2 trips	36.2	35.3	(253)
3-4 trips	10.6	10.4	(74)
5-6 trips	4.4	4.3	(31)
7-8 trips	1.4	1.4	(10)
9-10 trips	3.6	3.5	(25)
More than 10 trips	2.4	2.4	(17)
Total	100.0	97.5	(698)
Missing		2.5	(18)
Mean			2.1 days
Median			1.0 days
SD			4.4 days

TABLE 7 Previous Snorkeling Locations (Q7)*

Snorkeling location	Responded (%)	Overall (%)	(*n*)
Have not snorkeled anywhere else	53.4	51.1	(366)
Mediterranean	22.3	23.4	(160)
Elsewhere in SE Asia	16.4	15.6	(112)
Caribbean	14.5	13.8	(99)
Australia / New Zealand	13.5	12.8	(92)
Indian Ocean	10.0	9.6	(69)
Other	9.1	8.7	(62)
Red Sea	6.7	6.7	(48)
North America	5.1	4.9	(35)
South America	3.9	3.8	(27)
Missing		4.3	(31)

* Totals do not equal 100% due to multiple response

TABLE 8 The Number of Times Survey Respondents Snorkeled in a Coral Reef Environment in the Last Year (Q8)

Number of times snorkeling	Responded (%)	Overall (%)	(*n*)
Zero times	52.4	51.8	(371)
1-5 times	39.4	39.0	(279)
6-10 times	4.8	4.7	(34)
More than 10 times	3.4	3.4	(24)
Total	100.0	98.9	(708)
Missing		1.1	(8)

TABLE 9 Self Reported Level of Snorkeling Experience (Q9)

Level of experience	Responded (%)	Overall (%)	(*n*)
Novice	54.9	54.5	(390)
Intermediate	32.7	32.4	(232)
Advanced	10.1	10.1	(72)
Expert	2.3	2.2	(16)
Total	100.0	99.2	(710)
Missing		0.8	(6)

TABLE 10 Snorkeling Equipment Ownership (Q10)

Equipment ownership	Responded (%)	Overall (%)	(*n*)
Yes	31.4	31.3	(224)
No	68.6	68.3	(489)
Total	100.0	99.6	(713)
Missing		0.4	(3)

TABLE 11 Importance of Coral Reefs as a Tourist Attraction (Q11)

Importance of coral reefs	Responded (%)	Overall (%)	(*n*)
Not at all important	1.0	1.0	(7)
Slightly important	18.8	18.7	(134)
Very important	47.1	46.8	(335)
Extremely important	30.9	30.7	(220)
Not sure / undecided	2.2	2.2	(16)
Total	100.0	99.4	(712)
Missing		0.6	(4)

TABLE 12 The Importance of Various Environment and Setting Features to Visitors' Enjoyment of the Snorkeling Trip (Q12)

	RESPONSE (%)							
Environment and setting features	**Not at all important**	**Slightly important**	**Quite important**	**Extremely important**	**Not sure**	**Mean**	**SD**	**Missing (*n*)**
Warm weather	3.8	12.8	43.4	36.7	1.0	3.2	.82	(16)
Easy snorkeling conditions	2.9	13.7	40.5	39.4	1.0	3.2	.81	(18)
Good underwater visibility	0.1	1.5	15.5	80.2	0.6	3.8	.45	(15)
Attractive above water scenery	3.2	13.7	35.9	44.0	0.6	3.3	.83	(19)
Undamaged snorkeling sites	0.4	2.2	17.5	75.7	2.1	3.8	.53	(15)
Variety of marine life	0.4	2.8	24.4	69.0	1.5	3.7	.57	(13)
Variety of coral species	0.6	4.9	29.5	61.5	1.8	3.6	.64	(13)
Abundance of marine life	0.7	5.2	27.2	60.9	2.9	3.6	.67	(22)
Abundance of large fish	4.9	24.6	38.8	26.1	2.8	3.0	.92	(20)
Unique underwater formations	2.7	17.0	39.0	34.6	3.2	3.2	.86	(25)
Number of other snorkelers	12.2	23.9	31.0	26.8	3.2	2.8	1.06	(21)
Number of boats	8.7	23.0	33.2	28.6	3.8	3.0	1.02	(19)

TABLE 13 Satisfaction with Environment and Setting Features on the Snorkeling Trip (Q14)

	RESPONSE (%)							
Environment and setting features	**Very unsatisfied**	**Somewhat unsatisfied**	**Neutral**	**Somewhat satisfied**	**Very satisfied**	**Mean**	**SD**	**Missing (*n*)**
Warm weather	2.2	6.0	15.9	30.9	43.6	4.1	1.02	(10)
Easy snorkeling conditions	1.7	5.3	13.7	40.2	37.7	4.1	0.94	(10)
Good underwater visibility	1.3	11.6	16.8	40.4	28.1	3.8	1.01	(14)
Attractive above water scenery	1.0	5.0	19.1	39.7	32.7	4.0	0.91	(18)
Undamaged snorkeling sites	2.1	14.5	23.3	38.8	19.7	3.6	1.03	(11)
Variety of marine life	2.4	13.3	25.7	40.5	16.6	3.6	1.00	(11)
Variety of coral species	2.7	11.6	28.4	37.3	18.4	3.6	1.01	(12)
Abundance of marine life	2.5	12.3	30.9	38.7	14.1	3.5	0.97	(11)
Abundance of large fish	9.4	27.4	39.4	17.3	4.9	2.8	1.00	(12)
Unique underwater formations	3.6	17.5	42.0	26.1	8.4	3.2	0.95	(17)
Number of other snorkelers	12.4	27.1	35.5	18.2	4.9	2.8	1.05	(14)
Number of boats	10.5	28.2	38.3	17.5	3.6	2.8	1.00	(14)

TABLE 14 The Importance of Various Service Features to Visitors' Enjoyment of the Snorkeling Trip (Q18)

	RESPONSE (%)							
Service features	Not at all important	Slightly important	Quite important	Extremely important	Not sure	Mean	SD	Missing (*n*)
Information provided by boat crew	2.4	14.8	39.0	42.5	0.4	3.2	0.80	(7)
Commitment to the environment by boat crew	0.7	5.6	24.4	67.0	1.3	3.6	0.64	(7)
Safety procedures on boat	0.6	10.5	27.2	59.8	0.7	3.5	0.71	(9)
Length of snorkeling trips	0.7	11.7	53.4	32.3	0.8	3.2	0.68	(8)
Quality of marine transportation services	0.4	13.3	38.0	45.9	1.1	3.3	0.74	(9)
Variety of snorkeling trips available	1.7	13.8	47.2	33.7	2.1	3.2	0.77	(11)
Cost of snorkeling trip	2.2	15.8	40.9	38.4	1.5	3.2	0.81	(8)

TABLE 15 Satisfaction with Service Features on the Snorkeling Trip (Q19)

	RESPONSE (%)							
Service features	Very unsatisfied	Somewhat unsatisfied	Neutral	Somewhat satisfied	Very satisfied	Mean	SD	Missing (*n*)
Information provided by boat crew	13.7	19.1	26.0	29.3	9.8	3.0	1.20	(15)
Commitment to the environment by boat crew	7.8	16.6	29.9	30.4	13.0	3.2	1.13	(16)
Safety procedures on boat	6.8	17.2	35.6	27.1	11.0	3.2	1.07	(16)
Length of snorkeling trips	1.1	5.7	19.3	44.0	27.4	3.9	0.90	(18)
Quality of marine transportation services	2.7	7.8	32.7	40.4	13.7	3.6	0.92	(20)
Variety of snorkeling trips available	2.5	12.3	39.2	31.7	11.6	3.4	0.94	(19)
Cost of snorkeling trip	2.1	9.9	29.6	33.0	23.0	3.7	1.01	(17)

TABLE 16 Overall Level of Satisfaction with Environment and Setting Features on Snorkeling Trip (Q15)

Response	Responded (%)	Overall (%)	(*n*)
Very unsatisfied	2.8	2.8	(20)
Somewhat unsatisfied	11.5	11.3	(81)
Neutral	11.5	11.5	(82)
Somewhat satisfied	49.0	48.6	(348)
Very satisfied	25.2	25.0	(179)
Total	100.0	99.2	(710)
Missing		0.8	(6)
Mean			3.8
SD			1.02

TABLE 17 Willingness to Return to Koh Chang for Snorkeling Based on Quality of the Coral Reef Environment (Q16)

Response	Responded (%)	Overall (%)	(*n*)
Yes	73.1	72.2	(517)
No	26.9	26.5	(190)
Total	100.0	98.7	(707)
Missing		1.3	(9)

TABLE 18 Willingness to Recommend Snorkeling to Other Tourists Based on Quality of Coral Reef Environment (Q17)

Response	Responded (%)	Overall (%)	(*n*)
Yes	86.3	85.1	(609)
No	13.7	13.5	(97)
Total	100.0	98.6	(706)
Missing		1.4	(10)

TABLE 19 Overall Level of Satisfaction with Service Features on Snorkeling Trip (Q20)

Response	Responded (%)	Overall (%)	(*n*)
Very unsatisfied	9.3	8.9	(64)
Somewhat unsatisfied	30.7	29.6	(212)
Neutral	17.8	17.2	(123)
Somewhat satisfied	29.5	28.5	(204)
Very satisfied	12.7	12.3	(88)
Total	100.0	96.5	(691)
Missing		3.5	(25)
Mean			3.1
SD			1.22

TABLE 20 Learning Experience (Q21)

	RESPONSE (%)				
Question	True	False	Don't know	Correct Responses (%)	Missing (%)
Coral reef colonies can be hundreds of years old	75.8	2.8	21.2	75.8	0.1
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	9.1	88.5	2.2	88.5	0.1
Sand stirred up from the sea floor can kill corals	36.5	13.8	49.0	36.5	0.7
Corals are animals	75.4	13.1	10.9	75.4	0.6
Coral bleaching is a result of rising sea temperatures	32.8	6.4	59.5	32.8	1.3
Park personnel should feed marine animals because the animals are probably hungry	4.1	80.4	14.7	80.4	0.8
Tourism facilities on land can negatively impact coral reefs	84.5	6.0	9.1	84.5	0.4
Snorkelers should stand on the reef when they get tired	2.2	94.4	3.1	94.4	0.3
Boats can anchor on top of coral reefs without harming coral reef communities	3.5	91.5	4.5	91.5	0.6
Corals need sunlight to grow	64.9)	6.8	27.8	64.9	0.4
Snorkelers do not harm corals when they touch them with their hands or feet	10.8	78.9	9.4	78.9	1.0
Coral reefs are threatened ecosystems	87.4	3.1	8.8	87.4	0.6

TABLE 21 Learning Quiz Scores (Q21)

	CORRECT RESPONSE		
Quiz score	**Responded (%)**	**Overall (%)**	**(*n*)**
Score of 0-19%	0.8	0.8	(6)
Score of 20-29%	1.5	1.4	(10)
Score of 30-39%	1.3	1.3	(9)
Score of 40-49%	1.9	1.8	(13)
Score of 50-59%	14.6	13.9	(100)
Score of 60-69%	15.1	14.4	(103)
Score of 70-79%	19.2	18.3	(131)
Score of 80-89%	21.6	20.7	(148)
Score of 90-100%	24.0	22.9	(164)
Total	100.0	95.5	
Missing		4.5	(32)

TABLE 22 Importance of Coral Reef Learning Opportunities (Q22)

Importance of learning	**Responded (%)**	**Overall (%)**	**(*n*)**
Not at all important	2.0	2.0	(14)
Slightly important	18.6	18.6	(133)
Quite important	44.2	44.1	(316)
Extremely important	33.0	33.0	(236)
Not sure	2.2	2.2	(16)
Total	100.0	99.9	(715)
Missing		0.1	(1)
Mean			3.1
SD			0.81

TABLE 23 Rating of Opportunity to Learn About Coral Reefs in Koh Chang (Q23)

Learning experience	Responded (%)	Overall (%)	(*n*)
Very poor	14.0	14.0	(100)
Poor	21.3	21.2	(152)
Not sure	32.7	32.5	(233)
Good	26.7	26.5	(190)
Very Good	5.3	5.3	(38)
Total	100.0	99.6	(713)
Missing		0.4	(3)
Mean			2.9
SD			1.11

TABLE 24 Number of Snorkelers Respondents Expected to See While Snorkeling (Q24)

Number of snorkelers respondents expected	Responded (%)	Overall (%)	(*n*)
Less than they actually saw	40.6	40.1	(287)
About as many as they actually saw	19.9	19.7	(141)
More than they actually saw	20.4	20.1	(144)
Didn't know what to expect	19.1	18.8	(135)
Total	100.0	98.7	(707)
Missing		1.3	(9)

TABLE 25 Number of Other Snorkelers Respondents Recalled Seeing While Snorkeling (Q25)

Number of other snorkelers	Responded (%)	Overall (%)	(*n*)
0-9 snorkelers	5.0	4.9	(35)
10-19 snorkelers	9.0	8.9	(64)
20-29 snorkelers	14.0	13.8	(99)
30-39 snorkelers	18.0	17.7	(127)
40-49 snorkelers	14.8	14.7	(105)
More than 49 snorkelers	34.5	34.1	(244)
Not sure / can't recall	4.7	4.6	(33)
Total	100.0	98.7	(707)
Missing		1.3	(9)

TABLE 26 Level of Crowdedness While Snorkeling (Q26)

Crowdedness		Responded (%)	Overall (%)	(*n*)
Not at all crowded	1	2.4	2.4	(17)
	2	5.8	5.7	(41)
Slightly crowded	3	9.1	8.9	(64)
	4	14.6	14.4	(103)
	5	10.6	10.5	(75)
Moderately crowded	6	19.1	18.9	(135)
	7	18.0	17.7	(127)
Extremely crowded	8	10.2	10.1	(72)
	9	10.2	9.9	(71)
Total		100.0	98.5	(705)
Missing			1.5	11
Mean				5.7
SD				2.10

TABLE 27 Encounters Experienced with Others (Q27)

	RESPONSE							
	Too few		Too many		About right		Missing	
Encounter	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)
The number of other people snorkeling was…	3.8	(27)	52.7	(377)	41.8	(299)	1.8	(13)
The number of tourists on the boat was…	2.1	(15)	32.5	(233)	63.7	(456)	1.7	(12)
The number of other boats at the snorkeling sites was…	2.8	(20)	49.7	(356)	45.5	(326)	2.0	(14)
The number of mooring buoys in the water was…	20.0	(143)	14.2	(102)	57.4	(411)	8.4	(60)
The number of staff on the boat was…	7.5	(54)	3.1	(22)	88.0	(630)	1.4	(10)

TABLE 28 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28)

	RESPONSE (%)							
Number of other snorkelers	**Very unacceptable**	**Somewhat unacceptable**	**Not sure**	**Somewhat acceptable**	**Very acceptable**	**Mean**	**SD**	**Missing**
Photo A: 0 snorkelers	21.4	7.7	9.2	12.7	46.8	3.6	1.64	(16)
Photo B: 7 snorkelers	3.5	11.2	3.5	30.0	49.6	4.1	1.14	(16)
Photo C: 15 snorkelers	3.5	15.1	8.0	54.6	16.3	3.7	1.04	(18)
Photo D: 23 snorkelers	12.0	32.1	13.1	34.4	5.7	2.9	1.18	(19)
Photo E: 33 snorkelers	48.5	31.6	7.8	8.0	2.0	1.8	1.02	(16)
Photo F: 49 snorkelers	80.9	8.0	3.6	3.5	2.7	1.4	0.92	(10)

TABLE 29 Behaviour Observed by Respondents while Snorkeling (Q29, Q30)*

Behaviour	**(%)**	***(n)***
Snorkelers resting their feet on the reef	54.5	(390)
Snorkelers touching the reef with their hands	41.5	(297)
Snorkelers kicking the reef with their feet	18.9	(135)
Snorkelers breaking off a piece of coral	8.5	(61)
Snorkelers diving deeper for a closer look	59.1	(423)
Snorkelers touching marine animals	38.3	(274)
Garbage on the sea floor	40.5	(290)
Tourists collecting sea shells	31.1	(223)
Boats anchoring on top of the reef	21.8	(156)
Boats using mooring buoys	30.3	(217)
Tourists disposing of garbage in the water	20.7	(148)
Boat operators disposing of garbage in the water	12.6	(90)
Tourists feeding fish	82.4	(590)
Boat operators feeding fish	41.3	(296)
Missing	1.1	(8)

* Totals do not equal 100% due to multiple response

TABLE 30 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang (Q31)

Level of impact	Responded (%)	Overall (%)	(*n*)
Very large impact	15.6	15.2	(109)
Large impact	38.8	38.0	(272)
Small impact	30.0	29.3	(210)
No impact	3.9	3.8	(27)
Not sure	11.7	11.5	(82)
Total	100.0	97.8	(700)
Missing		2.2	(16)
Mean			2.6
SD			1.16

TABLE 31 Willingness to Make an Additional Monetary Contribution Toward Protection of the Marine Environment and the Snorkeling Sites Visited in Koh Chang (Q32A, B)

Response	Responded (%)	Overall (%)	(*n*)
Yes	43.4	40.4	(289)
Amount willing to contribute (USD):			
Less than $5	57.3	48.4	(140)
$5-$10	8.2	6.9	(20)
$10.01 - $15	20.9	17.7	(51)
More than $15	13.5	11.4	(33)
Total	100.0	84.4	(244)
Missing		15.6	(45)
Mean			$4.18 USD
SD			$17.24 USD
No	56.6	52.5	(376)
Total	100.0	92.8	(665)
Missing		7.1	(51)

TABLE 32 Visitors' Gender (Q33)

Response	Responded (%)	Overall (%)	(*n*)
Female	57.4	56.6	(405)
Male	42.6	41.9	(300)
Total	100.0	98.5	(705)
Missing		1.5	(11)

TABLE 33 Country of Residence (Q34)

Response	Responded (%)	Overall (%)	(*n*)
Europe	44.0	4.0	308
Sweden	12.0	11.7	84
Germany	8.0	7.8	56
England	5.0	4.9	35
France	4.0	3.9	28
Denmark	2.6	2.5	18
Holland	2.4	2.4	17
Switzerland	2.3	2.2	16
Norway	2.0	2.0	14
Netherlands	1.0	1.0	7
Finland	0.7	0.7	5
Czech Republic	0.7	0.7	5
Italy	0.6	0.6	4
Austria	0.6	0.6	4
Scotland	0.4	0.4	3
Russia	0.4	0.4	3
Belgium	0.3	0.3	2
Israel	0.3	0.3	2
Slovenia	0.3	0.3	2
Turkey	0.1	0.1	1
Hungary	0.1	0.1	1
Spain	0.1	0.1	1
Australia / New Zealand	3.0	3.0	21
North America	4.0	4.0	28
Canada	2.0	2.0	14
United States	2.0	2.0	14
Asia	49.0	47.8	343
Lao	0.1	0.1	1
Thailand	48.0	46.9	336
Singapore	0.1	0.1	1
Japan	0.3	0.3	2
China	0.3	0.3	2
India	0.1	0.1	1
Total	100.0	97.8	(700)
Missing		2.2	(16)

TABLE 34 Visitors' Age (Q35)

Response	Responded (%)	Overall (%)	(*n*)
18-25 years	31.0	30.7	(220)
25-35 years	43.6	43.3	(310)
36-45 years	16.1	15.9	(114)
46-55 years	6.5	6.4	(46)
56-65 years	2.7	2.7	(19)
Over 65 years	0.1	0.1	(1)
Total	100.0	99.1	(710)
Missing		0.9	(6)

TABLE 35 Highest Level of Education Completed (Q36)

Response	Responded (%)	Overall (%)	(*n*)
Grade / Primary school	2.3	2.2	(16)
High school	20.5	20.1	(144)
College / University	67.8	66.5	(476)
Trade / Apprenticeship	5.8	5.7	(41)
Other	3.6	3.5	(25)
Total	100.0	98.0	(702)
Missing		2.0	(14)

TABLE 36 Underwater Camera Ownership and Usage (Q37A, Q37B)

Own underwater camera?	Responded (%)	Overall (%)	(*n*)
Yes	9.9	9.8	(70)
Did you use your underwater camera while snorkeling?			
Yes		58.6	(41)
No		41.4	(29)
Total		100.0	(70)
No	90.1	89.2	(639)
Total	100.0	99.0	(709)
Missing		1.0	(7)

TABLE 37 SCUBA Certification (Q38A) **and Year of Certification** (Q38B)

Are you a certified diver?	Responded (%)	Overall (%)	(*n*)
Yes	11.6	11.5	(82)
Year of certification			
1970-1975	2.6	2.4%	(2)
1975-1980	3.9	3.6	(3)
1981-1985	3.9	3.6	(3)
1986-1990	11.7	11.0	(9)
1991-1995	16.9	15.9	(13)
1996-2000	23.3	22.0	(18)
2001-2005	37.7	35.4	(29)
Total	100.0	94.1	(77)
Missing		6.1	(5)
No	88.4	87.4	(626)
Total	100.0	98.8	(708)
Missing		1.1	(8)

TABLE 38 Number of Dives Completed in the Last Year (Q38C)

Number of dives in last year	Responded (%)	Overall (%)	(*n*)
0 dives	92.5	91.2	(653)
1-2 dives	2.4	2.4	(17)
3-4 dives	1.6	1.5	(11)
5-6 dives	1.3	1.3	(9)
7-8 dives	0.4	0.4	(3)
9-10 dives	1.0	1.0	(7)
More than 10 dives	0.8	0.8	(6)
Total	100.0	98.6	(706)
Missing		1.4	(10)
Mean			0.49
SD			2.75

Qualitative Responses

Question 13. Are there any other setting features that you feel are important to your snorkeling experience at Koh Chang?

- Should be maps to instruct during each part of the trip.
- More information about the coral reefs.
- Have a trainer. Have complete snorkeling tools. Provide information during the trip.
- Tourists should keep the sea clean. Do not throw garbage/food on the beaches, in the waters, or on the islands.
- Beautiful corals, but some are almost lost and damaged.
- The tour operators should arrange a tour promotion like special occasions. I have a limited budget, but if I came as a group, it would be worth it.
- Controlling system for snorkelers that will not affect the ecosystem. For e.g., control the number of tourists, and duration of time.
- Duration for snorkeling and surrounding sites that can do snorkeling.
- Good services of the tour operators. E.g., take us to the most beautiful coral reef spots.
- It's important that tourists should help to conserve and there should be training for the staff on boats to help in extending coral reef conservation, so that they can help tourists understand the value of the beautiful marine ecosystem.
- There should be officers to introduce or take the tourists to see coral reefs, because some tourists have less experience and/or cannot swim well, but they can still see around.
- Dangerous sea animals (e.g., sea urchins).
- Very beautiful corals! I did not touch the coral and thought the other tourists should not too! Snorkeling has a small impact if everyone does not disturb the nature.
- Clear water at the sites - at some sites the water wasn't clear, a lot of sand. Fish were not in abundance but pretty beautiful, some I have never seen before. Too many snorkelers, headache.
- I do not want to see anything like fast boats because it will affect the marine animals and pollute the sea.
- None, coral reefs are destroyed. (Would spend up to 10,000 baht towards additional protection of marine environment, depending on budget.)
- Skills in snorkeling and the equipment are very important for snorkeling. People should have basic snorkeling skills. Good equipment makes it easier to snorkel for a long time, enjoying the beautiful nature.
- There should be glass bottom boats so we can see corals on the boat, especially for the elderly people who would not have to go snorkeling (could have more tourists this way). There should be more group snorkeling trips (snorkeling at different islands).
- I want to see everyone conserve nature so we can come here again and again.
- Too much garbage in Koh Wai.
- Few tourists, several snorkeling sites and sites that are not so far from each other.
- Practicing how to use the equipment. An officer who can give private training. Q.15 - somewhat satisfied b/c waves were too strong. I want to return when the waves are good. The first site was beautiful but the waves were too strong. I never used the equipment so I missed the good corals.

- Accommodation that is close to the snorkeling sites and first aid officers/lifeguards.
- New sites. 2. Controlling system about number of boats and number of tourists. 3. Cleanliness. 4. Toilet.
- I want to see checking of the equipment to ensure it is in good condition.
- Prices for fast boats are very high, they should be reduced.
- Demonstration in events/exhibitions. (?)
- Boat condition, comfort on boat, and safety.
- Relatively unspoiled island. Not over commercialized.
- There were too many people in the water feeding the fishes so that all except for the tiger fish disappeared.
- Level of pollution of the water, amount of rubbish on the surface and under the water.
- Good snorkeling equipment; information about marine ecosystem and nature, the marine animals' behaviour; under sea conservation - not allowed to dive down deeper, stop the boats, or do some activities.
- The service and good staff. It's nice to get information about the tour and the dives.
- Level of service of the providing company - extremely important. Expense of the trip - quite important.
- People should be told not to walk on/damage the coral.
- Clean.
- Cleaning the garbage around the pier. Food courts more organized. Clean around Koh Rang. Toilet at Koh Rang. More local guides.
- Good places for the snorkeling (attractive spaces). Don't want to go to a place that looks like a dump.
- Clean water - no rubbish, e.g. plastic bags, refuse…
- Less snorkelers and boats in one area at the same time would be better. The damaging effects of touching/breaking coral was never stressed to tourists.
- Food on the boat (quality and vegetarian option). Safety of boat. Safety at snorkeling site.
- Information/instruction.
- There should be only 1-3 boats (big) each day. No small boats should be allowed.
- I want to be warned about touching dangerous sea animals.
- Number of dangerous animals (less is better).
- I think its very important that the coral is protected. You see, I saw quite a lot of dead coral, and that makes me want to stop snorkeling. I hope the government will protect it well.
- Not too many waves if this impacts visibility negatively.
- Travel time to sites
- Preserve the marine natural resources. Do not stop boats too close! Check condition of boats often to guard against pollution. Be strict about keeping environment clean!
- To explain how beautiful the areas are. I want to learn something while snorkeling, not just watch.
- Sea conditions.
- Too many people. Too many boats.
- How other people behave.
- Navigation and explanation of the environment.
- Not too many snorkelers and boats at the sight at the same time.

- The amount of people on a boat, some information on the area, sea life, English Speaking staff.
- Too many snorkelers; explanation about the coral species.
- Preserve the environment.
- Set the timetable and sites of each boats. Do not allow too many tourists. Spread tourists around several sites!
- Here is not far from Bangkok, so its good to come snorkeling. But bad luck to come during the high season. I saw some people standing on the coral reefs and break it/destroy it. So sad. The boat should also stop far from the snorkeling sites. Some boats also tie the boats to the corals.
- Not as beautiful as I thought it would be. Doesn't look clean. Too many sea urchins, dangerous.
- Too far, too long on the boat.
- Fish.
- We should conserve coral reefs. Do not break/destroy. Do not come during the rainy season.
- Improve the boat.
- Number of quality tour operators and safety.
- Safety on boat. Disposal from boat. Warning about Tsunami and climate. Controlling mechanism of the tour operators to not cause damage to the coral reefs and ecosystem.
- Easy transportation.
- No pollution.
- Very beautiful and well-protected. Biodiversity. The time for transportation is still important.
- Campaign for conservation.
- Limit the number of tourists each day. Reserve before coming. If more than that the tourists have to postpone…so ecosystem won't be destroyed.
- Should be mooring buoys for tying the boats at the snorkeling sites. The boats should not anchor.
- Security and that they take care of the coral reefs and the fishes.
- Good interpretation of what you get to see and how to behave.
- Instructions before getting on the boat are needed because the boat is too noisy and I can't concentrate.
- Currents; it's hard to go into some areas if there is a rough current!
- Snorkeling, together with conservation is the most important activity. Information provided by the tour operators and other organizations is necessary to help the tourists be more aware of the value of nature. There should be information provided before going to snorkel.
- Cost of snorkeling. Environmental awareness of company. Quality of rental equipment.
- A variety of colours is always good.
- Services on boat; towels, clean equipment, clean boat.
- Tourists should know how to protect corals before snorkeling.

BACK COVER: Is there anything else you would like to tell us about your snorkeling experience at Koh Chang Marine National Park?

- Fun! I've never been snorkeling before.
- Tourists should conserve the environment, and try not to be so close to the coral reefs.
- Snorkelers should not step on, or touch the corals and marine animals. Snorkelers should not throw garbage in the sea.
- Beautiful, but want the Thai tourists to come here more by introducing the diving sites more because some sites have less coral. There should be officers at each site to provide information about how long the corals have been there and how many tourists have visited the sites already.
- They should raise marine animals and bring them to the coral reefs because the number of some marine animals is poor and not in enough abundance. For e.g., tiger shell, other shells, and some crabs, etc.
- Give training to the tour operators in Koh Chang to preserve the coral reefs, then this will bring more foreign tourists.
- There should be officers teaching basic techniques in snorkeling that will not harm nature and what to do to not get into danger or endanger the environment.
- I want everyone to love the ocean and nature. Do not throw un-decomposed garbage in the sea and on the beaches. Everyone should realize that nature is a treasure, we should love and preserve nature to be as natural as it is.
- Now there are invaders and persons who want to destroy coral reefs a lot. We should pay attention to this situation very urgently before they [the reefs] are gone from the Thai ocean (especially Koh Chang).
- This is my first time snorkeling. The climate/environment was impressive and the services on the boat were good. I hope there is more PR about tourism in Thailand, so we don't have to go to other countries, because our country is much more beautiful.
- This is my first time snorkeling! This is remarkable nature and I want it to remain like this.
- People who live in Koh Chang should help in nature conservation too, either pollution issue or number of tourists, because this is the reason I decided to come snorkeling here as well.
- We can snorkel but we should not touch anything, it will be too much impact on nature.
- The waves were too strong today, causing some troubles while snorkeling but the corals were beautiful. However, fish were not in abundance. Sea was not clear in some spots, maybe because I have been snorkeling in the Andaman Sea several times so I did not feel so excited about the undersea world. But overall, the corals here are okay.
- Snorkeling here is something that should be conserved for our children to see in the future.
- I want the coral reefs not to be destroyed. There shouldn't be a lot of boats at the snorkeling sites.
- There should be more coral reefs.
- I want to come back!

- There should be more modern equipment. There should be more activities for the tourists.
- Corals have been destroyed a lot. There is garbage in the sea, and tourists step on the reefs. People lack the knowledge (how to do); there should be someone taking better care so that the tourists will not break the corals. Overall the trip was impressive but worried about the corals.
- It is truly great to have everything in a reach but it may result in destruction of the life in the area if no proper management is conducted. It is a good part for a tourist but bad for environment. And also irrigation and sanitary garbage management should be taken into consideration, as the # of tourists increases.
- I am so proud that our country still has beautiful places to see coral reefs. It should be conserved forever and I want to be one who can help conserve Koh Chang Marine National Park.
- First time here and very impressive, very beautiful. If there is the opportunity, there should be snorkeling at other places too.
- Snorkeling is an important activity for tourism. Tourists should try to understand to preserve nature, not only come here for fun. There should be more attention paid to: 1. Arranging the boats for looking around, 2. All tour workers should have cards, 3. promotion of tourism throughout the world, 4. information on how to conserve, 5. open for personnel and groups to arrange conservation activities in Koh Chang.
- Snorkeling equipment should be maintained in good condition. Officers on the boats worked well and paid attention to tourists and provided information about corals and marine animals.
- The local Thai people I met on the boat were very friendly. They were snorkeling for the first time - there was no information given to them about the importance of the coral reef and how to look after it. I was upset to see a boat guide playing with a marine animal - sea cucumber - like it was a toy.
- Information on how to use equipment. Instruction on snorkeling techniques which are good for corals.
- I was on a snorkeling trip once somewhere but was not impressed because the tour operator let tourists go by themselves. But I came snorkeling here and had an instructor to help/advise so I learned more about what I saw. The equipment was not very good. Some coral reefs in Koh Chang have been destroyed but I have no idea why. I have seen ropes in the sea flowers [fishing nets] and no one paid attention to pull them out or maybe I didn't see, but [the ropes] are for sure from humans. I didn't pull the ropes off because I can't swim. I saw some plastic bags on some beaches.
- I want to see less sea urchins, I'm scared to step on them. There are lots!
- Should be more organized tourism. More information on corals should be given during snorkeling. More information on coral conservation techniques before snorkeling is needed.
- Information about snorkeling before doing it. Raise more awareness for coral reef conservation. -Officers should provide information on coral reefs and marine animals. Cheaper price. Pay more attention to how tourists use the equipment.
- I have noticed a lack of awareness related to environment issues. Local residents should be aware of the importance of a clean environment. A clean and well preserved environment will bring tourists to the island and will bring the money they

need. Local government should be working towards sustainable development in the area.

- Best water I've seen in Thailand so far!
- Very enjoyable, good value for money. Coral looked very healthy. Hope it stays like that!
- Although the coral reef at the snorkeling sites was well protected and in good order, I noticed that 100 yards to left and right, the coral was nearly all destroyed. So I guess, carry on the good work and try to protect more.
- Beautiful, clean sea, no garbage, nice weather, tourists good number.
- No instructions on the boats, no sign for tourists indicating which animals are dangerous or what we shouldn't do to avoid harming the marine life.
- It would have been good to know whereabouts we were actually snorkeling. Maybe a map could be provided with the islands contained within the National park and the sites we go to. Tourists were constantly standing on coral - they should be informed of the dangers of this.
- Beautiful, but somewhat crowded in areas. It's expected though. Wish there were less people, but that would be hypocritical to say. More educational trips should be offered, or maybe there are and I didn't look hard enough. There should be more of a conservation effort put forth to conserve the reefs - saw damage, but not too much (could have been more I didn't notice).
- I think the staff on the boat should educate their passengers better when it comes to conservation of the reefs. Both staff and passengers were standing on the coral and some people were breaking bits off. The boat staff should make it their responsibility that this doesn't happen.
- Having previously snorkeled in Thailand I feel on this trip not enough information was given on what to do and not to do. For instance, when snorkeling previously we were told not to touch or stand on the coral as this damages it. Also not to feed the fish or take sea shells as souvenirs. None of this information was given on this trip!
- On a previous snorkeling trip in Phi Phi we were told not to stand on the coral, touch it, or feed the fish and this was not done this time.
- I first snorkeled in Thailand 25 years ago. Thai people rarely showed interest in this environment or the beautiful coral reefs then. Today, I noticed a lot of Thai people. It's good to see that they are so interested. Education on how to protect the natural environment is needed for Thais more than for foreign tourists.
- Surprised to see boat crew fishing from back of boat.
- Not impressed with music from neighboring boat!
- Boat crew should provide more information about the coral and what to do and what not to do. Make it an educational trip as well.
- The tour operators should give information to tourists who have never been to Koh Chang, such as how to protect themselves from dangerous animals (sea urchins). Tourists should be advised about what tools they can use to protect themselves…wearing shoes that can save them from sharp stones. -Tourists should be advised on how to use masks.
- Help to conserve the environment at Koh Chang and other islands for the next generation and the world.
- There should be a presentation during the trip…where we are going, history of the islands, species of coral/fish, some dos and don'ts during snorkeling. Do not allow

smoking on boats, this should be a smoke-free area because there were foreign tourists smoking and throwing their cigarettes into the sea.

- More information on history and instructions on snorkeling techniques so the tourists will not do anything that will harm the ecosystem and environment. More information on safety and fist aid techniques if any emergency should occur on the boat.
- I just found out how beautiful snorkeling is but I am afraid that it will disappear soon with all these people coming here.
- Visibility poorer than expected. Reefs a bit more damaged than expected. I had expected instructions and pamphlet with guidance on do's don'ts when swimming in the coral reefs area.
- Enjoyed the trip but too many snorkelers at each stop affected the activity. Would like an option of a 1/2 day trip as a day was quite long.
- Accommodation and food are very expensive - accommodation prices should be controlled. Boat cost is too expensive, most people don't want to see the other islands, they just stay at the beach. Shouldn't be many private beaches because this is very inconvenient. Keep the ocean more clean!
- There should be basic knowledge provided before getting on the boat. Provide training to boat officers often.
- Teaching the Thai tourists before they come to the island, from my experience seeing the Thai people destroy their own nature is very sad. Its our own country but we have foreigners complain and protect the environment instead. All boats should provide instruction in both Thai and English.
- I went on 2 snorkeling trips with my husband, and we are glad that we got to see the coral reefs and the variety of animals in the sea - BUT - we firmly believe that if the tourism industry, including snorkeling operators, is not quickly made subject to strict policies based on preserving the environment, there will not be any environment left to protect.
- Obviously I thought it was fantastic, and for all my snorkeling experience I am aware of the need for preservation, but what about the locals? As our boat operator did not speak English, I was unaware of any guidance given, if at all, to help preserve and protect this beautiful environment!
- I'm assuming it was extremely busy due to Songkran. I have snorkeled in other areas/islands of Thailand and have never experienced anything so busy. I also don't think a lot of Thai people understand the fragility of the coral ecosystem.
- Far too busy with people and boats. Boats too large and over crowded. Inabilities to swim of 90% of the snorkelers makes me think that a small glass-bottom boat would be vastly more suitable. I did not enjoy the snorkeling, however I did enjoy the diving from the boat's upper deck.
- Set the number of boats and visitors allowed per day. Give brief explanation about ecosystem and how to conserve the environment before going snorkeling. The tour operators should get official permission from the government and should be training every staff member often.
- Should be campaign among the tour operators to preserve coral reefs. Each company should donate money for regeneration because they have earned a lot already from their business.

- Very impressive. My first time. I never thought the undersea world in Thailand would be this beautiful. If there were more fish it would be great. Please help provide useful information to raise awareness of good ways to snorkel.
- More information on each island...what's good on the island, what there is to see, coral species identification and fish we will see while snorkeling.
- Tour operators should have less tourists on each boat...20-30 tourists per boat. Using big boats makes the surroundings less beautiful, less enjoyable.
- Okay, not much impression. Not sure what to see if come but people here are friendly. No cheating on the stoves, bus, boats. The locations should be more organized, more signs. Wider roads are needed, and they should connect to each other. More tourism activities are needed, more middle sized restaurants. Pubs/bars should be controlled. Should promote and conserve mangroves and fire flies immediately. Should leave some public beaches too, not just ones belonging to the resorts. People come to enjoy and walk on the beach. Trip to coral reefs is okay but should find the spot that is most impressive so we can tell our friends to come. Here/this time is not perfect yet.
- Seems all boats took the same trip and all started with the same islands. They should try to shuffle. They could prevent the snorkeling site from being too over crowded.
- Seeing the marine lives.
- No comment. Good as it is...good for tourists and snorkelers at all ages.
- Garbage is disposed of in the sea.
- Too short a time at each snorkeling site, and too many people.
- Beautiful and diversity. But, anyway, it needs to be protected cause I thought some of it might be disturbed by human beings. How about the oil/fuel of the boat when it stops to let passengers get down to snorkeling, is it gonna disturb the aquatic ecosystem? I saw some fuel on the surface (a few, a very few for one boat).
- I want to see cleaner sea water. Set the number of tourists permitted each year. Things left in Koh Chang are very good.
- Price of swim fins should be included rather than an additional charge. An information sheet written in English would have been helpful to understand itinerary and the park as the crew spoke very little English.
- Maybe a bit more information before starting to snorkel would be handy. For example to not feed the fish. I did not realize it would be harmful if you feed them bread or things like that.
- Snorkeling was a good experience; lets us see the real underwater world.
- If any boats/tourists see the garbage floating, like plastic bags, bottles, etc., they should help in cleaning it up, even if they didn't throw it. All snorkelers should watch their feet on the coral, some wear shoes/fins. Officers should be telling the tourists about the importance of the coral reefs.
- For an unknowing tourist the level of damage seems more or less acceptable. A contribution as a kind of tax to protection would be appraised by tourists, I guess information on influence of snorkeling on the coral as well.
- Snorkeling is a good ecotourism activity. We should teach the children and tell other who are in the same age, tell them to come. Need help from several organizations, both governmental and NGOs.
- Tour operators should explain rules, some dos and don'ts about the areas every time. Limit the number of tourists that can be in the area by having clear agreements between government and tour operators.

- Find funding for environmental conservation besides donations. Maybe it could come from entrance fees to the park.
- Ecotourism should remain in Koh Chang and I would like to see the researcher present the results to relevant agencies, especially Koh Chang Park for improvement of these officials. The information can also be a good reference for other Government organizations.
- Should have guides/officers to give useful/correct information to the next generation who are interested to come snorkeling.
- Less tourists on each trip. Don't destroy the ecosystem, intentionally or not intentionally. The can come to see this beautiful place next time.
- It was very enjoyable. I would recommend it to people.
- Fun recreation activity, not like just sitting on the boat.
- Not appropriate boat for the duration of the trip compared to other areas. Officers take care of only some groups of people. It's better to think that everyone has knowledge equal to zero. The boat staff should explain the dos and don'ts that tourists should know.
- Touring around Koh Chang should not destroy the environment. There were some tourists fishing in the islands although they will not eat/cook the fish at all...just catch and throw away. This is very destructive. I want to see the tour group leader help to provide information to the tourists on how to conserve the marine environment.

APPENDIX D Specialization Analysis

This appendix summarizes results for the following independent variables (from the visitor survey) that could have been used for the specialization analysis:

1. SCUBA certification (Q38),
2. equipment ownership (Q10),
3. number of times respondents snorkeled in a reef environment in the last year (Q8), and
4. number of previous snorkeling trips in Thailand (Q6).

The dependent variables used in the analysis fall into six main categories:

1. importance/satisfaction,
2. knowledge of coral reef ecosystems,
3. observations of tour operator and snorkeler behaviour,
4. perceptions of environmental impact,
5. perceptions of crowding, and
6. encounter norms.

The results are organized into sections by independent variable, i.e., the first section summarizes results for "SCUBA certification" as an indicate of specialization, followed by a summary of results for "equipment ownership" as an indicate of specialization, etc. Sample sizes and participation characteristics for independent variables are summarized at the beginning of each section.

SPECIALIZATION VARIABLE 1: SCUBA Certification (Q38)

TABLE 1 Assigned Specialization Levels for Specialization Variable

Certified SCUBA diver?	Specialization level	Sample size (*n*)	Percentage (%)
NO	Low	621	89.0
YES	High	77	11.0
	Total	698	100.0

TABLE 2 Participation Characteristics of High and Low Specialized Groups (SCUBA dive certification used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)				
	HIGH	LOW	Sig*	χ^2	*df*
"Snorkeling in Koh Chang…"					
Is the main reason for my visit	7.5	11.3			
Is a planned activity	66.3	62.2	.567	1.14	2
Is an unplanned activity	26.3	26.4			
"How many previous snorkeling trips have you taken in Thailand?"					
Zero	33.8	42.7			
1-5 trip	16.9	21.7	.062	5.57	**2**
More than 5 trips	49.4	35.6			
"Have you snorkeled anywhere outside of Thailand?"					
Yes	86.4	40.9	**.000***	59.31	1
No	13.6	59.1			
"How many times have you snorkelled in the last year?"					
Zero	25.0	56.5			
1-5	48.8	37.6	**.000***	50.71	2
More than 5	26.3	6.0			
"How would you describe your level of snorkeling experience?					
Novice	6.2	61.7			
Intermediate	45.7	30.8	**.000***	144.98	3
Advanced	37.0	6.6			
Expert	11.1	1.0			
"Do you own your own snorkeling equipment? "					
Yes	64.2	26.9	**.000***	46.40	**1**
No	35.8	73.1			
"Do you own an underwater camera?"					
Yes	16.0	9.1	**.044***	3.88	**1**
No	84.0	90.9			

* Significant at $p < 0.05$ (2-tailed test)

TABLE 3 The Importance of Snorkeling as a Tourist Attraction: A Comparison of High and Low Specialized Groups (SCUBA dive certification used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Importance of reefs as a tourist attraction	4.1	0.97	3.8	1.09	**.046***	-2.02	106

* Significant at $p < 0.05$

TABLE 4 The Importance of Various Physical, Natural, Social, and Service Conditions: A Comparison of High and Low Specialized Groups (SCUBA dive certification used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Physical conditions (Q12)							
Warm weather	4.2	1.04	3.9	1.12	**.029***	-2.22	106
Easy snorkeling conditions	3.5	1.23	4.1	1.08	**.000***	0.55	689
Good underwater visibility	4.7	0.45	4.8	0.56	.216	0.07	114
Natural conditions (Q12)							
Attractive above water scenery	3.5	1.28	4.1	1.10	**.000***	0.59	688
Undamaged snorkeling sites	4.7	0.54	4.7	0.68	.334	-0.06	115
Variety of marine life	4.5	0.67	4.6	0.71	.229	0.10	105
Variety of coral species	4.3	0.88	4.5	0.80	.064	0.19	98
Abundance of marine life	4.4	0.85	4.5	0.85	.785	0.03	102
Abundance of large fish	3.3	1.27	3.6	1.26	.057	0.29	100
Unique underwater formations	36	1.22	3.9	1.15	**.015***	0.34	682
Social conditions (Q12)							
Number of snorkelers	3.8	1.35	3.3	1.43	**.007***	-0.46	686
Number of boats	3.7	1.36	3.5	1.35	.090	-0.28	99
Service conditions (Q18)							
Information provided by boat crew	2.6	1.31	3.1	1.18	**.001***	3.40	691
Commitment to the environment	2.9	1.21	3.3	1.12	**.013***	2.53	99
Safety procedures on boat	3.1	1.07	3.2	1.08	.336	0.97	103
Length of snorkeling trips	4.1	0.79	3.9	0.91	**.012***	-2.57	110
Quality of marine transportation services	3.6	0.91	3.5	0.93	.613	-0.51	105
Variety of snorkeling trips available	3.4	0.99	3.4	0.93	.488	-0.70	100
Cost of snorkeling trip	3.9	0.99	3.6	1.01	**.044***	-2.04	105
Opportunity to learn about reefs (Q22)	2.5	1.13	2.9	1.10	**.001***	3.37	102

*Significant at $p < 0.05$

TABLE 5 Visitors' Satisfaction With the Physical, Natural, Social and Service Conditions: A Comparison High and Low Specialized Groups (SCUBA dive certification used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Physical conditions (Q14)							
Warm weather	4.4	0.88	4.0	1.02	**.000***	-3.89	110
Easy snorkeling conditions	4.1	0.94	4.1	0.93	.624	-0.49	102
Good underwater visibility	3.6	1.14	3.9	0.99	**.025***	2.25	693
Natural conditions (Q14)							
Attractive above water scenery	4.2	0.95	4.0	0.91	.068	-1.84	95
Undamaged snorkeling sites	3.3	1.07	3.6	1.02	**.006***	2.67	67
Variety of marine life	3.4	0.93	3.6	1.00	.075	1.80	103
Variety of coral species	3.4	1.03	3.6	1.01	.234	1.20	97
Abundance of marine life	3.4	0.93	3.5	0.98	.596	0.53	103
Abundance of large fish	2.6	0.91	2.8	1.01	.119	1.57	106
Unique underwater formations	3.0	0.93	3.2	0.95	**.043***	2.05	100
Social conditions (Q14)							
Number of snorkelers	2.1	1.04	2.8	1.03	**.000***	5.61	97
Number of boats	2.2	2.18	2.8	0.97	**.000***	5.62	96
Overall satisfaction (Q15)	3.6	1.19	3.8	1.00	**.125**	1.55	95
Service conditions (Q19)							
Information provided by boat crew	2.6	1.31	3.1	1.18	**.001***	3.40	691
Commitment to the environment	2.9	1.21	3.3	1.12	**.013***	2.53	99
Safety procedures on boat	3.1	1.07	3.2	1.08	.336	0.97	103
Length of snorkeling trips	4.1	0.79	3.9	0.91	**.012***	-2.57	110
Quality of marine transportation services	3.6	0.91	3.5	0.93	.613	-0.51	105
Variety of snorkeling trips available	3.4	0.99	3.4	0.93	.488	-0.70	100
Cost of snorkeling trip	3.9	0.99	3.6	1.01	**.044***	-2.04	105
Opportunity to learn about reefs (Q23)[c]	2.5	1.13	2.9	1.10	**.001***	3.37	102
Overall satisfaction (Q20)	3.7	0.91	3.0	1.23	**.000***	-6.51	116

*Significant at $p < 0.05$

TABLE 6 The Influence of Specialization on Visitors' Knowledge of Coral Reefs
(SCUBA dive certification used as indicate of specialization; Missing cases excluded)

Question	CORRECT RESPONSE (%) HIGH	LOW	Sig*	χ^2	*df*
Reef knowledge					
Coral reef colonies can be hundreds of years old	97.6	73.0	**.000***	23.9	2
Sand stirred up from the sea floor can kill corals	46.9	35.4	**.001***	14.0	2
Corals are animals	78.0	75.2	.854	0.31	2
Coral bleaching is a result of rising sea temperatures	50.0	31.1	**.000***	20.7	2
Corals need sunlight to grow	87.8	62.3	**.000***	23.0	2
Coral reefs are threatened ecosystems	93.9	87.1	.181	3.42	2
Human impacts					
Park personnel should feed marine animals because the animals are probably hungry	90.1	79.7	**.042***	6.32	2
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	98.8	87.4	**.009***	9.45	2
Tourism facilities on land can negatively impact reefs	90.2	83.9	.292	2.46	2
Snorkelers should stand on the reef when tired	98.8	94.2	.182	3.41	2
Boats can anchor on top of coral reefs without harming coral reef communities	91.5	92.0	.272	2.61	2
Snorkelers do not harm corals when they touch them with their hands or feet	88.8	78.3	**.023***	7.58	2
			Sig*	**t**	***df***
Mean Learning Score[1]	10.1	8.8	**.000***	5.25	675

[1] Score ranges from 0 (none correct) to 12 (all correct)

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 7 Behaviours Observed by Respondents: A Comparison of High and Low Specialized Groups (SCUBA dive certification used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)				
Behaviour observed? "Yes"	**HIGH**	**LOW**	**Sig***	χ^2	*df*
Snorkelers resting their feet on the reef	76.8	52.4	**.000***	17.45	1
Snorkelers touching the reef with their hands	53.7	40.5	**.023***	5.16	1
Snorkelers kicking the reef with their feet	31.7	17.3	**.002***	9.85	1
Snorkelers breaking off a piece of coral	12.2	8.1	.209	1.58	1
Snorkelers diving deeper for a closer look	76.8	57.6	**.001***	11.16	1
Snorkelers touching marine animals	34.1	39.4	.357	0.89	1
Garbage on the sea floor	43.9	40.5	.554	0.35	1
Tourists collecting sea shells	45.1	29.7	**.005***	8.01	1
Boats anchoring on top of the reef	32.9	20.6	**.012***	6.35	1
Boats using mooring buoys	45.1	28.7	**.002***	9.18	1
Tourists disposing of garbage in the water	24.4	20.5	.414	0.67	1
Boat operators disposing of garbage in the water	24.4	11.3	**.001***	11.10	1
Tourists feeding fish	89.0	82.7	.150	2.07	1
Boat operators feeding fish	49.4	41.0	.152	2.05	1

* Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 8 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang: A Comparison of High and Low Specialized Groups (SCUBA dive certification used as indicate of specialization; Missing cases excluded)[a]

	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Level of impact	2.8	1.10	2.4	1.15	**.001***	-3.35	692

[a] Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"

*Significant at $p < 0.05$

TABLE 9 The Number of Snorkelers That Respondents Expected to See (Q24), **Recalled Seeing** (Q25), **and Encounters Experienced** (Q27), **by Level of Specialization** (SCUBA dive certification used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)				
	HIGH	LOW	Sig*	χ^2	*df*
"I expected to see..." (Q24)					
Less snorkelers than I actually saw	52.4	38.9			
About as many snorkelers as I actually saw	23.2	19.3	**.006***	12.44	3
More snorkelers than I actually saw	18.3	20.7			
Didn't know what to expect	6.1	21.1			
"I remember seeing..." (Q25)					
Less than 40 snorkelers	40.7	46.9			
More than 40 snorkelers	59.3	47.7	**.032***	6.86	2
Not sure/ can't recall	0.0	5.3			
Encounters experienced (Q27)					
The number of people snorkeling was...					
Too few	1.2	4.1			
About right	22.2	45.6	**.000***	19.88	2
Too many	76.5	50.3			
The number of tourists on the boat was...					
Too few	1.2	2.3			
About right	64.6	64.7	.817	0.40	2
Too many	34.1	33.1			
The number of boats at the snorkeling site was...					
Too few	2.5	2.9			
About right	28.4	49.1	**.002***	12.99	2
Too many	69.1	48.0			
The number of mooring buoys in the water was...					
Too few	24.0	21.8			
About right	52.0	63.9	.059	5.67	2
Too many	24.0	14.3			
The number of staff on the boat was...					
Too few	4.9	8.0			
About right	91.5	89.0	.598	1.03	2
Too many	3.7	3.1			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 10 Crowding Perceptions (Q26) **by Level of Specialization** (SCUBA dive certification used as indicate of specialization; Missing cases excluded)[a]

	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Perceived crowding level	6.5	2.05	5.5	2.08	**.000***	-4.14	105

* Significant at $p < 0.05$

Table 11 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28) **by Level of Specialization** (SCUBA dive certification used as indicate of specialization; Missing cases excluded)[a]

Number of other snorkelers	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Photo A (0 snorkelers)	1.2	1.42	0.4	1.64	**.000***	-4.11	690
Photo B (7 snorkelers)	1.6	0.84	1.1	1.16	**.000***	-4.05	691
Photo C (15 snorkelers)	0.6	1.01	0.7	1.04	.290	1.06	106
Photo D (23 snorkelers)	-0.6	1.12	0.0	1.18	**.000***	4.30	107
Photo E (33 snorkelers)	-1.5	0.74	-1.1	1.04	**.000***	4.37	690
Photo F (49 snorkelers)	-1.8	0.65	-1.6	0.93	**.000***	3.02	696

* Significant at $p < 0.05$

SPECIALIZATION VARIABLE 2: Equipment Ownership (Q10)

TABLE 12 Assigned Specialization Levels for Specialization Variable

Own your own equipment?	Specialization level	Sample size (*n*)	Percentage (%)
NO	Low	481	69.0
YES	High	216	31.0
	Total	697	100.0

TABLE 13 Participation Characteristics of Visitors Segmented into High and Low Specialized Groups (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)				
	HIGH	**LOW**	**Sig***	**χ^2**	***df***
"Snorkeling in Koh Chang…"					
Is the main reason for my visit	7.7	12.7			
Is a planned activity	66.2	60.8	.126	4.15	2
Is an unplanned activity	26.1	26.6			
"How many previous snorkeling trips have you taken in Thailand?"					
Zero	33.8	44.8			
1-5 trip	19.0	22.5	**.001***	13.65	**2**
More than 5 trips	47.2	32.7			
"Have you snorkeled anywhere outside of Thailand?"					
Yes	74.0	33.3	**.000***	99.92	1
No	26.0	66.7			
"How many times have you snorkelled in the last year?"					
Zero	33.8	60.9			
1-5	47.7	35.6	**.000***	68.79	2
More than 5	18.5	3.5			
"How would you describe your level of snorkeling experience?"					
Novice	21.9	70.2			
Intermediate	50.4	24.5	**.000***	158.58	3
Advanced	22.3	4.5			
Expert	5.4	0.8			
"Are you a certified scuba diver?"					
Yes	23.6	6.0	**.000***	46.40	**1**
No	76.4	94.0			
"Do you own an underwater camera?"					
Yes	16.3	6.8	**.000***	15.49	**1**
No	83.7	93.2			

* Significant at $p < 0.05$ (2-tailed test)

TABLE 14 The Importance of Snorkeling as a Tourist Attraction: A Comparison of High and Low Specialized Groups (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Importance of reefs as a tourist attraction	4.1	0.95	3.8	1.12	**.001***	-3.35	507

* Significant at $p < 0.05$

TABLE 15 The Importance of Various Physical, Natural, Social, and Service Conditions: A Comparison of High and Low Specialized Groups (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Physical conditions (Q12)							
Warm weather	4.1	1.09	3.9	1.13	.117	-1.57	441
Easy snorkeling conditions	3.6	1.24	4.2	1.01	**.000***	6.28	694
Good underwater visibility	4.8	0.51	4.8	0.54	.570	0.57	457
Natural conditions (Q12)							
Attractive above water scenery	3.7	1.31	4.2	1.03	**.000***	4.97	692
Undamaged snorkeling sites	4.7	0.63	4.7	0.68	.789	-0.27	454
Variety of marine life	4.6	0.66	4.6	0.72	.550	-0.60	470
Variety of coral species	4.5	0.78	4.5	0.82	.700	0.39	451
Abundance of marine life	4.5	0.80	4.4	0.87	.305	-1.03	460
Abundance of large fish	3.5	1.30	3.6	1.24	.234	1.19	691
Unique underwater formations	3.8	1.20	3.9	1.14	.156	1.42	686
Social conditions (Q12)							
Number of snorkelers	3.3	1.45	3.4	1.42	.613	0.50	412
Number of boats	3.5	1.39	3.5	1.35	.990	0.13	416
Service conditions (Q18)							
Information provided by boat crew	3.8	1.23	4.2	1.04	**.000***	3.85	704
Commitment to the environment	4.4	0.92	4.6	0.79	.107	1.71	704
Safety procedures on boat	4.2	1.09	4.5	0.90	**.000***	3.77	702
Length of snorkeling trips	3.9	1.02	4.1	0.88	**.003***	2.98	382
Quality of marine transportation services	3.9	1.14	4.3	0.92	**.000***	4.87	702
Variety of snorkeling trips available	3.9	1.08	4.0	1.02	.068	1.83	400
Cost of snorkeling trip	3.8	1.17	4.1	1.08	**.001***	3.48	703
Opportunity to learn about reefs (Q22)	4.0	1.08	3.8	1.14	**.020***	-2.32	710

*Significant at $p < 0.05$

TABLE 16 Visitors' Satisfaction With the Physical, Natural, Social and Service Conditions: A Comparison High and Low Specialized Groups (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Physical conditions (Q14)							
Warm weather	4.4	1.00	4.0	1.01	**.000***	-4.52	432
Easy snorkeling conditions	4.1	0.04	4.1	0.89	.333	-0.97	701
Good underwater visibility	3.7	1.11	3.9	0.95	**.003***	2.98	697
Natural conditions (Q14)							
Attractive above water scenery	4.0	0.95	4.0	0.88	.461	-0.74	693
Undamaged snorkeling sites	3.4	1.13	3.7	0.97	**.000***	3.54	700
Variety of marine life	3.4	1.04	3.6	0.96	**.003***	3.01	390
Variety of coral species	3.5	1.07	3.6	0.97	.098	1.66	389
Abundance of marine life	3.4	0.99	3.5	0.95	.062	1.87	408
Abundance of large fish	2.7	1.00	2.8	0.99	.118	1.57	417
Unique underwater formations	3.1	0.95	3.2	0.94	**.036***	2.10	416
Social conditions (Q14)							
Number of snorkelers	2.5	1.05	2.8	1.04	**.000***	3.92	416
Number of boats	2.5	0.97	2.8	0.98	**.000***	4.19	425
Overall satisfaction (Q15)	3.7	1.16	3.9	0.95	**.033***	2.14	362
Service conditions (Q19)							
Information provided by boat crew	2.9	1.24	3.0	1.19	.204	1.27	417
Commitment to the environment	3.1	1.13	3.3	1.13	.173	1.36	429
Safety procedures on boat	3.1	1.03	3.2	1.09	.398	0.84	695
Length of snorkeling trips	4.1	0.84	3.8	0.92	**.000***	-3.53	466
Quality of marine transportation services	3.6	0.90	3.5	0.93	.441	-0.77	444
Variety of snorkeling trips available	3.4	0.95	3.4	0.93	.431	-0.79	412
Cost of snorkeling trip	3.8	1.01	3.6	1.01	**.001***	-3.33	428
Opportunity to learn about reefs (Q23)[c]	2.6	1.09	3.0	1.10	**.000***	4.46	434
Overall satisfaction (Q20)	3.5	1.16	2.8	1.18	**.000***	-6.55	**686**

*Significant at $p < 0.05$

TABLE 17 The Influence of Specialization on Visitors' Knowledge of Coral Reefs
(Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

Question	CORRECT RESPONSE (%) HIGH	LOW	Sig*	χ^2	*df*
Reef knowledge					
Coral reef colonies can be hundreds of years old	88.3	70.3	**.000***	29.5	2
Sand stirred up from the sea floor can kill corals	48.2	31.5	**.000***	19.6	2
Corals are animals	79.7	74.1	.088	4.86	2
Coral bleaching is a result of rising sea temperatures	42.8	29.0	**.000***	17.7	2
Corals need sunlight to grow	74.4	61.0	**.002***	12.3	2
Coral reefs are threatened ecosystems	92.4	86.0	**.020***	7.80	2
Human impacts					
Park personnel should feed marine animals because the animals are probably hungry	90.0	77.2	**.000***	19.0	2
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	93.3	86.7	**.030***	6.98	2
Tourism facilities on land can negatively impact reefs	86.5	84.2	.141	3.91	2
Snorkelers should stand on the reef when tired	96.0	94.3	.618	.963	2
Boats can anchor on top of coral reefs without harming coral reef communities	92.8	91.8	.786	.480	2
Snorkelers do not harm corals when they touch them with their hands or feet	84.2	77.9	.114	4.33	2
			Sig*	t	*df*
Mean Learning Score[1]	9.7	8.7	**.000***	-6.06	679

[1]Score ranges from 0 (none correct) to 12 (all correct)

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 18 Behaviours Observed by Respondents: A Comparison of High and Low Specialized Groups (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)				
Behaviour observed? "Yes"	**HIGH**	**LOW**	**Sig***	**χ^2**	***df***
Snorkelers resting their feet on the reef	70.7	48.0	**.000***	31.6	1
Snorkelers touching the reef with their hands	50.5	37.7	**.001***	10.2	1
Snorkelers kicking the reef with their feet	23.9	17.0	**.031***	4.67	1
Snorkelers breaking off a piece of coral	10.4	7.9	.274	1.20	1
Snorkelers diving deeper for a closer look	68.0	55.9	**.002***	9.28	1
Snorkelers touching marine animals	34.4	40.8	.106	2.61	1
Garbage on the sea floor	44.6	39.5	.206	1.60	1
Tourists collecting sea shells	38.7	28.4	**.006***	7.57	1
Boats anchoring on top of the reef	25.7	20.1	.095	2.79	1
Boats using mooring buoys	37.4	27.5	**.008***	6.94	1
Tourists disposing of garbage in the water	20.3	21.1	.797	0.67	1
Boat operators disposing of garbage in the water	15.8	11.4	.106	2.62	1
Tourists feeding fish	78.4	85.5	**.019***	5.55	1
Boat operators feeding fish	48.4	38.6	**.014***	6.02	1

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 19 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang: A Comparison of High and Low Specialized Groups (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Level of impact	2.6	1.11	2.3	1.17	**.005***	-2.84	698

[a] Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"

*Significant at $p < 0.05$

TABLE 20 The Number of Snorkelers That Respondents Expected to See (Q24), **Recalled Seeing** (Q25), **and Encounters Experienced** (Q27), **by Level of Specialization**
(Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)				
	HIGH	LOW	Sig*	χ^2	*df*
"I expected to see..." (Q24)					
Less snorkelers than I actually saw	52.7	35.1			
About as many snorkelers as I actually saw	23.2	18.6	**.000***	32.08	3
More snorkelers than I actually saw	12.7	23.8			
Didn't know what to expect	11.4	22.5			
"I remember seeing..." (Q25)[a]					
Less than 40 snorkelers	48.6	44.8			
More than 40 snorkelers	49.1	49.4	.108	4.46	2
Not sure / can't recall	2.3	5.8			
Encounters experienced (Q27)					
The number of people snorkeling was...					
Too few	0.9	5.2			
About right	34.6	46.0	**.000***	18.44	2
Too many	64.5	48.9			
The number of tourists on the boat was...					
Too few	2.8	1.9			
About right	62.7	65.9	.588[a]	1.06	2
Too many	34.6	32.2			
The number of boats at the snorkeling site was...					
Too few	1.9	3.1			
About right	37.5	50.3	**.003***	11.94	2
Too many	60.6	46.6			
The number of mooring buoys in the water was...					
Too few	18.9	22.8			
About right	56.1	65.6	**.000***	18.71	2
Too many	25.0	11.6			
The number of staff on the boat was...					
Too few	4.1	9.3			
About right	91.8	88.0	**.037***	6.57	2
Too many	4.1	2.7			

[a] One cell has an expected count of <5

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 21 Crowding Perceptions (Q26) **by Level of Specialization** (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Perceived crowding level	6.0	2.09	5.5	2.10	**.003***	-3.00	429

* Significant at $p < 0.05$

TABLE 22 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28) **by Level of Specialization** (Snorkeling equipment ownership used as indicate of specialization; Missing cases excluded)

Number of other snorkelers	HIGH		LOW				
	Mean	**SD**	**Mean**	**SD**	**Sig***	**t**	***df***
Photo A (0 snorkelers)	1.1	1.43	0.3	1.67	**.000***	-5.63	696
Photo B (7 snorkelers)	1.5	0.95	1.0	1.19	**.000***	-5.19	696
Photo C (15 snorkelers)	0.6	1.11	0.7	1.00	.105	1.62	694
Photo D (23 snorkelers)	-0.3	1.20	0.0	1.16	**.000***	3.54	405
Photo E (33 snorkelers)	-1.5	0.89	-1.1	1.06	**.000***	4.80	696
Photo F (49 snorkelers)	-1.8	0.69	-1.1	1.00	**.001***	3.26	702

*Significant at $p < 0.05$ (2-tailed t-test)

SPECIALIZATION VARIABLE 3: Number of Times Respondents Snorkeled in a Coral Reef Environment in the Last Year (Q8)

TABLE 23 Assigned Specialization Levels for Specialization Variable

How many times have you snorkeled in the past year?	Specialization level	Sample size (*n*)	Percentage (%)
Zero times	Low	371	51.8
1-5 times	Medium	279	39.0
More than 5 times	High	58	8.1
	Total	697	100.0

TABLE 24 Participation Characteristics of High, Medium, and Low Specialized Groups (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
"Snorkeling in Koh Chang..."						
Is the main reason for my visit	12.7	8.0	13.2	.115	7.42	4
Is a planned activity	67.3	67.2	58.7			
Is an unplanned activity						
"How many previous snorkeling trips have you taken in Thailand?"						
Zero	23.2	25.6	56.1			
1-5 trip	12.5	18.7	24.6	**.000***	111.35	**4**
More than 5 trips	64.3	55.7	19.3			
"Have you snorkeled outside of Thailand?"						
Yes	82.5	53.1	36.2	**.000***	49.58	2
No	17.5	46.9	63.8			
"How would you describe your level of snorkeling experience?						
Novice	6.9	40.1	73.4			
Intermediate	46.6	45.2	21.5	**.000***	164.80	6
Advanced	39.7	10.8	4.9			
Expert	6.9	3.9	0.3			
"Are you a certified scuba diver?"						
Yes						
No						
"Do you own your own snorkeling gear?"						
Yes	70.7	38.0	20.2	**.000***	68.79	**2**
No	29.3	62.0	79.8			
"Do you own an underwater camera?"						
Yes						
No						

* Significant at $p < 0.05$ (2-tailed test)

TABLE 25 The Importance of Snorkeling as a Tourist Attraction: A Comparison of High, Medium, and Low Specialized Snorkelers (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW				
	Mean	SD	Mean	SD	Mean	SD	Sig*	F	*df*
Importance of reefs as a tourist attraction	3.2	0.60	3.1	0.81	3.0	0.79	.086	2.46	2
							Bonferroni comparisons*		
							H-M	M-L	L-H
						p value	.491	.685	.109

* Significant at $p < 0.05$

TABLE 26 Comparison of Visitors' Evaluations of the Importance of Day-Trip Conditions by Level of Specialization[a,b] (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW					Bonferroni comparisons*		
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***	**H-M**	**M-L**	**H-L**
Physical conditions (Q12)												
Warm weather	3.8	1.31	4.0	1.15	4.0	1.06	.502	.689	2	.789	1.00	.772
Easy snorkeling conditions	3.6	1.16	3.9	1.20	4.1	1.02	**.002***	6.07	2	.227	.065	**.006***
Good underwater visibility	4.7	0.56	4.8	0.54	4.8	0.53	.469	0.76	2	.928	1.00	.657
Natural conditions (Q12)												
Attractive above water scenery	3.6	1.46	4.1	1.09	4.1	1.11	**.014***	4.29	2	**.021***	1.00	**.012***
Undamaged snorkeling sites	4.7	0.60	4.7	0.65	4.7	0.69	.754	0.28	2	1.00	1.00	1.00
Variety of marine life	4.6	0.70	4.6	0.69	4.6	0.71	.797	0.23	2	1.00	1.00	1.00
Variety of coral species	4.5	0.89	4.5	0.80	4.5	0.81	.930	0.72	2	1.00	1.00	1.00
Abundance of marine life	4.5	0.81	4.4	0.88	4.5	0.83	.630	0.46	2	1.00	1.00	1.00
Abundance of large fish	3.4	1.38	3.6	1.24	3.5	1.26	.405	0.90	2	.638	1.00	1.00
Unique underwater formations	3.7	1.28	3.9	1.17	3.9	1.12	.433	0.84	2	.836	1.00	.587
Social conditions (Q12)												
Number of snorkelers	3.4	1.37	3.5	1.43	3.3	1.42	.281	1.27	2	1.00	.360	1.00
Number of boats	3.6	1.31	3.5	1.41	3.5	1.33	.740	0.30	2	1.00	1.00	1.00
Service conditions (Q18)												
Information provided by boat crew	3.6	1.31	4.0	1.10	4.1	1.09	**.003***	5.89	2	**.011***	1.00	**.002***
Commitment to the environment	4.1	1.07	4.6	0.82	4.6	0.79	**.000***	8.26	2	**.000***	1.00	**.000***
Safety procedures on boat	4.1	1.10	4.4	0.93	4.4	0.98	.101	2.30	2	.151	1.00	.103
Length of snorkeling trips	3.9	1.12	4.0	0.91	4.1	0.91	.221	1.51	2	.634	1.00	.266
Quality of marine transportation services	3.6	1.20	4.2	0.96	4.2	1.00	**.000***	8.41	2	**.000***	1.00	**.000***
Variety of snorkeling trips available	3.8	1.00	4.0	1.01	4.0	1.06	.492	0.71	2	1.00	1.00	.784
Cost of snorkeling trip	3.3	1.31	4.1	1.09	4.0	1.07	**.000***	12.03	2	**.000***	1.00	**.000***
Opportunity to learn about reefs (Q22)	4.1	1.21	3.9	1.02	3.8	1.17	.068	2.70	2	1.00	.183	.227

[b]Recoded response categories ranged from 1= "not at all important", 2= "slightly important", 3= "not sure", 4= "quite important", 5= "extremely important";
*Significant at $p < 0.05$

TABLE 27 Comparison of Visitors' Satisfaction With Day-Trip Conditions by Level of Specialization[a,b] (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW					Bonferroni Comparisons*		
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***	**H-M**	**M-L**	**H-L**
Physical conditions (Q14)												
Warm weather	4.2	1.02	4.0	1.07	4.2	0.98	.052	2.97	**2**	.414	.066	1.00
Easy snorkeling conditions	3.8	1.00	4.0	0.98	4.2	0.88	**.002***	6.07	2	.434	**.032***	**.011***
Good underwater visibility	3.3	1.12	3.8	1.03	3.9	0.95	**.000***	9.40	**2**	**.005***	.212	**.000***
Natural conditions (Q14)												
Attractive above water scenery	3.6	1.07	4.0	0.83	4.0	0.91	**.001***	6.94	2	**.001***	1.00	**.001***
Undamaged snorkeling sites	3.1	1.09	3.5	1.01	3.7	1.01	**.000****	8.80	**2**	**.039***	**.043***	**.000***
Variety of marine life	3.2	0.97	3.5	0.95	3.7	1.01	**.001***	7.13	**2**	.116	.054	**.002***
Variety of coral species	3.4	0.98	3.5	0.99	3.6	1.02	.148	1.91	2	1.00	.353	.395
Abundance of marine life	3.2	0.96	3.5	0.92	3.5	0.99	.063	2.77	**2**	.249	.990	.063
Abundance of large fish	2.5	0.83	2.8	1.00	2.8	1.00	.088	2.43	2	.086	1.00	.139
Unique underwater formations	2.8	0.86	3.1	0.89	3.3	0.98	**.008***	4.92	**2**	.106	.339	**.008***
Social conditions (Q14)												
Number of snorkelers	2.2	0.81	2.7	1.12	2.8	1.02	**.000***	8.19	**2**	**.004***	.517	**.000***
Number of boats	2.3	0.87	2.7	1.02	2.8	0.97	**.002***	6.31	**2**	**.049***	.244	**.002***
Overall satisfaction (Q15)	3.3	1.19	3.8	0.99	3.9	0.99	**.001***	7.46	**2**	**.003***	1.00	**.000***
Service conditions (Q19)												
Information provided by boat crew	2.7	1.08	2.9	1.23	3.1	1.19	**.009***	4.73	2	.635	.069	**.032***
Commitment to the environment	3.1	1.26	3.2	1.17	3.3	1.08	.377	0.98	**2**	1.00	.622	1.00
Safety procedures on boat	3.0	1.04	3.1	1.07	3.2	1.07	.157	1.86	2	.982	.614	.260
Length of snorkeling trips	3.9	0.83	3.9	0.87	3.9	0.93	.988	0.12	2	1.00	1.00	1.00
Quality of marine transportation services	3.7	0.88	3.5	0.95	3.6	0.90	.439	0.70	2	.693	1.00	1.00
Variety of snorkeling trips available	3.4	1.02	3.4	0.96	3.4	0.90	.827	0.19	2	1.00	1.00	1.00
Cost of snorkeling trip	3.9	0.93	3.6	1.04	3.6	1.00	.109	2.22	2	.108	1.00	.185
Opportunity to learn about reefs (Q23)[c]	2.7	1.07	2.8	1.15	2.9	1.10	.316	1.44	**2**	1.00	1.00	.471
Overall satisfaction (Q20)	3.4	1.06	3.1	1.21	3.0	1.23	.077	2.57	**2**	.175	1.00	.071

[a] Recoded response categories ranged from 1= "very unsatisfied", 2= "somewhat unsatisfied", 3= "neutral", 4= "somewhat satisfied", 5= "very satisfied"; [b] Response categories ranged from 1= "very poor", 2= "poor", 3= "neutral", 4= "good", 5= "very good"; * Significant at $p < 0.05$

TABLE 28 The Influence of Specialization on Visitors' Knowledge of Coral Reefs: A Comparison of High, Medium, and Low Specialized Groups (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	CORRECT RESPONSE (%)					
Question	**HIGH**	**MEDIUM**	**LOW**	**Sig***	**χ^2**	***df***
Reef knowledge						
Coral reef colonies can be hundreds of years old	91.2	79.2	71.2	**.001***	18.03	4
Sand stirred up from the sea floor can kill corals	49.1	38.4	34.1	.256	5.32	4
Corals are animals	78.9	80.6	71.5	**.035***	10.32	4
Coral bleaching is a result of rising sea temperatures	49.1	37.7	27.3	**.000***	35.17	4
Corals need sunlight to grow	71.9	68.7	61.9	**.011***	13.06	4
Coral reefs are threatened ecosystems	92.9	88.8	86.5	**.549**	3.05	4
Human impacts						
Park personnel should feed marine animals because the animals are probably hungry	87.5	83.5	78.2	.200	5.99	4
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	93.0	91.4	86.0	.198	6.01	4
Tourism facilities on land can negatively impact reefs	89.5	87.5	82.9	.276	5.11	4
Snorkelers should stand on the reef when tired	93.0	95.7	94.3	.428	3.84	4
Boats can anchor on top of coral reefs without harming coral reef communities	93.0	92.1	92.2	.314	4.75	4
Snorkelers do not harm corals when they touch them with their hands or feet	83.6	81.7	77.7	.050	9.48	4
				Sig*	**F**	***df***
Mean Learning Score[1]	9.7	9.3	8.6	**.000***	11.18	2
				Bonferroni comparisons*		
				H-M	**M-L**	**L-H**
			p value	.437	**.000***	**.001***

[1]Score ranges from 0 (none correct) to 12 (all correct)

*Significant at $p < 0.05$

TABLE 29 Behaviours Observed by Respondents: A Comparison of High, Medium, and Low Specialized Groups (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)					
Behaviour observed? "Yes"	**HIGH**	**MEDIUM**	**LOW**	**Sig***	**χ^2**	***df***
Snorkelers resting their feet on the reef	63.8	62.0	48.9	**.002***	12.69	2
Snorkelers touching the reef with their hands	51.7	42.4	39.1	.176	3.48	2
Snorkelers kicking the reef with their feet	24.1	20.7	16.9	.287	2.49	2
Snorkelers breaking off a piece of coral	5.2	8.3	9.3	.572	1.12	2
Snorkelers diving deeper for a closer look	75.9	60.1	57.1	**.025***	7.35	2
Snorkelers touching marine animals	32.8	39.5	39.3	.609	0.99	2
Garbage on the sea floor	37.9	44.6	39.3	.356	2.06	2
Tourists collecting sea shells	29.3	31.5	32.0	.921	0.16	2
Boats anchoring on top of the reef	31.0	24.3	18.6	.047	6.11	2
Boats using mooring buoys	39.7	31.5	28.1	.183	3.39	2
Tourists disposing of garbage in the water	27.6	22.1	18.9	.254	2.74	2
Boat operators disposing of garbage in the water	29.3	13.0	9.6	**.000***	17.86	2
Tourists feeding fish	72.4	87.7	81.7	**.009***	9.42	2
Boat operators feeding fish	51.7	42.4	39.9	.231	2.93	2

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 30 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang: A Comparison of High, Medium, and Low-Specialized Groups (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)[a]

	HIGH		MEDIUM		LOW				
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***
Level of impact	2.6	1.04	2.6	1.11	2.2	1.19	**.000***	8.07	2
							Bonferroni comparisons*		
							H-M	**M-L**	**L-H**
						p value	1.00	**.001***	.077

[a] Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"

*Significant at $p < 0.05$

TABLE 31 The Number of Snorkelers That Respondents Expected to See (Q24), **Recalled Seeing** (Q25), **and Encounters Experienced** (Q27), **by Level of Specialization** (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
"I expected to see..." (Q24)						
Less snorkelers than I actually saw	47.4	44.0	37.1			
About as many snorkelers as I actually saw	28.1	22.5	17.2	**.000***	30.95	6
More snorkelers than I actually saw	14.0	22.5	19.3			
Didn't know what to expect	10.5	10.9	26.4			
"I remember seeing..." (Q25)						
Less than 40 snorkelers	49.1	47.5	50.5			
More than 40 snorkelers	50.9	47.5	50.5	.463	3.60	4
Not sure / can't recall	0.0	5.1	4.9			
Q27 Encounters experienced (Q27) **The number of people snorkeling was...**						
Too few	5.4	2.6	4.6			
About right	35.7	42.1	43.4	.493	3.40	4
Too many	58.9	55.3	51.9			
The number of tourists on the boat was...						
Too few	3.6	1.5	2.5			
About right	64.3	60.9	68.0	.229	5.63	4
Too many	32.1	37.6	29.5			
The number of boats at the snorkeling site was...						
Too few	1.8	1.1	4.1			
About right	37.5	48.3	46.0	.108	7.58	4
Too many	60.7	50.6	49.9			
The number of mooring buoys in the water was...						
Too few	22.4	22.0	21.5			
About right	53.1	60.8	65.6	.204	5.94	4
Too many	24.5	17.2	12.9			
The number of staff on the boat was...						
Too few	5.3	8.0	7.9			
About right	87.7	87.6	90.5	.119	7.34	4
Too many	7.0	4.4	1.6			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 32 Crowding Perceptions (Q26) **by Level of Specialization** (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW				
	Mean	SD	Mean	SD	Mean	SD	Sig*	F	*df*
Perceived crowding level	6.1	2.06	5.6	2.21	5.6	2.03	.191	1.66	2
							Bonferroni comparisons*		
							H-M	M-L	L-H
						p value	.307	1.00	.212

* Significant at $p < 0.05$

Table 33 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28) **by Level of Specialization** (Number of times snorkeled in the past year used as indicate of specialization; Missing cases excluded)

Number of other snorkelers	HIGH		MEDIUM		LOW				
	Mean	SD	Mean	SD	Mean	SD	Sig*	F	*df*
Photo A (0 snorkelers)	1.1	1.31	0.7	1.62	0.4	1.66	**.001***	6.68	2
Photo B (7 snorkelers)	1.6	0.71	1.2	1.09	1.0	1.22	**.001***	7.42	2
Photo C (15 snorkelers)	0.5	0.98	0.8	1.01	0.6	1.06	.130	2.04	2
Photo D (23 snorkelers)	-0.7	0.95	-0.1	1.17	0.0	1.20	**.000***	8.06	2
Photo E (33 snorkelers)	-1.6	0.70	-1.2	1.03	-1.1	1.05	**.008***	4.84	2
Photo F (49 snorkelers)	-1.9	0.35	-1.7	0.84	-1.5	1.03	**.016***	4.17	2
							Bonferroni comparisons*		
							H-M	M-L	L-H
						Photo A	.183	.051	**.004***
						Photo B	.068	.077	**.001***
						Photo C	.235	.411	.987
						Photo D	**.001***	1.00	**.001***
						Photo E	**.029***	1.00	**.006***
						Photo F	.244	.296	**.002***

* Significant at $p < 0.05$ (2-tailed t-test)

SPECIALIZATION VARIABLE 4: Number of Previous Snorkeling Trips in Thailand (Q6)

TABLE 34 Assigned Specialization Levels for Specialization Variable

Number of previous snorkeling trips in Thailand	Specialization level	Sample size (*n*)	Percentage (%)
Zero times	Low	288	41.3
1-5 times	Medium	149	21.3
More than 5 times	High	261	37.4
	Total	698	100.0

TABLE 35 Participation Characteristics of High, Medium, and Low Specialized Groups (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
"Snorkeling in Koh Chang..."						
Is the main reason for my visit	12.2	11.7	9.6			
Is a planned activity	67.3	63.4	57.1	**.019***	11.73	4
Is an unplanned activity	20.5	24.8	33.3			
"Have you snorkeled anywhere outside of Thailand?"						
Yes	49.4	37.3	48.9	**.043***	6.29	**2**
No	50.6	62.7	51.1			
"How many times have you snorkeled in the last year?"						
Zero	27.1	60.5	71.0			
1-5	58.9	34.7	24.5	**.000***	111.35	4
More than 5	14.0	4.8	4.5			
"How would you describe your level of snorkeling experience?						
Novice	38.2	61.1	67.0			
Intermediate	42.5	30.9	25.3	**.000***	53.94	6
Advanced	14.7	7.4	6.7			
Expert	4.6	0.7	1.1			
"Are you a certified scuba diver?"						
Yes	14.8	8.9	9.0	.062	5.57	**2**
No	85.2	91.1	91.0			
"Do you own your own snorkeling gear?"						
Yes	39.4	27.5	25.3	**.001***	13.65	**2**
No	60.6	72.5	74.7			
"Do you own an underwater camera?"						
Yes	11.3	8.8	9.4	.651	0.86	**2**
No	88.7	91.2	90.6			

TABLE 36 The Importance of Snorkeling as a Tourist Attraction: A Comparison of High, Medium, and Low Specialized Snorkelers (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW				
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***
Importance of reefs as a tourist attraction	4.1	0.82	3.9	1.10	3.8	1.08	.080	2.54	**2**
							Bonferroni comparisons*		
							H-M	**M-L**	**L-H**
						p value	.353	.881	.087

* Significant at $p < 0.05$ (2-tailed test)

TABLE 37 Comparison of Visitors' Evaluations of the Importance of Day-Trip Conditions by Level of Specialization[a,b] (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW					Bonferroni comparisons*		
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***	**H-M**	**M-L**	**H-L**
Physical conditions (Q12)												
Warm weather	3.8	1.25	4.1	1.01	4.0	1.05	.502	0.69	2	.789	1.00	.772
Easy snorkeling conditions	3.9	1.20	4.1	1.09	4.1	1.06	**.002***	6.07	2	.227	.065	**.006***
Good underwater visibility	4.8	0.52	4.7	0.63	4.8	0.52	.469	0.76	2	.928	1.00	.657
Natural conditions (Q12)												
Attractive above water scenery	4.0	1.19	4.1	1.16	4.1	1.10	**.014***	4.29	2	**.021***	1.00	**.012***
Undamaged snorkeling sites	4.7	0.62	4.7	0.77	4.7	0.65	.754	0.28	2	1.00	1.00	1.00
Variety of marine life	4.7	0.63	4.6	0.76	4.6	0.73	.797	0.23	2	1.00	1.00	1.00
Variety of coral species	4.5	0.74	4.5	0.85	4.4	0.85	.930	0.07	2	1.00	1.00	1.00
Abundance of marine life	4.6	0.69	4.4	0.94	4.4	0.92	.630	0.46	2	1.00	1.00	1.00
Abundance of large fish	3.6	1.26	3.6	1.32	3.6	1.26	.405	0.90	2	.638	1.00	1.00
Unique underwater formations	4.0	1.11	3.8	1.29	3.8	1.12	.433	0.84	2	.836	1.00	.587
Social conditions (Q12)												
Number of snorkelers	3.3	1.40	3.3	1.47	3.4	1.42	.281	1.27	2	1.00	.360	1.00
Number of boats	3.5	1.38	3.4	1.43	3.6	1.29	.740	0.30	2	1.00	1.00	1.00
Service conditions (Q18)												
Information provided by boat crew	4.0	1.14	4.1	1.14	4.2	1.08	**.003***	5.89	2	**.011***	1.00	**.002***
Commitment to the environment	4.5	0.77	4.4	0.94	4.6	0.83	**.000***	8.26	2	**.000***	1.00	**.000***
Safety procedures on boat	4.2	0.99	4.4	0.98	4.4	0.96	.101	2.30	2	.151	1.00	.103
Length of snorkeling trips	4.0	0.97	4.1	0.94	4.1	0.89	.221	1.51	2	.634	1.00	.266
Quality of marine transportation services	4.1	1.02	4.3	0.98	4.1	1.01	**.000***	8.41	2	**.000***	1.00	**.000***
Variety of snorkeling trips available	4.0	1.00	4.1	0.99	3.9	1.09	.492	0.71	2	1.00	1.00	.784
Cost of snorkeling trip	3.9	1.16	4.1	1.10	3.9	1.08	**.000***	12.03	2	**.000***	1.00	**.000***
Opportunity to learn about reefs (Q22)	3.9	1.10	3.9	1.19	3.8	1.11	.068	2.70	2	1.00	.183	.227

[b]Recoded response categories ranged from 1= "not at all important", 2= "slightly important", 3= "not sure", 4= "quite important", 5= "extremely important";
*Significant at $p < 0.05$

TABLE 38 Comparison of Visitors' Satisfaction With Day-Trip Conditions by Level of Specialization[a,b] (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW					Bonferroni Comparisons*		
Condition items	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Sig***	**F**	***df***	**H-M**	**M-L**	**H-L**
Physical conditions (Q14)												
Warm weather	3.9	1.05	4.0	1.11	4.3	0.94	.052	2.97	2	.414	.066	1.00
Easy snorkeling conditions	3.9	0.99	4.0	1.02	4.3	0.81	**.002***	6.07	2	.434	**.032***	**.011***
Good underwater visibility	3.7	1.01	3.8	1.08	4.0	0.97	**.000***	9.40	2	**.005***	.212	**.000***
Natural conditions (Q14)												
Attractive above water scenery	3.8	0.91	3.9	0.98	4.2	0.85	**.001***	6.94	2	**.001**	1.00	**.001***
Undamaged snorkeling sites	3.4	1.02	3.6	1.09	3.7	0.98	**.000***	8.80	2	**.039***	**.043***	**.000***
Variety of marine life	3.3	0.97	3.5	1.03	3.7	0.98	**.001***	7.13	2	.116	.054	**.002***
Variety of coral species	3.4	1.01	3.6	1.01	3.7	1.00	.148	1.91	2	1.00	.353	.395
Abundance of marine life	3.4	0.97	3.5	0.95	3.6	0.97	.063	2.77	2	.249	.990	.063
Abundance of large fish	2.7	0.93	2.8	1.00	2.9	1.05	.088	2.43	2	.086	1.00	.139
Unique underwater formations	3.0	0.90	3.1	0.92	3.3	0.99	**.008***	4.92	2	.106	.339	**.008***
Social conditions (Q14)												
Number of snorkelers	2.6	1.07	2.8	1.04	2.8	1.06	**.000***	8.19	2	**.004***	.517	**.000***
Number of boats	2.7	1.01	2.7	0.99	2.8	0.99	**.002***	6.31	2	**.049***	.244	**.002***
Overall satisfaction (Q15)	3.6	1.05	3.9	0.94	3.9	1.02	**.001***	7.46	2	**.003***	1.00	**.000***
Service conditions (Q19)												
Information provided by boat crew	3.0	1.19	2.9	1.24	3.0	1.21	**.009***	4.73	2	.635	.069	**.032***
Commitment to the environment	3.1	1.13	3.2	1.18	3.3	1.10	.377	0.98	2	1.00	.622	1.00
Safety procedures on boat	3.1	1.09	3.2	1.05	3.2	1.06	.157	1.86	2	.982	.614	.260
Length of snorkeling trips	3.8	0.91	3.9	0.97	4.0	0.85	.988	0.01	2	1.00	1.00	1.00
Quality of marine transportation services	3.5	0.95	3.5	0.98	3.6	0.88	.439	0.82	2	.693	1.00	1.00
Variety of snorkeling trips available	3.4	0.96	3.3	0.97	3.4	0.91	.827	0.19	2	1.00	1.00	1.00
Cost of snorkeling trip	3.5	1.00	3.6	1.06	3.8	0.98	:109	2.22	2	.108	1.00	.185
Opportunity to learn about reefs (Q23)[c]	2.9	1.11	2.9	1.10	2.8	1.14	.316	1.15	2	1.00	1.00	.471
Overall satisfaction (Q20)	3.0	1.17	3.0	1.24	3.1	1.23	.077	2.57	2	.175	1.00	.071

[a] Recoded response categories ranged from 1= "very unsatisfied", 2= "somewhat unsatisfied", 3= "neutral", 4= "somewhat satisfied", 5= "very satisfied"; [b] Response categories ranged from 1= "very poor", 2= "poor", 3= "neutral", 4= "good", 5= "very good"; * Significant at $p < 0.05$

TABLE 39 The Influence of Specialization on Visitors' Knowledge of Coral Reefs: A Comparison of High, Medium, and Low Specialized Groups (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	CORRECT RESPONSE (%)					
Question	**HIGH**	**MEDIUM**	**LOW**	**Sig***	**χ^2**	***df***
Reef knowledge						
Coral reef colonies can be hundreds of years old	76.9	74.5	76.4	.178	6.29	4
Sand stirred up from the sea floor can kill corals	41.9	38.3	31.7	**.023***	11.35	4
Corals are animals	82.2	78.5	68.9	**.004***	15.46	4
Coral bleaching is a result of rising sea temperatures	40.2	31.0	27.7	**.005***	14.98	4
Corals need sunlight to grow	71.0	60.4	62.4	.060	9.03	4
Coral reefs are threatened ecosystems	91.1	86.6	86.0	**.047***	9.64	4
Human impacts						
Park personnel should feed marine animals because the animals are probably hungry	80.6	80.4	82.2	.508	3.30	4
Coral reefs are not harmed when tourists break off small pieces of coral to keep as a souvenir	88.8	90.6	87.2	.542	3.09	4
Tourism facilities on land can negatively impact reefs	88.8	85.1	81.2	.164	6.52	4
Snorkelers should stand on the reef when tired	94.6	92.6	95.8	.343	4.50	4
Boats can anchor on top of coral reefs without harming coral reef communities	93.4	91.3	91.3	.460	3.62	4
Snorkelers do not harm corals when they touch them with their hands or feet	86.8	72.8	76.7	**.002***	17.05	4
				Sig*	**F**	***df***
Mean Learning Score[1]	9.4	8.8	8.7	**.001***	7.33	2
				Bonferroni comparisons*		
				H-M	**M-L**	**L-H**
			p value	**.033***	1.00	**.001***

[1]Score ranges from 0 (none correct) to 12 (all correct)

*Significant at $p < 0.05$

TABLE 40 Behaviours Observed by Respondents: A Comparison of High, Medium, and Low Specialized Groups (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)					
Behaviour observed? "Yes"	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
Snorkelers resting their feet on the reef	61.6	54.4	49.8	**.022***	7.68	2
Snorkelers touching the reef with their hands44.6	44.6	38.1	41.4	.436	1.66	2
Snorkelers kicking the reef with their feet	24.8	15.6	15.8	**.014***	8.58	2
Snorkelers breaking off a piece of coral	8.1	8.2	9.5	.831	0.37	2
Snorkelers diving deeper for a closer look	60.1	59.2	60.0	**.982**	0.03	2
Snorkelers touching marine animals	39.9	44.9	35.4	.153	3.75	2
Garbage on the sea floor	46.5	36.7	38.9	.090	4.80	2
Tourists collecting sea shells	36.4	25.2	30.5	.056	5.75	2
Boats anchoring on top of the reef	25.6	21.1	18.9	.169	3.55	2
Boats using mooring buoys	29.8	25.9	33.0	.305	2.37	2
Tourists disposing of garbage in the water	22.5	23.8	17.9	.259	2.70	2
Boat operators disposing of garbage in the water	18.6	10.2	9.5	**.004***	11.28	2
Tourists feeding fish	87.2	78.9	82.5	.080	5.04	2
Boat operators feeding fish	41.9	44.9	39.3	.527	1.28	2

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 41 Respondents' View of the Impact of Snorkeling on Coral Reefs in Koh Chang: A Comparison of High, Medium, and Low-Specialized Groups (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)[a]

	HIGH		MEDIUM		LOW				
	Mean	SD	Mean	SD	Mean	SD	Sig*	F	*df*
Level of impact	2.6	1.00	2.4	1.19	2.3	1.25	**.011***	4.53	2
							Bonferroni comparisons*		
							H-M	**M-L**	**L-H**
						p value	.281	1.00	**.009***

[a] Recoded response categories ranged from 0= "not sure", 1= "no impact", 2= "small impact", 3= "large impact", 4= "very large impact"

*Significant at $p < 0.05$

TABLE 42 The Number of Snorkelers That Respondents Expected to See (Q24), **Recalled Seeing** (Q25), **and Encounters Experienced** (Q27), **by Level of Specialization** (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	RESPONSE (%)					
	HIGH	MEDIUM	LOW	Sig*	χ^2	*df*
"I expected to see..." (Q24)						
Less snorkelers than I actually saw	42.6	39.2	39.5			
About as many snorkelers as I actually saw	23.4	18.2	18.2	**.010***	16.85	6
More snorkelers than I actually saw	21.5	24.3	17.1			
Didn't know what to expect	12.5	18.2	25.2			
"I remember seeing..." (Q25)						
Less than 40 snorkelers	49.6	43.2	44.8			
More than 40 snorkelers	46.5	49.3	51.4	.299	4.89	4
Not sure / can't recall	3.9	7.4	3.8			
Q27 Encounters experienced (Q27) **The number of people snorkeling was...**						
Too few	4.7	3.4	3.5			
About right	40.6	45.9	41.5	.791	1.70	4
Too many	54.7	50.7	55.1			
The number of tourists on the boat was...						
Too few	2.3	2.1	2.1			
About right	61.3	65.5	66.1	.832	1.47	4
Too many	36.3	32.4	31.8			
The number of boats at the snorkeling site was...						
Too few	2.8	4.1	2.1			
About right	47.2	46.6	44.6	.727	2.05	4
Too many	50.0	49.3	53.3			
The number of mooring buoys in the water was...						
Too few	23.0	29.0	16.0			
About right	60.3	53.6	70.3	.010*	13.18	4
Too many	16.7	17.4	13.7			
The number of staff on the boat was...						
Too few	7.8	9.5	6.6			
About right	87.5	89.1	90.6	.322	4.67	4
Too many	4.7	1.4	2.8			

*Significant at $p < 0.05$ (chi-square, 2-tailed)

TABLE 43 Crowding Perceptions (Q26) **by Level of Specialization** (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

	HIGH		MEDIUM		LOW				
	Mean	SD	Mean	SD	Mean	SD	Sig*	F	*df*
Perceived crowding level	5.8	2.04	5.5	2.22	5.6	2.09	.252	1.38	2
							Bonferroni comparisons*		
							H-M	M-L	L-H
						p value	.318	1.00	.881

* Significant at $p < 0.05$

Table 44 Levels of Acceptability Regarding Numbers of Other Snorkelers (Q28) **by Level of Specialization** (Number of previous snorkeling trips in Thailand used as indicate of specialization; Missing cases excluded)

Number of other snorkelers	HIGH		MEDIUM		LOW				
	Mean	SD	Mean	SD	Mean	SD	Sig*	F	*df*
Photo A (0 snorkelers)	0.5	1.64	0.5	1.66	0.7	1.60	.460	0.78	2
Photo B (7 snorkelers)	1.1	1.16	1.0	1.26	1.3	1.06	**.044***	3.14	2
Photo C (15 snorkelers)	0.6	1.02	0.7	1.03	0.7	1.06	.849	0.16	2
Photo D (23 snorkelers)	-0.1	1.17	0.0	1.18	-0.1	1.20	.477	0.74	2
Photo E (33 snorkelers)	-1.2	0.99	-1.1	1.17	-1.2	0.97	.404	0.91	2
Photo F (49 snorkelers)	-1.7	0.72	-1.5	1.17	-1.6	0.88	**.037***	3.32	2
							Bonferroni comparisons*		
							H-M	M-L	L-H
						Photo A	1.00	.924	.862
						Photo B	1.00	.065	.206
						Photo C	1.00	1.00	1.00
						Photo D	.794	.817	1.00
						Photo E	.611	.729	1.00
						Photo F	**.032***	.422	.525

* Significant at $p < 0.05$ (2-tailed t-test)