

Marine Tourism Predicament in Andaman Sea from Declining Biotic and Water Quality

Pasinee Worachananant^{1*}, Suchai Worachananant² and Rodney William (Bill) Carter³

ABSTRACT

Thailand's marine tourism relies heavily on pristine environments; hence, preservation of environmental quality is vital for sustainable tourism. In this study, tourist activities, perceptions and satisfactions with marine environmental condition were examined by questionnaire survey at the island province of Phuket, and two nearby marine national parks (Phi Phi and Surin) to cover high to low tourist intensities (2,032 survey responses). Two tourist groups were identified based on the main purpose of their visit and activities undertaken: underwater experience explorers (Surin) and those visiting principally for rest and relaxation (Phuket and Phi Phi). Environmental data such as coral condition, fish species and fish quantity were collected by line intercept and belt transect techniques while water quality parameters such as dissolved inorganic nitrogen, dissolved inorganic phosphorus and total suspended solids were analysed in the laboratory. Environmental data indicated that water quality and underwater biotic characteristics decreased with increasing level of tourist intensity. Satisfaction declined with declining quality of water (increasing pollution level) ($r^2 = -0.18, -0.21, -0.32$ for dissolved nitrogen, dissolved phosphorus and total suspended solids, respectively; $n = 1,683$; $p < 0.01$). However, level of satisfaction increased with increasing quality of coral, fish variety and fish quantity ($r^2 = 0.34, 0.29, 0.25$; $n = 1,698$; $p < 0.01$). Thai and foreign tourists responded differently to questions regarding a hypothetical decline in reef quality (real or perceived) in the future; Thai tourists would contribute to resource restoration through involvement in conservation projects, while international tourists would change their destination. The implication is that the sustainability of Thai marine-based tourism is vulnerable to a decline in tourist satisfaction with the quality of reefs. Given the economic importance of international tourism to Thailand, the study area's tourism dependency on quality marine experiences, and its declining reef quality, efforts to abate existing anthropogenic threats to reefs must be a priority.

Keywords: Andaman Sea, Coastal environment, Marine tourism, Perception

INTRODUCTION

Tourism is a significant sector of the global economy (World Travel & Tourism Council, 2016), and Thailand is one of the fastest growing tourist destinations. Tourist arrivals in Thailand have roughly quadrupled in the last fifteen years, from

9.58 million in 2000 to 39.79 million in 2019 (Ministry of Tourism and Sports, 2020).

With the rapid growth in nature- and marine-based tourism, concern for damage to the environment has attracted considerable attention (Rouphael and Inglis, 2001; Worachananant *et al.*,

¹Department of Environmental Technology and Management, Faculty of Environment, Kasetsart University, Bangkok, Thailand

²Department of Marine Science, Faculty of Fisheries, Kasetsart University, Bangkok, Thailand

³Sustainability Research Centre, University of the Sunshine Coast, Australia

* Corresponding author. E-mail address: p.worachananant@gmail.com

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2008). This is particularly so for the declining quality of the coastal environment and coral reefs because of natural phenomena and anthropogenic activities (Fabricius *et al.*, 2005). Many researchers report that coral reef and environmental quality are declining due to poor effluent management (Fabricius and McCorry, 2006; Worachananant *et al.*, 2008; Reopanichkul, 2010).

The positive economic impacts of tourism are well recognised (Akama and Kieti, 2007; Lundie *et al.*, 2007), but these are matched by environmental impact concerns (Rouphael and Inglis, 2001; Mason, 2008). Consequently, reliable data on resource characteristics, impacts, use patterns, and user characteristics are required to inform the management of biophysical impacts as well as visitors (Buckley and Pannell, 1990).

Thailand's international travel image stems from its scenic natural beauty, rich culture, cuisine and hotels of good value, and good shopping (Henkel *et al.*, 2006; Tourism Authority of Thailand, 2016). Its negative image relates to levels of pollution and the perceived declining quality of some tourist destinations, both socially and environmentally (Rittichainuwat *et al.*, 2001; Green, 2005). Tourist perception and satisfaction not only influence destination selection but also affect how the destination and experience is evaluated after the vacation. This can determine whether the tourist will return to the destination (Bigne *et al.*, 2001; Henkel *et al.*, 2006) and recommend it to others.

To clarify the implications of a decline in environmental quality, this study investigated factors of tourist perception of, and satisfaction with the environment at the destination, as well as the likely response should environmental quality decline. We hypothesized that tourist satisfaction would decline with increasing tourist intensity and decreasing environment quality, and that this would be reflected in tourist motivations to visit. If a decline in environmental quality results in decreasing levels of satisfaction and, subsequently, tourist arrivals, especially international tourists, then performance improvement action of tourist operators and government agencies will be essential to sustain businesses and tourism benefits.

MATERIALS AND METHODS

Study sites

Questionnaires were administered at three tourist destinations along the west coast of the Thai peninsula: Phuket Island, Hat Noppharat Thara-Mu Koh Phi Phi Marine National Park (Phi Phi) and Mu Koh Surin Marine National Park (Surin) (Figure 1). All sampling sites lie within the Andaman Sea, and were chosen to represent different intensities of tourism, from intensive to sporadic.

Phuket is one of the southern provinces of Thailand. It is the largest island of Thailand (543 km²) and promoted as the “pearl of the Andaman” (Tourism Authority of Thailand, 2016). An estimated 13,966,694 tourists arrived at Phuket in 2019 (Ministry of Tourism and Sports, 2020).

Phi Phi is situated in Krabi Province. It covers an area of approximately 388 km². The park is about 45 km southeast of Phuket and 42 km south of Krabi Town. An estimated 1,142,113 tourists arrived at Phi Phi in 2019 (Department of National Parks, 2020).

Surin was declared an Asian Heritage Site in 2003. The park covers an area of approximately 135 km². Surin is reputed to be the best shallow-water coral reef in Asia (Tourism Authority of Thailand, 2018). An estimated 54,171 tourists visited Surin in 2019 (Department of National Parks, 2020).

Survey sample

In total, 2,032 visitors were surveyed at the beginning and end of the tourism season in 2007-2008; the three sites were resurveyed in 2015-2016 in order to reconfirm the rationale of tourist satisfaction after the massive coral bleaching in 2010. A self-administered questionnaire was provided to participants with an explanation of the objectives of the research (Table 1).

Table 1. Survey response.

Location	2007-2008		2015-2016		Survey sites
	Surveys	Response	Surveys	Response	
Phuket	450	241 (54 %)	550	267 (49 %)	Patong, Kata and Karon beaches
Phi Phi	450	298 (66 %)	550	344 (61 %)	Tonsai and Lo Dalam bays
Surin	450	391 (87 %)	550	491 (89 %)	Chong Khad and Mai Ngam bays
Total	1,350	930 (68.88 %)	1,650	1,102 (66.78 %)	

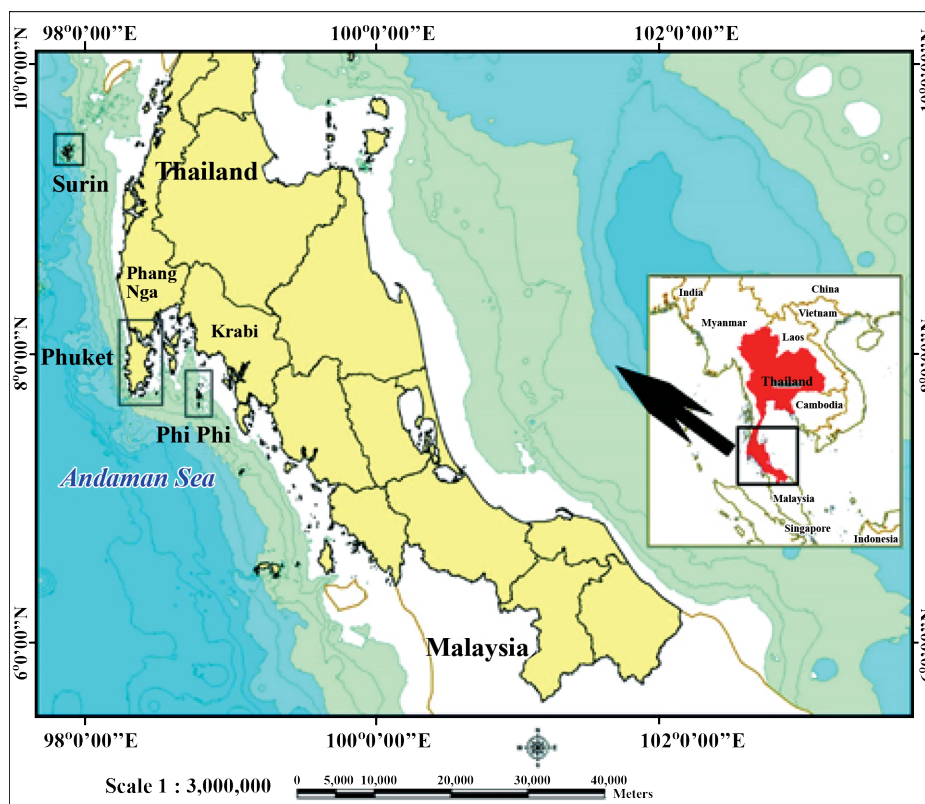


Figure 1. Study sites of Phuket, Phi Phi and Surin in southern Thailand.

Questionnaire data

A mix of open-ended and closed questions was used to allow respondents to answer in their own words as well as provide responses for statistical analysis. The questionnaires consisted of four sections: general information, tourist recreation activities, opinion and satisfaction, and tourist background. General information questions related to the main purpose of their trip, the sources of information used, travel group categories and the number of previous visits to the interview site.

For tourist recreation activities, opinion and satisfaction, Likert-like scales and multiple-choice questions were used. From a range of options, respondents were asked to identify the importance of factors that influenced the decision to visit the interview location and the activities undertaken during their visit. Finally, tourist demographic information was noted, including age, gender, place of residence and level of education.

Environmental data

Environmental data were collected from December 2007 to January 2008 and from November 2015 to December 2015 and used to identify correlations with level of satisfaction. Coral condition (percentage cover), fish variety and fish quantity were surveyed with line intercept and belt transect techniques (English *et al.*, 1997). Water quality, as dissolved inorganic nitrogen and phosphorus as well as total suspended solids was assessed through analysis of samples collected from four places at each study site.

Statistical analyses

Relationship between tourist satisfaction and environmental data was studied using Pearson's correlation. The Spearman rank correlation was used to determine correlations between visit motivation factors and activities undertaken during the visit. Moreover, analysis of variance (ANOVA) and the

Student Newman Keuls (SNK) test were used to determine whether there were any statistically significant differences among the three locations.

RESULTS

Visitors to the Phuket region who undertook active and passive marine-related activities were predominantly under 40 years of age, well educated, travelling with friends and visiting for the first time. While differences in these demographic variables existed between locations, the major differences were that visitors to Phuket and Phi Phi were predominantly from overseas, male, and visiting for rest and relaxation, while visitors to Surin were mostly Thai nationals, female and visiting for snorkeling (Table 2).

Analysis of variance (ANOVA) and the Student Newman Keuls (SNK) test confirmed these demographic differences among locations. The ANOVA showed that visitors to Surin were significantly different from those to Phuket and Phi Phi, based on nationality, gender and purpose of visit, but no other demographic variable was observed to differ (Table 3). There was no difference between the Phuket and Phi Phi samples. In addition, there were no significant differences between the two periods of data collection ($p < 0.05$). Accordingly, to investigate the influence of tourist nationality and travel motivations on activities undertaken, perception of, and satisfaction with environmental factors, the data from Phuket and Phi Phi were combined, as were data from the two survey periods.

Visitors were asked to rate the importance of activities undertaken. For the Phuket and Phi Phi group, the most important activities undertaken were to rest and relax, followed by swimming and sightseeing, respectively. At Surin, this was almost reversed. Rest and relaxation remained important, but snorkeling and SCUBA diving were the most important (Table 4).

Table 2. Visitor characteristics by location.

Characteristics		Percentage (2007-2008)			Percentage (2015-2016)		
		Phuket n = 241	Phi Phi n = 298	Surin n = 392	Phuket n = 267	Phi Phi n = 344	Surin n = 491
Nationality	Foreign	82.5	94.4	13.8	88.5	93	11
	Thai	17.5	5.6	86.2	11.5	7.6	89
Gender	Male	50.9	55.6	41.1	56.5	46.8	37.1
	Female	49.1	44.4	58.9	43.5	53.2	62.9
Age	< 22	15.4	14.7	14.4	16.2	8.1	14.6
	22-39	45.7	68.5	64	38.9	62.9	57.4
	40-59	32.9	11.2	20.4	36.9	21.4	26.8
	≥ 60	6	5.6	1.3	8	7.6	1.1
Education	Below bachelor	34.4	26.6	16.7	29.6	18.6	13.1
	Bachelor	38.4	48.7	59.5	42	53.9	59.3
	Above bachelor	21.4	21.8	22.8	21.4	21.8	25.6
	Other	5.8	3	1.1	7	5.6	1.9
Traveling group	Friends	29.2	42.3	59.8	36.2	56.1	57
	Couple	27.1	32.6	16.8	26.1	28	17.8
	Family	27.1	15.4	17.3	23.1	13	25.5
	Individual	16.2	9.7	3.6	12.4	1.1	2
	Other	0.4	1.4	0.1	2.2	0.4	0
Number of times visited	First time	58.6	73.1	78.7	50.6	71.7	73.7
	Two to four times	23.8	21.2	16.4	26.4	26.4	20.6
	More than four times	17.5	5.7	4.9	23.1	1.9	5.7
Purpose of visit	Rest and relax	73.9	67.6	26.9	74.5	69	11.3
	Socialize with friends/family	4.1	6.1	1.8	5.5	4.1	0.8
	Swimming	3.3	1.4	0.8	3.7	1	0.6
	Experience nature	1.7	2.7	4.3	1.1	2.9	2.1
	Beach walking	1.1	2.4	0.5	1.9	2.6	0.3
	Snorkeling	2.5	9.1	55.8	3.9	11.5	64.6
	SCUBA diving	2.1	6.4	3.6	3.5	4.4	16.6
	Business	2.1	0.3	0.7	3.3	1.1	0.1
	Other	6.2	4.1	5.1	5.6	3.3	4.1

Table 3. Summary of ANOVA comparing demographic data by location.

Characteristics	F value	Location	SNK test group
Nationality (df = 2, 1827)	592.13***	Phuket	A
		Phi Phi	A
		Surin	B
Gender (df = 2, 1592)	10.93**	Phuket	A
		Phi Phi	A
		Surin	B
Main purpose of visit (df = 2, 1904)	154.48***	Phuket	A
		Phi Phi	A
		Surin	B

Note: significant at $p < 0.05$, ** significant at $p < 0.01$, *** significant at $p < 0.001$

Table 4. Participation in activities by location (mean \pm SD).

Activities	2007-2008		2015-2016	
	Phuket and Phi Phi	Surin	Phuket and Phi Phi	Surin
Rest and relax	4.33 \pm 0.81	4.08 \pm 0.97	4.43 \pm 0.58	3.68 \pm 0.73
Swimming	3.85 \pm 1.03	3.46 \pm 1.11	3.99 \pm 0.99	3.58 \pm 1.19
Sightseeing	3.69 \pm 1.05	3.38 \pm 1.15	3.93 \pm 1.12	3.16 \pm 1.07
Sun bathing	3.54 \pm 1.19	2.54 \pm 1.33	3.60 \pm 1.25	1.66 \pm 1.26
Beach walking	3.37 \pm 1.12	3.32 \pm 1.21	3.47 \pm 1.27	3.54 \pm 1.64
Shopping	2.88 \pm 1.23	1.97 \pm 1.30	3.20 \pm 1.16	0.07 \pm 0.64
Snorkeling	3.28 \pm 0.72	4.48 \pm 0.82	3.50 \pm 0.61	4.60 \pm 0.41
SCUBA diving	2.86 \pm 1.28	4.23 \pm 1.07	3.10 \pm 0.53	3.59 \pm 0.55

Note: 5 point rating scale: 1 = not at all important to 5 = extremely important

Spearman correlation revealed that visitors to Phuket and Phi Phi could be further separated into two groups. The first (around 82 % of visitors) was motivated by setting characteristics (beach, water, scenery) and largely engaged in above-water activities with some taking the opportunity to snorkel. This group did not SCUBA dive. Rather, they sought to rest and relax, but included the activity of swimming. The second group (around 28% of visitors) was motivated by underwater characteristics (biotic quality of the reef environments) and was more likely to snorkel and SCUBA dive (Table 5). This latter group was akin to those who visit Surin, but was foreign-born rather than Thai.

In contrast, visitors to Surin almost exclusively did so for snorkeling and SCUBA (84 %) (Tables 2 and 4). Accordingly, visitors who traveled to Surin were mainly motivated by beach, water, scenery and coral. In addition, park management offered a daily boat trip from the accommodation areas to snorkeling sites and provided snorkeling equipment, so most visitors had a chance, at least once, to have an underwater experience. This partially explained the correlations for Surin between underwater variables and activities in which they participated. However, the relatively small participation in SCUBA diving means that there were fewer correlations than might be expected. Participation in SCUBA diving was only significantly

correlated with travel motivations relating to the underwater variables of coral condition and fish size, although other variables exhibited positive values.

As might be expected, both at Phuket/Phi Phi and Surin, underwater characteristics were the main motivating factors for visitors who specifically sought to engage in underwater experiences, while setting characteristics (beach, water and scenery) were the main motivation factors for visitors who participated in other activities.

Environmental quality, tourist satisfaction and intentions

Environmental data indicate that water quality and underwater biotic characteristics decrease with increasing level of tourist intensity. In addition, the coral condition as well as fish variety and quantity were significantly reduced at all places after a coral bleaching event in 2015 (Table 6).

Table 5. Correlation between motivations and activities undertaken during the visit.

	Motivations for travel to the destination	Activities						
		Rest and relax	Sun bathing	Sightseeing	Swimming	Beach walking	Snorkeling	SCUBA
Phuket and Phi Phi	Beautiful beach	0.27**	0.25**	0.21**	0.38**	0.31**	0.17*	-0.05
	Clear water	0.20**	0.19**	0.13*	0.31**	0.26**	0.20**	-0.02
	Scenery	0.19**	0.13*	0.30**	0.21**	0.23**	0.13*	-0.09
	Coral condition	0.02	0.03	0.10	0.05	0.05	0.26**	0.40**
	Fish variety	0.04	-0.05	0.08	0.06	0.05	0.31**	0.42**
	Coral variety	0.01	0.03	0.12*	0.05	0.07	0.34**	0.44**
	Fish quantity	-0.06	-0.06	0.09	0.09	0.01	0.30**	0.46**
	Fish size	-0.04	0.05	0.01	-0.08	-0.04	0.24**	0.50**
	Other natural features	0.12	0.10	0.57*	0.40*	0.35	0.42	0.04
Surin	Beautiful beach	0.39**	0.28*	0.29**	0.37**	0.40**	0.05	0.39**
	Clear water	0.23**	0.29**	0.26**	0.35**	0.30**	0.28**	0.20
	Scenery	0.40**	0.23*	0.29**	0.27**	0.32**	0.04	0.31*
	Coral condition	0.15*	0.04	0.21**	0.09	0.08	0.39**	0.40**
	Fish variety	0.10*	0.16	0.24**	0.18**	0.16*	0.39**	0.23
	Coral variety	0.06	-0.19	0.11	0.07	0.16*	0.39**	0.24
	Fish quantity	0.17**	0.12	0.30**	0.10	0.16*	0.30**	0.27
	Fish size	0.07	0.12	0.26**	0.08	0.16**	0.27**	0.51**
	Other natural features	0.20	0.73*	0.22	0.16	0.67**	0.25	0.77

Note: * significant at $p < 0.05$, ** significant at $p < 0.01$

Table 6. Measured range of environmental data at Phuket, Phi Phi and Surin.

Factors	2007-2008			2015-2016		
	Phuket	Phi Phi	Surin	Phuket	Phi Phi	Surin
Visitor numbers	ca. 4.7×10^6	ca. 1×10^6	ca. 0.02×10^6	ca. 12×10^6	ca. 2×10^6	ca. 0.05×10^6
Dissolved inorganic nitrogen ($\mu\text{g}\cdot\text{L}^{-1}$)	4.9 – 37.0	4.5 – 31.3	2.8 – 22.5	5.2 – 38.7	5.1 – 34.2	2.9 – 24.8
Dissolved inorganic phosphorus ($\mu\text{g}\cdot\text{L}^{-1}$)	1.2 – 12.48	0.9 – 3.36	0.8 – 2.1	1.4 – 16.1	1.0 – 3.4	0.9 – 2.4
Total suspended solids ($\text{mg}\cdot\text{L}^{-1}$)	16.4 – 57.5	14.3 – 46.9	8.3 – 36.1	19.2 – 60.4	15.7 – 43.7	8.8 – 36.6
Coral condition (percentage cover)	18.4 – 47.3	21.2 – 50.4	39.7 – 60.2	10.8 – 29.2	18.2 – 30.4	16.3–35.4
Fish variety (species)	37 – 60	51 – 69	58 – 82	30 – 48	42 – 58	49 – 72
Fish quantity (individuals $\times 250 \text{ m}^{-2}$)	238 – 521	459 – 945	893 – 1,020	202 – 427	345 – 810	623 – 820

Level of satisfaction was significantly correlated with environmental quality (both for water quality and biological data). Satisfaction declined with declining quality of water (increasing pollution level) ($r^2 = -0.18, -0.21, -0.32$ for dissolved nitrogen, dissolved phosphorus and total suspended solids, respectively; $n = 1,683$; $p < 0.01$). However, level of satisfaction increased with increasing quality of coral, fish variety and fish quantity ($r^2 = 0.34, 0.29, 0.25$; $n = 1,698$; $p < 0.01$). That is, level of satisfaction decreased with more polluted waters and the decline in the quality of biotic characteristics from Surin, to Phi Phi and Phuket. However, overall satisfaction for all places was rated as good, although the decrease in satisfaction persisted along the gradients of environmental quality (Table 7).

Levels of satisfaction were highest at Surin, followed by Phi Phi and Phuket, which is consistent with tourist visitation and environmental quality. The exception was the satisfaction with scenery and landscape at Phi Phi, which was higher than any other place. This may be explained by the reputation and particularly scenic qualities of Maya Bay at Phi Phi, with its precipitous limestone

landscape, which was the location of the 1999 movie “The Beach.”

To clarify tourist response to a decline in environmental quality, tourists were asked their reaction to a hypothetical (though our data suggests it is real) decline in quality. Most tourists at Phuket and Phi Phi indicated they would explore and travel to other destinations, while the majority of Surin’s visitors indicated they would participate in conservation projects to help improve quality (Table 8). The Phuket and Phi Phi group were predominantly overseas visitors, which is the major tourist market for Thailand. Should international tourists explore and travel to other places when environmental quality declines, the sustainability of tourism in Thailand will be vulnerable to a decline in real or perceived environmental quality.

The results show that international visitors at all places surveyed were more likely to explore and travel to other places when the quality of the reef or environment declined, although international visitors at Phi Phi and Phuket indicated they would also donate money to support conservation projects (Table 9).

Table 7. Tourist satisfaction with environmental quality (mean±SD).

Level of satisfaction with the experience	2007-2008			2015-2016		
	Phuket	Phi Phi	Surin	Phuket	Phi Phi	Surin
Scenery or landscape	3.94±0.87	4.34±0.89	4.32±0.74	3.70±0.95	4.28±1.13	4.24±0.69
Beach	3.77±0.98	3.80±0.89	4.16±0.85	3.53±0.97	3.76±0.84	3.90±0.99
Sea water	3.88±0.95	3.98±0.91	4.39±0.83	3.54±1.02	3.60±0.81	4.23±0.97
Fish communities	3.55±1.03	3.63±0.77	4.14±0.89	3.13±1.07	3.31±0.93	3.94±0.82
Coral reef	3.20±1.00	3.53±0.86	3.81±0.97	3.08±1.12	3.49±1.02	3.67±1.08
Overall	3.91±0.79	4.03±0.78	4.42±0.67	3.77±0.87	3.99±0.83	4.28±0.63

Note: 5 point rating scale: 1 = very poor to 5 = very good

Table 8. Tourist intentions should a decline in environmental quality occur (mean±SD).

Response	2007-2008		2015-2016	
	Phuket and Phi Phi	Surin	Phuket and Phi Phi	Surin
Explore and travel to other places	4.63±1.18	3.81±1.64	4.41±0.98	3.45±1.73
Provide support funding	3.85±1.19	4.20±1.07	3.39±1.03	3.96±1.21
Participate in conservation projects	3.62±1.16	4.13±1.00	3.56±1.23	4.24±0.92
Lobby government	3.42±1.22	3.33±1.28	2.82±1.51	3.09±1.14

Note: 5 point rating scale: 1 = very poor to 5 = very good

Table 9. Correlation between international visitors' intentions and a hypothetical decline in environmental quality.

Response	Phuket and Phi Phi	Surin
Explore and travel to other places	0.34**	0.22*
Provide support funding	0.13**	-0.07
Participate in conservation projects	-0.07	-0.08
Lobby government	0.03	0.02

Note: * significant at $p < 0.05$, ** significant at $p < 0.01$

DISCUSSION

Perceived environmental quality of a destination is an important factor in travel decisions due to increased environmental awareness and tourist demand for better quality. It is a factor that gives a destination a marketing edge. The quality of a destination's natural attractions forms a significant part of visitor assessment of the quality of a destination (Middleton, 1997). Petrosillo *et al.* (2007) reported that the quality of seawater followed by landscape values and relaxation opportunities were the most important factors influencing tourist decisions to stay at a coastal destination.

In this study, satisfaction with the natural environment parallels biological and water quality data. Other studies have similarly found that declining environmental quality tends to diminish the level of satisfaction and quality of recreational experiences (Lynn and Brown 2003; Petrosillo *et al.*, 2007). Moreover, overseas visitors tend to have higher levels of satisfaction than Thai tourists. This might be because Thai visitors are familiar with the environmental context of places visited, so they recognize the change over time and are more aware of environmental problems. Nevertheless, all visitors to the Phuket tourism region, but particularly international visitors, still have moderate to high

levels of satisfaction with environmental quality. Accordingly, there is a positive outlook for sustained tourism at all destinations surveyed.

For overseas visitors, their choice of a holiday destination will be, in part, determined by the real or perceived environmental quality of possible destinations and their expectations/motivations for travel (Inskeep, 1991). Should environmental quality not meet expectations, they are likely to shun the Phuket region and travel elsewhere to realise their travel motivations. For Thailand, where tourism is a major source of national income, loss of the international tourist market may result in economic crisis. Therefore, it is important to sustain or improve environmental quality to keep tourists satisfied with their destinations.

CONCLUSION

This study found that the factors influencing the decision of tourists to visit a place were related to activities undertaken during the visit, while satisfaction was influenced by the environmental characteristics of the place visited and nationality of the visitor. Although overall satisfaction was moderate to high, especially from overseas visitors, level of satisfaction increased with increasing quality of water and marine biota. However, the quality of water and marine biota in many places in Thailand shows signs of degradation, particularly in tourist-intensive areas. If the decline in marine environments results in decreased tourist satisfaction, then a decline in visitor arrivals is likely, and tourism in Thailand may be threatened and its economic benefits diminished.

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