The past, present, and future of incentive-based coral conservation: Sustainability of diving on the Andaman coast of Thailand

by

Skye Augustine
B.Sc., University of Victoria, 2011

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Dr. Phil Dearden, (Department of Geography)
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Dr. Rick Rollins, (Department of Geography)
Departmental Member

Abstract

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Supervisor

Dr. Rick Rollins, Department of Geography
Departmental Member

Rapidly changing oceans are threatening coastal ecosystems and require effective conservation efforts. On the Andaman coast of Thailand, SCUBA diving tourism is one activity that can aid conservation by providing incentives to conserve, rather than exploit, natural resources such as coral reefs. In 2011, the largest ever recorded coral bleaching event prompted the closure of many of the countries' most popular dive sites to allow coral to recover. This unprecedented move and the resulting drop in dive tourists demonstrated the vast changes that could confront the dive industry in the face of climate change, altering its role as a vital activity within Thailand as well as its potential as a conservation tool along the coast. Ensuring the sustainability of Thailand's coral reefs requires that we consider changes to both these components. This thesis tracks changes to the sustainability of diving as a conservation tool and predicts how these trends might vary in a future with continued climate change impacts.

This research uses a wildlife tourism model proposed by Duffus and Dearden (1990) as a theoretical framework to examine changes to diving over time. A standardized questionnaire was administered to diving tourists in 2012 and compared against a similar study completed in 2000 to evaluate development and shifting sustainability of diving. Additionally, the ecotourism values and climate change perceptions of divers were measured to explore the present and future conservation potential.

This work found that the conservation value of the dive industry has declined and will continue to do so without management interventions. Specifically, the specialization level

of divers has declined between the years, yielding a population that has low skill level, generalized motivations, few ecotourism values, is easily satisfied, and spend less money than divers in 2000. Currently, there are many niche companies that all cater to mainstream tourists. However, within this broad industry, this research identified only one diving company that practices all of The International Ecotourism Societies' principles for ecotourism operators, suggesting that diving on the Andaman coast is not an ecotourism industry. We anticipate that in the face of continuing climate change impacts, there will be a significant loss in clientele, but demand for diving will remain within the generalist divers on the Andaman coast.

These findings provide clear evidence for shifting baselines, a phenomenon that will exacerbate declines in the conservation potential of the industry. Despite this, our results show that most divers are concerned about the impacts of climate change and are interested in learning about it, suggesting that there is potential to increase the educational value of the dive industry, and simultaneously boost its conservation contributions. To do so will require the efforts of both protected area managers and dive operators.

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Acknowledgments

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Introduction

Coral reefs, climate change, and wildlife tourism conservation

This research takes place in a rapidly changing ocean that is at once a place of great beauty and diversity, and is also under great threat. Managing the balance between conserving our oceans and using them is a complex endeavour. This research contributes to achieving the desired balance by looking at the evolution of the relationship between coral reef conservation and coral reef use by diving recreationists.

A significant body of work has examined the various characteristics that influence our ability to achieve the best conservation results. Similarly extensive research has identified the characteristics that determine an optimal tourism experience. An emerging and complex field is the intersection of these two bodies of research. Most managers within these fields recognize the need to understand how the relationship between marine conservation and recreation changes, yet there is a pronounced gap in the literature of recreation and conservation management through time.

Approaching ocean management with a temporal lens has become highly pertinent in recent years as climate change prompts a dramatic shift in all marine ecosystems. The effects of climate change on the relationship between conservation and recreation have received minimal attention, a gap this research aims to fill by examining the relationship between dive tourists and coral reefs 12 years ago, now, and as climate change transforms coral reef ecosystems.

This introductory chapter is broken into six sections. The first three sections set the context for the research by outlining the problems addressed by this work, the major theoretical frameworks used to examine them, and the importance of this work on the Andaman coast of Thailand. Section four describes the role of this research within the broader goals of Project IMPAACT, while section five outlines the specific research

objectives and structure of this thesis. Finally, section six provides an overview of the methods used to address the research objectives.

1. Background

Coral reefs are home to thousands of ocean species, create extensive habitats, provide breakwater effects that protect coastal regions, and support fisheries that feed millions (Wilkinson 2004). Termed the 'rainforests of the sea' coral reefs host the largest diversity of animal and plant life found anywhere on the planet, making them highly unique and attractive features. Despite this unequivocal importance, coral reefs are disappearing rapidly, experiencing extensive damage from human uses as well as from climate change (Knowlton & Jackson 2008).

Climate change is warming and acidifying oceans, raising sea levels, changing ocean circulation patterns, altering freshwater influxes, and increasing the severity of storms. Individually, each of these stressors can dramatically impair coral reef ecosystems, and together their results are difficult to predict. For instance, ocean warming is causing global coral bleaching events by breaking down the symbiotic relationship between corals and their photosynthetic zooxanthellae (Anthony et al. 2011). Ocean acidification is inhibiting coral calcification and is accelerating the breakdown of reef structures. Corals with weakened skeletons are less resistant to storms and erosion, leading to elevated rates of coral breakage and mortality (Anthony et al. 2011; Kleypas & Yates 2009). Similarly, an increased prevalence of extreme weather events is associated with high levels of oceanic turbidity, which can restrict the ability of corals to use solar energy. Furthermore, rising sea levels change the wavelengths of light that reach the corals reducing the ability of zooxanthellae to produce energy. The threats posed by climate change compound upon existing stressors in most coral ecosystems, such as overfishing, run off from coastal development, and coral disease (Knowlton & Jackson 2008). The complex interactions between these human and environmental factors make coral reefs difficult to manage and it has been suggested that multiple approaches are needed to achieve management and conservation results (Keller et al. 2009).

Marine protected areas (MPAs) are an increasingly common marine conservation strategy. They are effective at curbing biodiversity loss within coral reef ecosystems but are challenged by slow rates of implementation (Agardy 1994; McCook et al. 2010; Selig et al. 2012) and difficulties in achieving compliance from resource extractors who fear a loss of income. While scientists suggest that marine biodiversity requires at least 30 percent protection to recover from current degradation, MPAs currently protect only 1.6 percent of oceans (Fraschetti et al. 2009; Jessen et al. 2011; Lester & Halpern 2008; MPANews 2012). This suggests the need to develop additional conservation tactics such as green business incentives, payments for ecosystem services, and incentive-based conservation approaches to supplement current conservation efforts (Allison et al. 1998; Margules & Pressey 2000; Selig et al. 2012).

'Incentive-based conservation' describes economic incentives such as conservation agreements or alternative livelihoods that shift the economic base from environmentally degrading activities toward conservation-focused employment (Hutton & Leader-Williams 2003). Ecotourism is one activity that has become an increasingly prominent topic in marine conservation literature, and offers to contribute to the ecological, socio-cultural, and economic conditions in local regions (Agardy 1993). Ecotourism can act as a conservation tool in currently unprotected marine regions or can complement conservation efforts already established, such as MPAs, by increasing the attractiveness of protected regions, generating funds for conservation efforts, providing revenue to local peoples, and promoting awareness of marine ecological issues (Eagles 2013).

SCUBA diving tourism is one incentive-based conservation tool that works to conserve biodiversity both inside and outside of MPAs. Since its popularization in the late 1960's, SCUBA diving has continually grown. PADI, the worlds largest diving certification company, administered over 940 000 diving certifications in 2012 alone, totalling at over 21 million certifications worldwide since 1967 (PADI 2013). This growth in certified divers has been accompanied by the growing attraction of many diving destinations around the world. In some of these destinations, diving has demonstrated significant potential to generate funds for conservation and local economic development (Arin &

Kramer 2002; Balmford et al. 2009), funding park management (Hawkins et al. 2005; Uyarra et al. 2009), and providing employment opportunities for locals who would otherwise depend on extractive-based livelihoods (Carrier & Macleod 2005; Clifton 2005; Taylor et al. 2002). Yet, diving can also have significant impacts on reefs. It can increase sedimentation rates, cause coral breakage, and increase the susceptibility of reefs to disease (Barker & Roberts 2004; Dearden et al. 2010; Hasler & Ott 2008; Hawkins & Roberts 1993; Leujak & Ormond 2008). In addition, coral reefs experience indirect impacts from dive tourism including sewage and oil pollution from boat discharge, and reef damage due to anchoring (Bennett 2002; Dearden et al. 2007). Balancing the conservation benefits and costs while simultaneously maintaining optimal recreation experiences so that both are sustainable for the long term is a complex task.

2. Wildlife Tourism Sustainability

Wildlife tourism includes three basic elements: the wildlife species and its habitat, the wildlife tourist, and the historical relationship between the two (Duffus & Dearden 1990). These three elements underlie the development and sustainability of any wildlife tourism activity and each must be understood to manage the industry appropriately. For instance, wildlife tourism can only be sustained when species appear readily in a small area and are easily observed by tourists. This is often dictated by both the behaviour of the wildlife species and the characteristics of its habitat. Additionally, only certain visitors seek out wildlife tourism experiences, and their desire to do so is often determined by a combination of personality variables. Finally, the popularity of a wildlife tourism industry is often based on the historical relationship between the wildlife species and humans, as the most rare (often because of past human exploitation) tend to be the most attractive. These three elements readily interact and evolve over time, changing at both the user and site levels to meet new market tastes. It is this dynamic nature of wildlife tourism areas that makes managing activities for optimal conservation and recreation a difficult task.

Several frameworks have been proposed to examine wildlife tourism that use variations on some or all of these concepts (Butler & Waldbrook 1991; Duffus & Dearden 1990; Orams 1999; Reynolds & Braithwaite 2001). Recently, Catlin et al. (2011) compared many of these tourism frameworks and concluded that a model proposed by Duffus and Dearden (1990) "remains the most relevant framework for wildlife tourism" (p. 1539). The Duffus and Dearden (DD) model stands alone as the only model to incorporate all components of the wildlife experience, as well as the tendency of industries to change over time, and the need for different management approaches to achieve stated objectives. The DD framework provides a heuristic to examine and predict temporal changes to both environmental and industry considerations. This makes it an important tool for researchers and practitioners to forecast changes in industry development and determine the appropriate management interventions required to optimize both the conservation value and recreation experience of a wildlife tourism industry. This theory underpins much of the research in this thesis as it aims to evaluate the relationship between reef conservation and dive tourism over time.

2.1 Duffus-Dearden Model

The DD framework (Figure 1) combines theory on the lifecycle of tourism sites (Butler 1980), recreation specialization (Bryan 1977), and limits of acceptable change (Stankey et al. 1984) to forecast and understand the change and sustainability of non-consumptive wildlife tourism industries. Butler's (1980) theory of the Tourism Area Lifecycle (TALC*)* proposes that tourism operations often change over time starting in a phase of limited growth and growing until the site becomes well known. At this point some sites become so heavily used that the conditions are degraded. The second theory included in the DD model, recreation specialization, is a way to categorize heterogeneous recreationists into groups that share similar motivations, skills, attitudes, knowledge, and behaviours, and place them on a spectrum ranging from generalist to specialist (Bryan 1977). The final component of the model is based on the premise that in the absence of management, growing tourism will have increasingly negative impacts on the desired environmental, social, and managerial conditions (Higham 1998a; Smith 2011; Ziegler et al. 2011). Establishing 'limits of acceptable change' (LAC) (Stankey et al. 1984) requires that

managers identify the level of resource protection, and social conditions desired at a wildlife tourism site so that appropriate management interventions can be enacted, and the indicators monitored, to ensure the site remains within the determined LACs. This differs from the better-known approach of managing a site to its ecological or social carrying capacity, which maximizes the number of users that visit a site without causing permanent damage to ecological or social conditions. In contrast, LAC's can be set at a range of levels, the uppermost being the conventional 'carrying capacity'. Roman et al. (2007) provide one example of the use of LACs in their LAC assessment for snorkelling tourism in Koh Chang National Marine Park in the Gulf of Thailand.

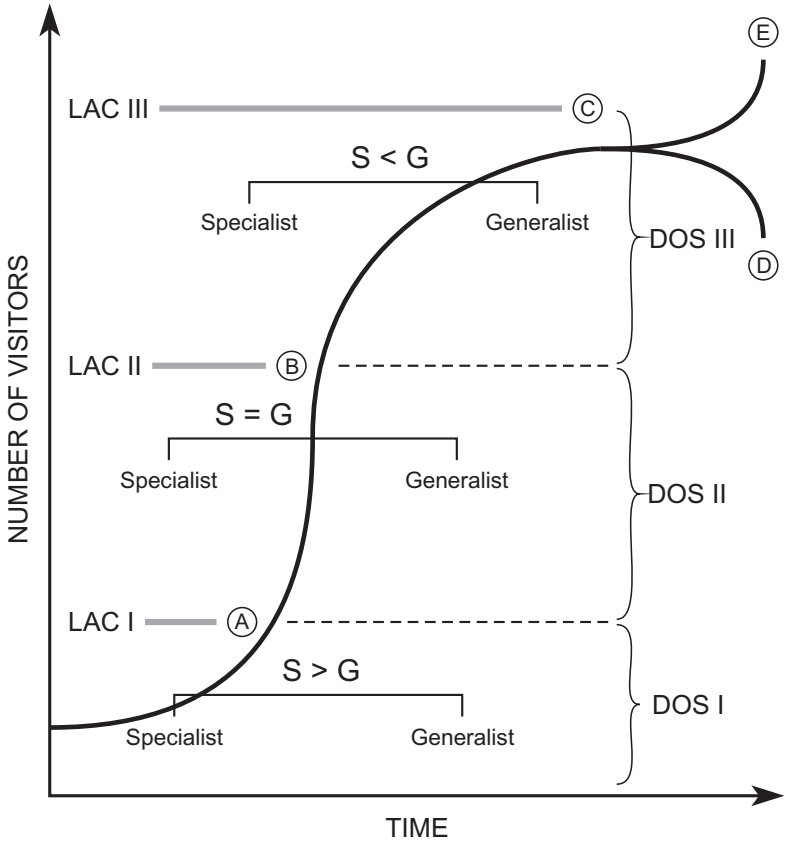

Figure 1: Duffus and Dearden's wildlife tourism framework: The relationship between user specialization and site evolution (Modified from Dearden et al. 2006).). LAC = Limits of Acceptable Change, DOS = Diver Opportunity Spectrum, S = Specialists, G = Generalists.

Butler and Waldbrooks (1991) used similar bodies of theory to develop a comparable model to the DD framework, adapting Clark and Stankey's (1979) recreation opportunity spectrum to be more appropriate for tourism sites, terming it the tourism opportunity

spectrum (TOS). This model highlights the need to include both the temporal aspect of wildlife tourism development and a focus on users, but missed the importance of management that is captured by the DD model. In 2006, Dearden et al. (2006) added the concept of the diver opportunity spectrum (DOS) to the DD model, suggesting three DOS levels to match dive site characteristics with user specialization levels and represent the range of opportunities available within different stages of industry development. This innovation adds a spatial dimension to the dominantly temporal model.

The DD framework shows the number of visitors over time and illustrates the logistic curve expected of tourism sites, identifying various phases of industry development with the letters A through E. The discovery phase (A) has few specialist users while the exponential growth phase (B) shows a more equal distribution of specialist and generalist visitors. In the period of saturation (C), specialists begin to be displaced by generalists, which is followed by either a period of decline (D) as the environmental and social conditions become so degraded that the site becomes less attractive, or a period of continued growth (E). Three potential LAC's are placed at critical points in the model, and demonstrate the range of conditions that managers can select as optimal states for a given site. Each LAC will require different management actions to ensure the associated objectives are met. For instance, managing a site for minimum revenue from the maximum number of visitors will require different actions than managing for high ecological conservation values and maximum per capita revenue from few visitors. Determining the management goals and situating a tourism site on the model allows practitioners to identify any discrepancy between current practices and desired conditions and evoke various interventions to ensure the management goals are met. In a similar way, three DOS levels identify the range of dive opportunities required within each LAC to optimize the recreation experience within ecological goals. DOS I falls within LAC I and targets the most pristine and attractive dive sites in the region, zoned to protect the best experiences that are least accessible, most attractive, and have the lowest density of visitors. This region requires strict monitoring to maintain ideal conditions. DOS II includes less pristine sites with less restrictive management and high diver densities while

DOS III includes the most accessible sites with minimal management, ideal sites to use for training new divers.

Climate change is causing complex and rapid changes to the marine environment, particularly to coral reefs, and will likely change many of the interactions within wildlife dependent activities such as diving. Dearden and Manopawitr (2011) discuss a revised wildlife tourism model that examines the possible affects of global climate change on dive tourism in Southeast Asia, shown in Figure 2. For instance, rising costs of air travel and increasing air temperatures will likely result in reductions to the number of international tourists visiting Southeast Asia throughout the lifecycle of the industry. The shape of the curve is expected to vary from the original curve depending on specific site characteristics. Vulnerable sites will likely have lower resilience and quickly collapse under any tourism pressure (D). This will result in fewer high quality reefs, and those that are resilient to the initial impacts of climate change will likely see steeper growth curves as visitors have fewer sites to choose from (C). For all sites, it is predicted that the LACs will be approached more quickly than expected with the original model (B). Landauer et al. (2011) suggest that destinations may be affected by climate change differently when at periods of discovery, growth, or saturation. Following the 2004 tsunami the number of Thai diving companies dropped by one third but resulted in greater cooperation among remaining companies (Main & Dearden 2007) suggesting that all consequences of climate change may not be negative.

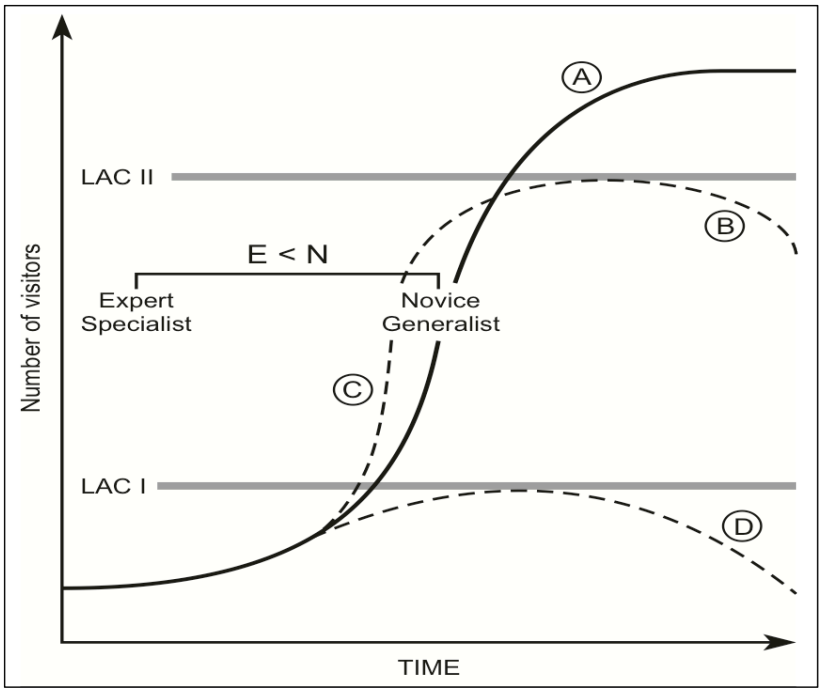

Figure 2: Potential adaptation of dive site evolution model under the stress of climate change (Modified from Dearden & Manopawitr 2011). LAC = Limits of Acceptable Change, S = Specialists, G = Generalists.

The DD model has been applied in various studies to assess an industry's position on the model, and therefore its sustainability. For instance, it has been applied in studies of tourism with marine birds (Higham 1998b), whale sharks (Catlin & Jones 2010), manatees (Sorice et al. 2006), whale watching (Peake 2011), and diving (Dearden et al. 2006) (for a complete review see Catlin et al. 2011). An application on whale shark tourism by Catlin and Jones (2010) confirmed the DD assertion that as a site becomes increasingly popular, the specialized market will be overwhelmed by the less specialized market, dramatically shifting the characteristics of the industry. This study of whale sharks is one of few studies that have used longitudinal data to examine changes to wildlife tourism industries over time. To date no studies have tested the Dearden and Manopawitr (2011) predictions. The research in this thesis looks at the changes to the Thai diving industry over time, examining development progressions of user characteristics, motivations and satisfaction, the present conservation potential of the

industry, and evaluates possible visitor responses to climate change, forecasting future development patterns for the industry.

3. Andaman Coast of Thailand

This study focuses on the Andaman coast of Thailand (Figure 3), a region that is within the Coral Triangle and home to some of the most diverse, and visited reefs in the world (Briggs 2005). Southeast Asia has 34 percent of the worlds largest reefs, hosting over 600 species of hard coral, 1 300 reef-associated fish, and simultaneously supports large coastal populations (Tun et al. 2008). These ecosystems form the foundation of 18 MPAs along the Andaman coast, including several that are internationally known. For instance, dive magazines have identified Koh Similan National Marine Park and Mu Ko Surin National Marine Park as being among the premier dive destinations in the world. Additionally, these sites have been the focus of efforts to nominate the region as an UNESCO world heritage site. Many of these MPAs are heavily used by international dive tourists between November and May each year when the average number of visitors can exceed 350 people per day (Asafu-Adjaye & Tapsuwan 2008).

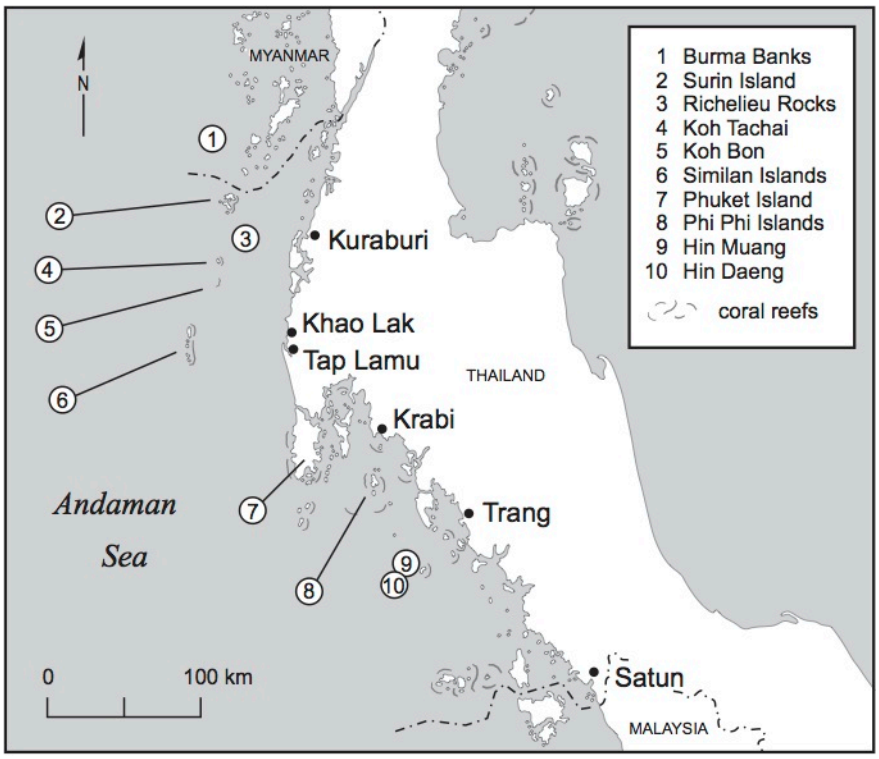

Figure 3: Main cities, coral reefs, and dive sites on the Andaman coast of Thailand

These diverse reefs and MPAs are one feature that makes Thailand a global destination for diving tourists around the world and the focus of previous research projects. Bennett (2002) completed one of the first studies of diving on the Andaman coast in her evaluation of the diving visitors to Phuket and found that divers were contributing over $150 million USD per year to the local economy. Additionally, this study found that generalist divers were more satisfied with their experience than specialists and, using the DD wildlife tourism model, predicted that this trend would result in a future decline to the sustainability of the industry (Dearden et al. 2006), a prediction this thesis tests. A similar study compared diver perceptions before and after they completed diving and found that after diving, visitors believed the activity to have a larger negative impact on reefs (Dearden et al. 2007). Additionally, Dearden et al. (2007) found that divers who witnessed damage to reefs were more likely to want to participate in reef conservation activities in the future. One study focused on divers visiting Koh Similan National Marine Park and showed that divers are willing to pay over two times as much as they are currently charged to visit the park (Asafu-Adjaye & Tapsuwan 2008). Studies have also

examined the response of the dive industry to shocks. For instance, Main and Dearden (2007) studied the response of the dive industry following the 2004 tsunami and found that although one third of dive companies went out of business, the remaining companies came together and were instrumental in post-tsunami rescue, relief, and restoration efforts. In a more recent evaluation of dive company resilience, Biggs (2012) found that informal operators were more equipped to adapt to shock events than formal dive operators. These results highlight the complexities of managing the Andaman coast dive industry.

The popularity of Thailand's coral reefs to international visitors has helped contribute to tourism as a major economic force in the country, where visitor arrivals have grown 7.4 percent annually between 1998 and 2007 (TAT 2013a). In 2012 Thailand received over 22 million visitors who contributed $8.4 billion USD to the Thai economy between January and March of the same year (TAT 2013b). This large economic importance makes the future of reef tourism particularly relevant for Thailand.

Thai coral reefs have been subject to various human disturbances such as development, fishing, and pollution. Despite this, for the last two decades coral cover has remained constant until the coral bleaching of 2010 which saw 17 percent coral mortality in many regions (Phongsuwan 2013). Trends observed on the Andaman coast indicate that the damage is just beginning for Thailand's reefs. Over 50 years of sea surface temperature data for the region show increases similar to those predicted by IPCC climate change reports which predict that corals will face an increasingly hostile environment in coming years (Brown et al. 1996). Some studies predict that by 2020, bleaching events will be an annual and severe event throughout most of Southeast Asia (Burrows et al. 2011).

At the height of the dive season in January 2011, the Prime Minister of Thailand ordered many of the most popular reefs in Thailand to be closed to diving due to concerns over reef health following the most dramatic coral bleaching to ever hit the Andaman coast. The dive industry was severely compromised as divers throughout the world cancelled their dive holidays in the country. This event has highlighted the vast role climate change

will play in the future of coral reef activities and conservation, stressing the importance of understanding better both coral reef threats and visitor responses.

4. Project IMPAACT

The research presented in this thesis fulfills one component of Project IMPAACT, a program run out of the Marine Protected Areas Research Group at the University of Victoria. Project IMPAACT stands for Improving Marine Protected Areas on the Andaman Coast of Thailand and includes various research initiatives that address individual components of this topic. The project was launched in 2010, the same year that the Andaman coast witnessed the start of what was the most severe coral reef bleaching ever in Southeast Asia. Concern around the expectations for increasing climate change impacts are heightened by the high dependence of many coastal communities on marine and coastal resources in this region. These dependencies range from traditional and commercial fishing activities through to a more recent dependence on coastal tourism such as snorkelling and SCUBA diving. All of these activities will see significant changes as coastal ecosystems are impacted. The goal of Project IMPAACT is to provide further understanding of likely climate-change induced transformations to coastal ecosystems, communities, and activities, and suggest interventions that can increase the resilience of ecosystem conservation and the adaptive capacity of livelihood dependent communities in the future.

The work in this thesis addresses one component of the overarching goals of Project IMPAACT by examining changes to SCUBA diving, with a particular focus on the potential impacts of climate change. In order to do that, this research has taken a temporal focus on the sustainability and conservation value of the diving industry, examining changes over the past 12 years, its current status, and the likely implications of increasing impacts from climate change.

5. Research Objectives & Organization of Thesis

This thesis is organized into three individual papers that address the overarching goal of tracking changes to the sustainability of diving as a conservation tool and predicting how these trends might vary in a future with continued climate change impacts. Each paper aims to improve our understanding of the potential strengths and challenges associated with using tourism, such as diving, to aid marine conservation. In this way the research in this thesis will build on existing knowledge about the development of tourism industries over time, improving our understanding of the dynamic relationship between recreation and conservation. Additionally, this study will provide some of the first insight into diver response to climate change.

The first paper is a comparative study that examines changes to diving between 2000 and 2012. The second paper looks at the current status of diving as an ecotourism industry, investigating both company marketing tools and visitor motivations. The last paper examines diver perceptions on climate change and their implications for the future of diving on the Andaman coast. Since each paper is intended as an individual publication there is some overlap among the three papers, particularly within the methods and background information. This thesis concludes with a chapter synthesizing key findings and recommendations.

Specifically, this research addresses the following objectives:

Paper 1:

a) *Examine changes to the composition of dive industry in 2000 and 2012*
b) *Compare diver specialization, motivations, satisfaction and willingness to return in 2000 and 2012*
c) *Use the Duffus-Dearden model to evaluate the sustainability of the diving industry in 2012 and compare this to findings in 2000 by Dearden et al. 2006*

Paper 2:

d) *Assess use of ecotourism principles as marketing mechanisms by dive companies*

e) Determine ecotourism values and motivations amongst diver clientele

Paper 3:

f) Investigate the characteristics of divers based on climate change perceptions

g) Estimate future changes to the development of the diving industry in the face of climate change

Together the papers evaluate and predict changes to the conservation value of the dive industry and make recommendations for using diving to strengthen the conservation of the Andaman coast.

6. Methods

Primary data was collected using a standardized questionnaire administered to SCUBA diving tourists. This study adapted methods used by Bennett in her 2000 research on diving tourists in Phuket (Bennett 2002) to maximize comparability while also addressing the impact of climate change on the dive industry. Similar to 2000, stratified random sampling was used to select a sample of dive companies operating along the Andaman coast based on the region of operation, the price of trips offered, and the types of activities available. The visitor questionnaire included four sections: demographics, specialization level, motivations and satisfaction, and climate change perceptions. Secondary data was collected using a survey of dive company websites to assess the prevalence of conservation-based marketing. Prior to data collection, research was approved with a Thai Research Permit (Appendix I) as well as through the University of Victoria Human Research Ethics Board (Appendix II). In addition, copyright and moral rights have been waived for two figures and a questionnaire that have been reproduced in a modified format in this thesis (Appendix III).

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Paper 1

Declining conditions for SCUBA diving as a conservation tool on the Andaman coast of Thailand: A comparison of industry sustainability in 2000 & 2012

1. Abstract

Coral reefs play a critical role in maintaining the biodiversity of tropical marine ecosystems but many are becoming degraded. In some locations SCUBA diving may act as an incentive-based conservation mechanism for local communities by funding conservation and replacing more consumptive reef uses. However, for this to happen diving must be sustainable. One challenge to sustainability is changing reef conditions and diving clientele over time. This paper examines these changes with respect to SCUBA diving on the Andaman coast of Thailand.

In 2012 a questionnaire was administered to 591 scuba divers. The survey allowed for a direct comparison with data collected in 2000. This paper is the first study to evaluate the sustainability impacts of a diving industry across time and is also novel in its use of the Duffus-Dearden (1990) wildlife tourism model to complete a temporally comparative evaluation of a diving industry. Key findings include:

1. The 2012 industry has a higher proportion of low and medium specialization visitors that have more general expectations for their dive experience than visitors in 2000
2. The less specialized clientele of 2012 have lower expectations and declining satisfaction, yet they are as willing to return as the 2000 clientele
3. The average economic contribution of divers to the local economy as well as the amount spent on dive trips both declined substantially by 2012
4. Andaman coast diving continued to grow in 2012, dominated by mass-market tourism that had diversified into several niches

5. The results verify the use of the Duffus-Dearden wildlife tourism model as a tool to understand industry sustainability, and suggest further development of the model to capture the growth of these niche markets

Overall, as predicted by the Duffus-Dearden model, there is an inevitable decline in the sustainability of wildlife tourism such as SCUBA diving unless strong management interventions are implemented to achieve stated goals. Interventions for Phuket and other SCUBA diving destinations include: regulating access, preserving experiences desired by higher specialization divers, zoning reefs based on resilience to diver impacts, increasing access fees to marine protected areas and dive sites, and providing interpretation opportunities to operators, guides, and divers.

2. Introduction

Accelerating global environmental degradation requires creative conservation tactics. To date, the conservation tool of choice for coastal ecosystems has been the establishment of marine protected areas (MPAs). MPAs are effective at curbing biodiversity loss but are challenged by slow rates of implementation with MPAs currently protecting only 1.6 percent of oceans (MPANews 2012). This observation suggests the need to develop additional conservation tactics such as green business incentives, payments for ecosystem services, and incentive-based conservation approaches to supplement current conservation efforts (Allison et al. 1998; Margules & Pressey 2000; Selig et al. 2012).

Coral reefs are some of the most diverse and important ecosystems in the world and are major attractions for dive tourism, a form of nature-based recreation that can act as an incentive-based conservation tool (Dearden et al. 2006). However, in the absence of management, the development of tourism can have negative impacts on important ecosystems. Ensuring the sustainable development of SCUBA diving requires a balance of sometimes competing requirements from visitors, ecosystems, and industry. The Duffus-Dearden (DD) wildlife tourism model (1990) provides a framework to examine the interactions among these players, predict future sustainability, and design appropriate management interventions for meeting site objectives. This study will perform one of the

first temporal comparisons of an incentive-based conservation industry to track shifts in its conservation value over time. Specifically, this study examines changes to Thailand's Andaman coast diving industry between 2000 and 2012 focusing on shifts within the characteristics of diving clientele, diver motivations and satisfaction, diver specialization, the DD wildlife tourism sustainability model, and the economic contribution of diving.

3. Literature Review

'Incentive- based conservation' describes economic incentives such as conservation agreements or alternative livelihoods that aim to shift the economic base from environmentally degrading activities toward conservation-focused employment (Hutton & Leader-Williams 2003). Wildlife-based tourism, such as SCUBA diving, can be an incentive-based conservation tool that works to conserve biodiversity both inside and outside of MPAs and has demonstrated significant potential to generate funds for conservation and local economic development (Arin & Kramer 2002; Balmford et al. 2009). In many places, the user fees paid by tourists benefit conservation by funding park management and providing employment opportunities for locals who would otherwise depend on extractive-based livelihoods (Carrier & Macleod 2005; Clifton 2005; Taylor et al. 2002). Marine parks such as those at Saba and Bonaire have become self-financing through these fees, allowing for conservation that would otherwise be impossible (Hawkins et al. 2005; Uyarra et al. 2009). In Mu Ko Similan National Marine Park in Thailand, divers were documented as being willing to pay between $27.07 and $62.64 USD per annum to dive in the park amounting up to $2.1 million USD in revenue per year (Asafu-Adjaye & Tapsuwan 2008). In addition, divers were documented as contributing over $150 million USD per annum to the local economy in Phuket (Bennett et al. 2002).

Diving can also have direct negative impacts on coral reef ecosystems (Barker & Roberts 2004; Dearden et al. 2010; Hasler & Ott 2008; Hawkins & Roberts 1993; Leujak & Ormond 2008). Increased sedimentation rates and broken coral caused by divers' fins decrease the habitat available for fauna and make reefs more susceptible to disease

(Hasler & Ott 2008; Hawkins & Roberts 1993). In addition, reefs experience indirect impacts from dive tourism including sewage, oil pollution from boat discharge, and reef damage due to anchoring (Bennett 2002; Dearden et al. 2007). Individual divers differ significantly in their impact on reefs and evidence points to diver specialization as an indicator of these differing impacts. Divers who are new to the sport or dive infrequently ('generalists') typically have poor buoyancy control and less awareness of body movements and therefore cause more reef damage than their 'specialist' counterparts who have better developed skills (Dearden et al. 2006; Hawkins et al. 2005; Luna et al. 2009). Diver specialization can act as a key indicator of dive industry sustainability because of the associated motivations, satisfaction, and impacts. Specialization is also a central component of the DD wildlife tourism model that has been used to assess dive industry sustainability (Bennett et al. 2002; Catlin & Jones 2010; Dearden et al. 2006).

The DD framework (Figure 4) combines theory on the lifecycle of tourism sites (Butler 1980), recreation specialization (Bryan 1977), and limits of acceptable change (Stankey et al. 1984) to forecast and understand the change and sustainability of non-consumptive wildlife tourism industries such as diving and has been assessed as the most effective framework for wildlife tourism (Catlin et al. 2011). This study uses the DD model to examine the temporal changes to the sustainability of diving on the Andaman coast of Thailand building on an earlier study in the same location.

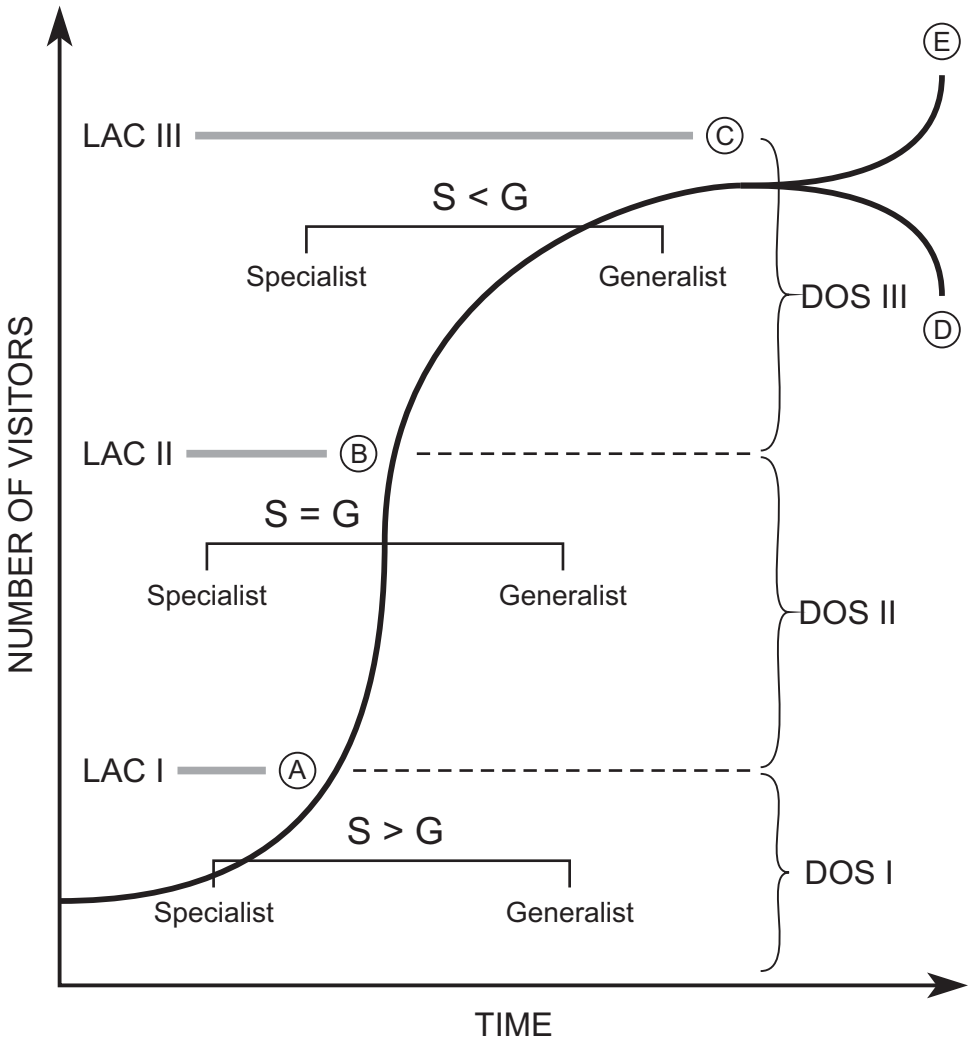

Figure 4: Duffus and Dearden's wildlife tourism framework: The relationship of user specialization and site evolution (Modified from Dearden et al. 2006). LAC = Limits of Acceptable Change, DOS = Diver Opportunity Spectrum, S = Specialists, G = Generalists.

Butler's (1980) theory of Tourism Area Lifecycle (TALC*)* proposes that tourism industries often change over time. Each site enters an initial phase of limited growth where only few tourists know and visit the site. Once a site begins to be well known it enters a period of rapid growth until it becomes so heavily used that the site becomes less attractive. At this point the tourism site may decline, stagnate, or continue to grow depending on the management actions applied, the characteristics of the site, and the potential for accessing new markets.

The second theory included in the DD model, recreation specialization, is a way to categorize heterogeneous recreationists into groups that share similar motivations, skills, attitudes, knowledge, and behaviours (Bryan 1977) and has been applied to various wildlife-based recreation opportunities including camping (McFarlane 2004), fishing (Salz & Loomis 2005), bird watching (Scott et al. 2005), and diving (Sorice et al. 2009). Specialization often relates closely to the level of development of a wildlife tourism site (Duffus & Dearden 1990). In the early stages of tourism development a tourism site starts with small numbers of specialists, who are highly skilled, knowledgeable about the ecosystem they are visiting, will pay more to access the conditions they desire, and travel to remote locations to access pristine sites (Bryan 1977; Pabel & Coghlan 2011; Paterson et al. 2012). As a tourism site grows, specialists become displaced by a growing proportion of generalists who are more easily satisfied than specialists (Dearden et al. 2006; Meisel-Lusby & Cottrell 2008). Generalists often place more emphasis on the social and managerial settings of their experience, have greater interest in a wide range of services, and are more reliant on infrastructure (Catlin et al. 2011). This specialization framework has been applied to examine diving in Australia (Pabel & Coghlan 2011), Thailand (Dearden et al. 2006), and the United States (Paterson et al. 2012; Sorice et al. 2009).

The DD model suggests that in the absence of management, growing tourism will have increasingly negative impacts on the desired environmental, social, and managerial conditions. There is considerable support in the literature for this assertion in relation to wildlife tourism (Higham 1998a; Smith 2011; Ziegler et al. 2011) and SCUBA diving (Hasler & Ott 2008; Hawkins & Roberts 1993; Leujak & Ormond 2008; Luna et al. 2009; Van Treeck & Schuhmacher 1999). Establishing “limits of acceptable change” (LAC) (Stankey et al. 1984) requires managers to identify the level of resource protection, and social conditions desired at a wildlife tourism site. Based on these objectives, indicators can be set and evaluated against standards designed to ensure management objectives will be met. Appropriate management interventions can be enacted and the indicators monitored to ensure the site remains within the determined LACs. Figure 4 shows three

potential LACs applied together with recreation specialization and the tourism lifecycle in the Duffus- Dearden (1990) framework. LAC I indicates the level of use that a site can sustain without having a noticeable environmental impact. LAC II occurs when use is at a level that begins to compromise the wildlife species, and finally, LAC III occurs when the site reaches the maximum number of tourists that can participate in an activity and have it be sustained. After this point, the activity will either decline or will change dramatically catering to a different clientele and offering different activities and services.

In order to meet the preferences and needs of various visitors and simultaneously preserve the environment, a 2006 study revised the model to include what they termed the diver opportunity spectrum (DOS), which was based on the recreation opportunity spectrum introduced by Clark and Stankey (1979). Dearden et al. (2006) suggested three DOS levels as a management tool to match dive site characteristics with user specialization levels and represent the range of opportunities available within each LAC. DOS I targets the most pristine and attractive dive sites in the region, zoned to protect the best experiences that are least accessible, most attractive, and have the lowest density of visitors. This region requires strict monitoring to maintain ideal conditions. DOS II includes less pristine sites with less restrictive management and high diver densities while DOS III includes the most accessible sites with minimal management, ideal sites to use for training new divers.

The DD model has been applied in various studies to assess the position, and therefore the sustainability of an industry. For instance, it has been applied in studies of tourism with marine birds (Higham 1998b), whale sharks (Catlin & Jones 2010), manatees (Sorice et al. 2006), whale watching (Peake 2011), and diving (Dearden et al. 2006) (for a complete review see Catlin et al. 2011). Despite this robust application, one of the main dynamic, and underused, elements of the model is time. To date, two studies have used longitudinal data to evaluate the models' ability to predict industry progression. Higham (1998b) found that the model was able to predict the evolution of tourists visiting an albatross colony in New Zealand. With an absence of management, the birds' wellbeing was compromised and there was a shift to less specialized visitors who were less

environmentally aware. Similarly, Catlin and Jones (2010) studied the whale shark watching industry in Ningaloo Marine Park in Australia and found increasing numbers of generalist visitors exhibited different preferences for their whale shark watching experience. The generalist visitors were less skilled, demonstrated a higher tolerance to crowding, and were more concerned with the non-wildlife parts of their experience. Despite the potential for diving as a conservation tool, no studies have tested the changes to dive visitor experiences or the sustainability of a diving industry over time. Both of these aspects are necessary to inform our management of diving industries as conservation tools, as well as to test our application of the DD model.

This paper reports on diving visitor experience and industry sustainability on the Andaman Coast of Thailand. The experience of divers was first studied in 2000 with an evaluation of diver specialization, motivations, and satisfaction (Bennett 2002; Dearden et al. 2006). The initial study found indicators of declining user specialization such as low satisfaction among more specialized divers. Similar to findings in the Australian whale shark watching industry by Catlin and Jones (2010), Dearden et al. (2006) found that novice participants (generalists) had different preferences than specialist divers and were more focused on the general aspects of their experience such as exploring new environments and being in warm water, and were more easily satisfied. Based on these findings, Dearden et al. (2006) argued for restrictions in the overall numbers of divers as well as interventions to deter generalist divers from highly vulnerable sites. The study was completed at a time when Phuket was the center for all diving on the Andaman Coast and had experienced substantial growth in the preceding decade. It has grown rapidly from two or three companies based in Phuket in the 1980's, to 80 companies in 2000, and more than 115 companies distributed between Phuket and Khao Lak in 2012. After completing their study, Dearden et al. (2006) suggested that the diving industry would not be sustainable in the absence of improved management. The present study repeated this research in 2012 to track the changes that have occurred to diving and reassess the sustainability of the industry as a conservation tool.

4. Methods

From January to May 2012, diving tourists to the Andaman coast of Thailand completed surveys that asked closed and open questions about their level of experience, motivations, and satisfaction with their dive trip, as well as socio-demographic characteristics (Appendix IV). Two sampling approaches were taken: a paper questionnaire administered on board dive boats, and an online version of the same survey that respondents completed in the weeks following their dive trip.

4.1 Paper Survey Methods

The sampling strategy and research instrument were designed to maximize comparability with the questionnaires collected in 2000 (A summary of the methods used is shown in Table 1). Stratified random sampling was used to select 23 of the approximately 116 companies operating along the Andaman coast based on the region of operation, the price of trips offered, and the types of activities available. All divers on participating boats were asked to complete a survey about their diving experience.

Table 1: Survey structure in 2000 and 2012

	2000	2012
Study season	January - June	January - May
Approximate number of companies in population	85	116
Number of companies in sample	15	23
Languages	English, German, Japanese	English
Survey Design	Before/after dive	In person/ intercept

In 2000, the diving industry was dominated by American, German, and Japanese tourists and questionnaires were offered in English, German, and Japanese. In 2012, the industry had diversified significantly; although it still catered to many Germans, Americans, and Japanese, there were now equally large (if not larger) numbers of Russians, Chinese, Koreans, Finnish, and French divers. It was not possible to provide surveys in all these

languages, therefore only English surveys were used. Questionnaires were administered by either the researcher or the dive trip leader after participants had finished one or more dives (Appendix V).

4.2 Intercept Survey Methods

In 2000, the Similan and Surin islands were accessed almost exclusively by liveaboard trips, but by 2012, many companies had stationed overnight boats on the islands and used speedboats to shuttle divers daily. This shift meant that day trip divers were not on board a boat long enough to complete a questionnaire. Instead, these divers were intercepted when returning to their pier and asked to complete an online survey.

Intercept surveys were completed daily between March 17 and April 6, 2012. Visitors were approached by the researcher or an assistant who would introduce themselves and ask each diver to complete a 15-minute survey online about their diving experience (Appendix VI). Two or three days after the intercept, each diver was sent an email that reminded participants about the study, provided a link to the online survey, explained the purpose of the project, and outlined the confidentiality promise (Appendix VII). Four weeks after the initial email was sent, respondents were emailed a second reminder that they could participate until the end of data collection on May 15, 2012.

Five percent of the 251 divers contacted did not want to provide their email address while 20 percent did not have enough time, could not speak English, or provided an illegible email address. This resulted in 165 addresses that were sent survey information, 33 of which were returned to sender. In total there were 132 successfully sent surveys and of those, 60 were completed before the deadline of May 15, 2012. This figure represents a 45 percent response rate (60/132) of divers successfully contacted or 24 percent (60/251) of divers intercepted. A total of 591 visitors surveys were collected in 2012 using both intercept surveys and on-board questionnaires.

4.3 Data Analyses

Results from all 2000 and 2012 surveys were compiled and analyzed in IBM SPSS Statistics. T-tests and chi-square tests were used to determine if differences exist in the responses given in 2000 and 2012 on motivations, satisfaction, specialization, and willingness to return.

Diver specialization was measured using an index consistent with the Dearden et al. (2006) study. The index is based on three dimensions suggested by Bryan (1977) including past diving experience, investment in diving, and centrality to life. The index uses a series of seven questions converted to a binary scale and summed to allocate each diver a value between 0 and 7. Based on this value, divers were assigned to one of three groups: (0-3) low specialization, (4-5) medium specialization, or (6-7) high specialization.

Overall satisfaction was measured in two ways: a 10-point scale (1=highly dissatisfied, 10=high satisfied), and a 5 -point scale comparing actual experience with expectations ("much worse" to "much better"). Diver motivation and satisfaction with specific trip features were each measured using a 5-point likert scale ranging from "very unsatisfied"/ "very unimportant" to "very satisfied"/ "very important". Finally, divers willingness to return was measured on a 3- point scale (yes, no, unsure).

Economic contribution was measured with two open-ended questions: "how much did you spend on your dive trip" and "how much did you spend on other non-dive trip expenses while in Thailand". In 2000, all values were given in USD, while in 2012, values were given in the currency indicated and were converted to USD within the month the survey was collected for consistency with the 2000 survey. To calculate the change in economic contribution between years, mean values were obtained and inflation was calculated based on the US consumer price index (CPI). The amount spent in each category in 2000 was transformed to the amount that would hold the same buying power in 2012 based on average CPI values for both years. Both the 2000 and 2012 values were

then converted to THB based on the average conversion rate for each year to represent their buying power in Thailand.

5. Results

The 2012 diving industry was markedly different than that in 2000 (Table 2). The most important motivators for divers in 2012 were clear unpolluted dive sites, the variety and abundance of marine life, and appropriate safety procedures. This is similar to 2000 when the strongest motivators were undamaged dive sites, clear, unpolluted dive sites, and variety and abundance of marine life. However, the trip features divers were most satisfied with changed between 2000 and 2012. In 2000, they were most satisfied by the friendliness of the crew, a high quality dive master and warm water. By 2012, divers were most satisfied with a high quality of service, the dive shops' commitment to the environment, and a high quality dive master.

Table 2: Diving visitors in 2000 and 2012 (%)

	2000 (Bennett 2002)	2012
On day trip	40	47
On liveaboard	61	57
Diving in Thailand for first time	60	55
Diving was the main reason for trip	64	38
Diving was a planned activity on trip	32	53
Diving was an unplanned activity	4	9
Interested in helping with reef monitoring	68	50
Male	64	59
Female	36	41
Bachelor degree or higher	48	70

Economic elements of the industry have also shifted dramatically. In 2012, the average amount spent on a dive trip was 29 910 THB while the average amount spent on other trip expenses was 60 420 THB. Accounting for inflation and fluctuating exchange rates, the average amount spent on these items in 2000 was 49 812 THB and 95 838 THB respectively. This represents on average a 40 percent loss in value of dive trips and a 37 percent loss in other economic contributions over the 12-year period.

The proportion of highly specialized divers dropped significantly between 2000 and 2012, while the proportion of low specialized divers increased ($p=<0.001$; $\lambda = 0.167$). Divers were relatively equally distributed in 2000, with over 30 percent in each specialization group. By 2012, 89 percent of divers were in either the low or medium specialization categories with only 11 percent of respondents in the high specialization category. Along with these changes to diver specialization, divers in 2000 and 2012 also had different expectations for their trip, placing different importance on many dive trip features (Table 3).

5.1 Motivations for Diving in 2000 and 2012

Four of seven *motivation factors* showed no significant change between 2000 and 2012 including: marine flora and fauna, desire to expand knowledge, develop diving skills, and social activity. Three features increased in importance in 2012: seeking adventure, underwater photography, and exploring new environments. With the exception of good photo opportunities, all *environmental features* showed a significant decline in importance from 2000. In 2012, divers rated several *service features* as significantly less important including: information from their dive master, friendliness of the crew, safety procedures, a good dive master, the compatibility of fellow divers, and a high quality of service (Table 3). Commitment to the environment, and on board services each demonstrated no change between years.

Table 3: Comparison of reasons for diving in 2000 and 2012

Dive trip features	***Mean importance by year***		***t***	***df***	***p***
	2000	***2012***			
Motivation to dive					
Marine flora and fauna	4.32	4.26	1.169	1014.00	0.242
Seeking adventure	3.23	3.77	-7.574	873.33	0.000
Underwater photography	2.61	3.02	-4.954	933.93	0.000
Explore new environments	3.85	4.02	-2.880	905.17	0.004
Expand knowledge	3.89	3.82	1.291	1011.00	0.197
Develop diving skills	3.73	3.75	-0.351	953.61	0.726
Social activity	3.63	3.19	-1.569	1008.00	0.117
Environmental features					
Good underwater visibility	4.48	4.16	7.273	1018.00	0.000
Variety and abundance of marine flora and fauna	4.61	4.50	2.927	1016.80	0.003
Unpolluted dive sites	4.69	4.56	3.462	1017.69	0.001
Undamaged dive sites	4.68	4.37	7.309	976.99	0.000
Easy dive conditions	3.33	3.07	3.930	978.55	0.000
Absence of crowding	4.26	3.87	7.341	1014.00	0.000
Good above water scenery	3.58	3.10	7.669	1009.00	0.000
Whale sharks	4.03	3.49	7.750	1010.36	0.000
Other sharks	3.77	3.54	3.145	1014.00	0.002
Manta rays	4.12	3.77	5.501	1014.00	0.000
Turtles	3.87	3.69	2.840	1011.39	0.005
Good photo opportunities	2.90	3.24	-4.102	965.17	0.000
Opportunity to learn about environment	3.84	3.70	2.364	998.60	0.018
Service Features					
On board services	3.66	3.67	-0.245	1006.00	0.806
Information from dive master	4.37	4.22	3.231	1012.00	0.001
Friendliness of crew	4.23	4.13	2.106	1010.00	0.035
Safety procedures	4.60	4.44	3.820	992.55	0.000
Good dive master	4.55	4.38	4.201	1008.96	0.000
Compatibility of fellow divers	4.10	3.58	10.391	1001.76	0.000
High quality of general service	4.12	3.95	3.633	995.37	0.000
Commitment to environment	4.43	4.35	1.674	1002.60	0.094

5.2 Satisfaction with Dive Trip Features and Willingness to Return

Overall diver satisfaction declined 17 percent between 2000 and 2012 (Table 4). Despite this, there was no change to the reported satisfaction compared to expectations between years. This indicates that while satisfaction is declining substantially, diver expectations are also declining. Consistent with this, diver willingness to return, an important indicator

of industry sustainability, did not change between 2000 and 2012 ($p=0.982$). However, the distribution of willingness to return in 2012 differed significantly by specialization with more specialized divers less willing to return than their low specialization counterparts ($p=0.018$; $\lambda=0.025$).

Table 4: Comparison of satisfaction with dive trip features between 2000 and 2012

Dive trip features	***Mean satisfaction by year***		***t***	***df***	***p***
	2000	***2012***			
Overall Satisfaction	9.2085	7.6872	2.982	472.955	0.003
Satisfaction compared to expectations	3.4167	3.4766	-1.004	980.887	0.316
Motivation to dive					
Seeking adventure	3.49	3.77	-5.270	996.00	0.000
Explore new environments	3.90	4.08	-3.273	1001.00	0.001
Develop diving skills	3.81	3.82	-0.022	998.00	0.983
Social activity	3.78	3.61	2.563	996.31	0.011
Environmental features					
Good underwater visibility	3.62	3.92	-4.857	969.88	0.000
Variety and abundance of marine flora and fauna	4.06	4.08	-0.337	1005.00	0.736
Unpolluted dive sites	3.85	3.91	-1.111	974.86	0.267
Undamaged dive sites	3.68	3.57	1.611	999.00	0.108
Easy dive conditions	3.87	3.95	-1.403	1007.00	0.161
Absence of crowding	3.27	3.25	0.199	967.46	0.842
Good above water scenery	4.09	4.03	1.344	994.00	0.179
Whale sharks	1.82	2.01	-2.573	924.42	0.010
Other sharks	2.67	2.29	4.636	945.52	0.000
Manta rays	2.61	2.70	-3.673	967.89	0.000
Turtles	2.47	3.02	-6.276	971.73	0.000
Good photo opportunities	3.31	3.48	-2.548	964.00	0.011
Opportunity to learn about environment	3.70	3.74	-0.682	898.83	0.495
Service Features					
Good dive master	4.61	4.24	8.665	932.78	0.000
High quality of general service	4.41	4.34	1.374	985.15	0.170
Commitment to environment	4.44	4.29	3.323	989.01	0.011

Fewer significant differences were present in satisfaction between years than changes to motivations. Divers in 2012 were more satisfied with their opportunity to seek adventure, explore new environments, take good photos, experience good underwater visibility, and

see turtles, whale sharks, and manta rays (Table 4). In addition, each of the features that increased in importance in 2012 demonstrated a corresponding increase in satisfaction. Divers were less satisfied with their opportunity for social activity, to see sharks, having a good dive master, and the dive shop's commitment to the environment. There was a significant decline in the importance attached to undamaged dive sites in 2012, yet there was no change to diver satisfaction with dive sites. Additionally, the 2000 study noted that the opportunity to see whale sharks was heavily advertised and consequently was a significant motivating factor for many divers. Unfortunately, whale shark sightings were becoming rare (Theberge & Dearden 2006), leaving many divers disappointed. In 2012, there was less promotion of whale shark sightings, which may account for 2012's fewer disappointed patrons. In a similar way, photography has grown in importance as well as satisfaction. This has happened congruent with technological advances that make taking underwater photos more accessible for everyone, regardless of experience. The past 12 years has also seen growth in social networking sites that promote the use of photos as a public display and documentation of life events.

6. Discussion

Between 2000 and 2012 the Thai diving industry changed substantially. In 2000 it was characterized by approximately equal proportions of divers in each specialization category. By 2012 however, the industry was primarily composed of low and medium specialization divers who had lower expectations for their dive experience and expressed lower overall satisfaction. Despite this, divers reported a similar willingness to return and in both years expressed no change to their satisfaction compared to their expectations. These findings indicate an important shift in the sustainability of the dive industry in Thailand that has implications for the management of MPAs.

This shift away from an even distribution of low, medium, and high specialization divers in 2000, to an industry dominated by low and medium specialization divers is similar to the change observed in the whale shark watching industry in Ningaloo Marine Park (Catlin & Jones 2010). Between 1995 and 2005 there was a growth in the industry and an

associated increase the in the proportion of low specialization tourists. Similarly, the present study found that with fewer specialized divers visiting the Andaman coast, the overall expectations for dive trips in 2012 were dramatically reduced across the industry, a finding that is congruent with other wildlife-based tourism industries (Catlin & Jones 2010; Pabel & Coghlan 2011), and is consistent with the predictions of the DD model. Often, recreationists that are less specialized visit destinations for a variety of reasons and choose to participate in the focus activity to supplement their experience rather than it being the central focus of their trip (Bryan 1977; Catlin & Jones 2010). Despite diver satisfaction showing a significant decline in the 2012 study, there was no change to satisfaction compared to expectations, suggesting visitors had overall lower expectations in 2012. We also found that divers in 2012 were far less likely to have visited Thailand for the primary purpose of diving. This peripheral importance of diving can manifest in lower expectations for specific aspects of their diving experience as their focus shifts from diving-specific activities to more general aspects of their trip. For instance, there was a significant decline in the importance attached to visiting undamaged dive sites in 2012, yet there was no change to diver satisfaction with the level of damage despite documented declines to reef quality on the coast (Phongsuwan 2013).

If less specialized divers focus more on non-diving aspects of their trips, they may place higher emphasis on having opportunities for social activity. Although there was no change to the importance placed on social activity in this study, we found that divers in 2012 were significantly less satisfied with their opportunity for social activity than in 2000. It is possible that this finding is another, different, manifestation of a lower specialized population. Divers with less experience, as found in 2012, may be less comfortable in their surroundings and therefore, less inclined to engage in other new activities such as interacting with unfamiliar people. Compounding on this, it is possible that divers for whom diving is a peripheral activity have less in common with one another than those more experienced divers who in 2000, made up a larger proportion of the industry. In past years it is likely that specialists discussed marine life, diving gear, and other destinations they had visited. While the overall population of less specialized divers

exhibited lower expectations and no change to their overall willingness to return, when examined alone, the response of high specialist divers differed.

Despite no overall change to diver willingness to return or satisfaction compared to expectations, high specialization divers reported being much less willing to return for diving on the Andaman coast. With only 53 divers classified as highly specialized, it is likely that some are atypical high specialists and likely exhibit a level of place fidelity and will continue to dive in Thailand despite changes to the industry or reef conditions because they value other aspects of the trip. Congruent with this, we found that there were fewer first time visitors to Thailand in 2012 than 2000. In addition, 2012 divers were more likely to be visiting Thailand primarily for reasons other than diving. This suggests that many 2012 divers may be Thai loyals, valuing things such as Thai food, language, culture, or that they have an established community of friends and family. This finding suggests the continued trend toward the extinction of high specialists as visitors move toward those for whom diving is secondary to other motivations. Divers who are less invested in the activity, are often also less invested in reef conservation and have a lower willingness to pay for the activity prompting negative implications for conservation.

Increasing proportions of less experienced visitors can contribute to rapidly shifting baselines and declining environmental memory. 'Shifting baselines syndrome' can alter visitor perceptions around what ideal conditions should be due to a gradual loss of memory about past conditions that results in an eventual accommodation of environmental degradation (Papworth et al. 2009; Pauly 1995). New or inexperienced divers have little prior information to establish expectations for environmental or social conditions and therefore can be more satisfied with their experience. Consistent with this, Breen and Breen (2008) found that divers have the cognitive ability to adapt to the adverse conditions of increased use. In addition, a phenomena known as "product shifts" can complicate visitor responses and increase the acceptability of undesirable conditions (Shelby et al. 1988). For instance, when visitors engage in a remote wilderness experience but encounter conditions that are inconsistent with their expectations, such as

more people and infrastructure, many will shift their definition of the product (in this case the diving trip) to something that better fits reality, such as a semi-wilderness experience. Other studies show that visitor perceptions of reef conditions can be inconsistent and largely inaccurate, although education and experience have been associated with more accurate perceptions of reef quality (Leujak & Ormond 2007; Uyarra et al. 2009). Similar results were found in Thailand during a study completed after the Southeast Asian tsunami where 85 percent of recreational divers did not detect damage on reefs that had been classified as degraded (Main & Dearden 2007). Shifting baselines and product shifts together may accelerate the development of a market for damaged reefs as people forget or shift their expectations for their Andaman underwater experience.

6.1 Duffus & Dearden Wildlife Tourism Model

Declining specialization, generalized motivations, and little change to satisfaction all confirm predictions posed by Dearden et al. (2006) based on their initial study of the Andaman coast diving industry, as well as the progression expected by the DD model. Both papers predicted that without improved management, reef conditions would decline and prompt a continued shift toward less specialized divers. More companies were operating out of the Andaman coast in 2012 than in 2000 illustrating continued industry development. However, through the same time period there was a resounding shift in the industry away from high-class and research-based operators. Over the past several years, every high-end company either foreclosed or left Thailand to capitalize on emerging clientele in Indonesia. This is consistent with observations by Burton (1998) who found that many ecologically focused tourism operators respond to increasing competition by relocating. Additionally, overall satisfaction significantly declined between 2000 and 2012 suggesting the possibility of slowed growth in coming years. Together, these findings indicate that the Andaman coast diving industry has continued to grow but has a significantly different composition in terms of the nature of divers and the industry that caters to them.

This new industry lacks the high-end, ecologically inclined portion of the market and is instead comprised almost exclusively of mass tourism that has segmented into many small, niche markets that cater to the diverse nationalities of visitors to the Andaman coast. The diversification of Thailand's tourism base allows increasingly niche markets to maintain a substantial enough clientele to continue operating, yet the mass-tourism nature of the new industry dramatically reduces the conservation potential of diving in the region. This progression echoes a trend observed in the trekking industry of Northern Thailand where visitors shifted from being path-breaking adventurer's focused on getting to know different ethnic tribes, to more general recreationists (Dearden & Harron 1994). This trend was accompanied by a diversification of the activities offered within the industry to include river rafting, elephant riding, and jungle survival skills. A similar diversification of attention and activities may be seen now on the Andaman coast with the provision of language-specific trips, quicker access routes, and supplementary beach visits. In addition, there is consistent turnover among dive operators. Despite a high rate of dive operator start-up, many companies become insolvent due to high competition and overhead costs, and lower price expectations from dive tourists. This high turnover may mask small declines within the industry.

Based on these findings, we suggest a specification to the DD model that reflects the observed progression from an industry with high conservation potential that caters to both generalist and specialist visitors, to an industry that splits, loosing the high end portion and resurging with mass-market niche tourism. The new industry is substantially different from when it first emerged, having lower standards, less economic value, lower specialization visitors, less investment in conservation, and reduced potential as an incentive-based conservation mechanism.

This study of Andaman coast diving, as well as longitudinal studies completed by Higham (1998b) and Catlin and Jones (2010) tell us that the DD model can be used to understand and predict changes to wildlife tourism industries at various points of development. Knowing this, wildlife tourism managers, or managers of MPAs need to use LACs to establish the ideal level of development for their tourism site, promoting

conditions within the first stages of development that prioritize high paying, low impact visitors. As suggested by Butler et al. (2007) and Catlin et al. (2011), it is possible that emerging destinations will progress more quickly through the tourism lifecycle or omit the first few stages as more people travel and seek diversified tourism experiences. This makes establishing effective management practices even more pertinent in order to slow the decline of fragile marine ecosystems.

6.2 Management

Several studies have demonstrated interventions that can be effective at managing wildlife tourism opportunities including regulating access (Di Franco et al. 2009; Hasler & Ott 2008), providing tailored opportunities for low and high specialization recreationists (Dearden et al. 2006; Thapa et al. 2006), capitalizing on user fees to fund conservation (Asafu-Adjaye & Tapsuwan 2008; Depondt & Green 2006), providing in-depth interpretive programs that educate visitors on reef ecology and appropriate underwater behaviour (Medio et al. 1997), and providing training for dive leaders to intervene when divers make contact with reefs or associated fauna (Barker & Roberts 2004). Many of these tools can be applied to destinations such as the Andaman coast of Thailand to control changes to the industry and preserve the conservation value of diving.

Despite this potential, shifting industry conditions found on the Andaman coast suggest that managing the dive industry as a conservation tool may be more difficult to achieve in 2012 than it would have been in 2000. Lower specialized recreationists often have different attitudes toward management restrictions than their more specialized counterparts (Sorice et al. 2009). In addition, the lower economic contribution made by the divers in 2012 will restrict local economic development and weaken the use of diving an incentive-based conservation mechanism. As found in this study, other studies have found that less specialized divers are often more concerned with the affordability of a dive trip and are less inclined to pay high diving fees, which could compromise the ability for conservation funding (Pabel & Coghlan 2011). Visitors in 2012 also identified

less interest in learning about the marine environment and a drop in interest to do reef monitoring, highlighting the diminishing conservation potential.

The development of effective interpretation programs will be an important tool to try to counteract these shifts and instil in visitors a conservation ethic to protect the reefs from growing pressures including that of increased visitation. A study by Medio et al (1997) documented the substantial influence of thorough pre-dive briefings on underwater behaviour. Another study in Australia showed that environmental education-based interpretation programs can be an effective means of managing visitor interactions with wildlife (Orams 1997). Other management tools such as restrictions to the number of boats, divers, and frequency each site is visited may preserve the attractiveness and ecological conditions of protected reefs (Leujak & Ormond 2008). Operator certification systems can provide an incentive for dive companies to use appropriate interpretation programs and comply with regulations by promoting their sustainable approach and set a standard for companies to strive for (Anderson et al. 2012). Finally, zoning sites based on visitor experience using the DOS measures proposed by Dearden et al. (2006), will preserve a diversity of experiences within the region.

7. Conclusion

While MPAS are an essential conservation tool to allow marine biodiversity to recovery, their slow rate of establishment requires that they be supplemented with other methods. SCUBA diving can play an important role in achieving the conservation of fragile ecosystems. This study compared the Andaman coast diving industry in 2000 and 2012 and found the industry had less conservation value and was further from being an incentive-based conservation mechanism in 2012 than had been previously. While there were approximately equal proportions of three specialization levels in 2000, by 2012 the industry was dominated by low and medium specialization divers who had lower overall expectations for their dive trip experience and were more focused on general aspects of the trip. In addition, divers in 2012 contributed an estimated 37 percent less to the local

economy than those in 2000, compromising the potential for conservation funding and alternative livelihood development within the region.

During the initial study, the industry was assessed as approaching the decline phase of the DD wildlife tourism model. This analysis suggests that instead, the industry split. The high-end and research focused portion was displaced as predicted, but the mass-market industry continued to grow and diversified into several niche markets with lower overall conservation value. Based on these findings, this study suggests an elaboration of the DD model to account for the development of a dramatically different, mass-tourism niched market and the associated loss of conservation potential. In the face of declining reef conditions, shifting industry structure and changing visitation, management becomes even more crucial to mitigate the impacts of human activity. Employing limits of acceptable change and establishing effective management interventions such as high impact interpretation programs will be necessary for the sustainable development of diving and its promotion as a conservation tool.

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Paper 2

Searching for the 'eco' in ecotourism: Few incentives for conservation focused tourism in the Andaman coast diving industry

1. Abstract

Urgent action is needed to counteract accelerating marine destruction and ecotourism is one tool that can help slow the loss of biodiversity. This study evaluates the ecotourism status of the diving industry on the Andaman coast of Thailand and makes recommendations for using diving to strengthen the conservation of the coast. Surveying websites, the study evaluates the compliance of dive operators with ecotourism principles outlined by The International Ecotourism Society (TIES), as well as the ecotourism values and motivations of diving visitors. Key findings include:

- One out of 86 companies surveyed described activities and services that meet the TIES principles for ecotourism
- There are three groups of ecotourists: serious ecotourists (15.6%), casual ecotourists (50.3%), and non-ecotourists (34%)
- There was no difference to satisfaction based on ecotourist group but serious ecotourists were less willing to return
- Increasing the conservation value of the dive industry requires interpretation programs that cater to mainstream tourists

2. Introduction

Urgent action is needed to counteract accelerating marine destruction. Ecotourism ventures offer one solution that can benefit conservation and simultaneously support local communities. SCUBA diving is one such nature-based tourism activity that offers benefits to conservation, particularly in Southeast Asia, a hub of both global marine biodiversity and tourism arrivals. The dive industry is often advocated as a form of marine ecotourism that can provide alternative livelihood options for local communities, enhance the conservation of local coral reef ecosystems, and provide educational

opportunities for visitors. In fact, for many southern nations in the world, ecotourism has become the primary generator of foreign currency (Moreno 2005).

Thailand receives several million visitors per year, many of whom travel to visit the coastal regions including the well-known coral reefs on the Andaman coast. It has been estimated that diving brings upward of $150 million USD to the region annually (Bennett 2002). This suggests that diving could offer significant potential to fund conservation and contribute to local communities, yet various factors make ecotourism difficult to achieve. This study evaluates the ecotourism potential of diving on the Andaman coast of Thailand based on the compliance of dive operators with several ecotourism principles, as well as the ecotourism values and motivations of diving visitors.

3. Literature Review

The ocean provides life-services necessary for human survival yet oceanic ecosystems are under continual pressure from human activities that threaten biodiversity, disrupt natural processes, and impair the ocean's ability to recover from disturbances (Gaston et al. 2008; Worm et al. 2006). Since the 1990's ecotourism has become an increasingly prominent topic in marine conservation literature, offering to contribute to the ecological, socio-cultural, and economic conditions in local regions (Agardy 1993). Ecotourism can act as a conservation tool in currently unprotected marine regions or can complement conservation efforts already established, such as marine protected areas, by increasing the attractiveness of protected regions, generating funds for conservation efforts, providing revenue to local peoples, and promoting awareness of marine ecological issues (Eagles 2013).

Ecotourism is a concept that has been infinitely redefined including concepts such as: nature-based, minimal impact, includes a form of environmental interpretation, and most importantly, makes a positive contribution to conservation (Buckley 2003; Buckley 2009; Donohoe & Needham 2006). The International Ecotourism Society (1990) describes ecotourism as “responsible travel to natural areas that conserves the environment and improves the well-being of local people”. This positive contribution to conservation can

be achieved through ecotourism activities such as wildlife viewing, restoration activities, volunteer data collection, and public environmental education (Rollins et al. 2009). To achieve conservation benefits some ecotourism industries aim to alleviate poverty by developing alternative livelihoods that reduce dependence on resource extraction, providing employment opportunities, and generating revenue for local communities. They also conduct activities to restore local ecosystems, complete research on ecosystem health and functioning, generate revenue to fund conservation, and generate awareness through environmental education (Brondo & Woods 2007; Galley & Clifton 2004).

There are instances where ecotourism has met many of these goals well. For example in Fiji a community set aside a small area for protection that now includes snorkelling tours, annual ecological surveys, education opportunities for local students, and the sale of locally made products (Sakata & Prideaux 2013). Similar success stories have occurred around the world (Brondo & Woods 2007; Galley & Clifton 2004). However, the level of investment in conservation and local communities varies within ecotourism ventures in part due to the myriad of challenges associated with effective ecotourism practices. Challenges include unequal power distributions within communities, revenue leakage through foreign operators, and increased pressure on natural resources, each of which can lead to resistance to ecotourism and conservation efforts (Carrier & Macleod 2005; Christie 2004; Kruger 2005)

While some operators take extensive action to conserve the natural environment and support local communities, other operations pay little regard to conservation or the fundamental ecotourism principles using the term as a marketing strategy to attract tourists without regard for its meaning, a problem often termed ‘greenwashing’ (Carrier & Macleod 2005; Orams 1995). Greenwashing is particularly pronounced where there is a lack of regulations and guidelines for operators, who often do not know what ecotourism requirements to be following (Kruger 2005).

In an effort to standardize the requirements for ecotourism operators, TIES (2012) suggests several principles that centre on "uniting conservation, communities, and sustainable travel…

- Minimize impact
- Build environmental and cultural awareness and respect
- Provide positive experiences for both visitors and hosts
- Provide direct financial benefits for conservation
- Provide financial benefits and employment to local people
- Raise sensitivity to host countries' political, environmental and social climate".

SCUBA diving is one marine-based environmental activity that can provide many of the benefits sought by ecotourism. Dive tourism can generate significant rates of return both for local communities and conservation. In Mu Ko Similan National Marine Park in Thailand, divers were documented as being willing to pay up to $62.64 USD per annum to dive in the park, amounting to $2.1 million USD in revenue per year (Asafu-Adjaye & Tapsuwan 2008). In addition, divers contribute over $150 million USD per annum to the local economy in Phuket (Bennett et al. 2002). In some places, the user fees paid by tourists benefit conservation by providing employment opportunities for locals who would otherwise depend on extractive-based livelihoods (Clifton 2005; Taylor et al. 2002). Marine parks such as those at Saba and Bonaire have become self-financing through tourist access fees, allowing for conservation that would otherwise be impossible (Hawkins et al. 2005; Uyarra et al. 2009). Additionally, operations with interpretation programs built on environmental education principles can change tourist's interaction with wildlife, promoting more ecologically aware behaviour (Orams 1997). Finally, many dive operators organize restorative activities such as reef clean ups and building artificial reefs, directly contributing to coral reef conservation (Brock 1994).

Ultimately, ecotourism ventures are profit-driven and will cater to what their customers want. Understanding tourist motivations, values, and expectations is an important part of estimating the eco-potential of an industry. Not all ecotourism participants are themselves ecotourists. Ecotourists and mainstream tourists have different motivations, preferences,

and interests (Hvenegaard & Dearden 1998; Perkins & Grace 2009). For instance, ecotourists most value nature, are bio-centric, and have a strong interest in experiencing and learning about the environment, while mainstream tourists place more value on relaxation and spending time with their family (Beaumont 2011; Eagles 1992; Galley & Clifton 2004; Weaver 2002). Unlike mainstream tourists who may participate in ecotourism occasionally or by accident, ecotourists regularly seek out specific ecotourism activities that match their values (Galley & Clifton 2004). In most industries, ecotourists are the minority (Hvenegaard 2002). A study of ecotourism in Lamington National Park in Australia found that 'hardcore' ecotourists made up only one percent of the sample (Weaver 2002). Zografos and Allcroft (2007) segmented visitors based on eco-centric and anthropocentric values, while an Australian survey divided tourists based on social values and found that most did not have particularly green values (Blamey & Braithwaite 1997).

The ecotourism value of the diving industry within Thailand has had no evaluation to date. With a growing tourism industry fed largely off attractive coastal resources, the Andaman coast is a vital place for conservation efforts. This study aims to understand the strengths and weaknesses of the diving industry as an ecotourism and conservation venture. To investigate this we first examine the use of ecotourism components as marketing mechanisms, and second, we group visitors based on their ecotourism values and expectations. Exploring these components together, we can evaluate the ecotourism potential of the industry and make recommendations for using diving to strengthen the conservation of the coast.

4. Methods

4.1 Ecotourism Web-Marketing Survey

The first approach surveyed the websites of dive operators based in Phuket and Khao Lak to understand better their use of ecotourism concepts such as conservation, community investment, and science as marketing mechanisms. A total of 149 diving companies in Phuket and Khao Lak were identified through two means. First, the most current list of dive operators based in these regions was obtained from the Thai Diving Association

(TDA). Second, internet searches on google.com and yahoo.com were conducted using keywords such as "Scuba diving", "Phuket", "Thailand", and "Liveaboard". Of the companies identified, those that act primarily as online booking agents, charter companies, or retail stores were excluded from the sample. Additionally, companies that had moved, gone out of business, did not offer a website in English, or no longer had websites were also excluded (Appendix VIII). This list was verified through interviews with approximately 10 longstanding dive operators in both Phuket and Khao Lak. It is unlikely that this is a completely exhaustive list of all tour operators, but it represents a significant sample of the diving industry and provides a look at the use of ecotourism principles in marketing by dive operators within this highly competitive industry.

Each of the remaining 86 websites were examined for content relating to ecology, conservation, science, research, or community involvement. Five to ten minutes was spent on each site, looking for three specific criteria. Criteria 1: *The presence of keywords*. Each major page of the website was examined for keywords such as "scientific projects", "eco", "conservation", "environment", "awards", "projects", "marine life", or "community investment". Criteria 2: *Affiliated organizations*. Each website identifies the operators membership to various diving organizations such as PADI, SSI, CMAS, NAUI, BSAC, or VDST. This section also includes badges that indicate membership or affiliation with conservation and sustainable operators programs such as Project Aware[1], Mission Deep Blue, Ranger Station[2], and Greenfins[3], indicating that a company may have an ecotourism component. Criteria 3: *Ecological Awards*. Individual websites were examined for mention of environmental or ecotourism awards. For instance, it is possible

[1] Project AWARE is a marine conservation advocacy organization founded by PADI that aims to create a network of educated divers and raise awareness and conservation efforts around key marine issues. (www.projectaware.org).

[2] Mission Deep Blue is a program jointly founded by Scuba Schools International (SSI) and Sharkproject. As a part of the program, dive centers can be recognized as "Ranger Stations" that provide marine conservation training and agree to follow a set of responsible tourism guidelines. (http://www.divessi.com/deep_blue_responsibility).

[3] Green Fins was started in 2004 by the United Nations Environmental Programme (UNEP) and aims to promote sustainable diving tourism by describing responsible behaviours for tourists, and setting environmental standards for diving companies. (http://www.greenfins.net).

for companies to be recognized by awards such as the PADI 'Green Star' award for exceptional commitment to environmental conservation efforts. Websites that met one or more of these criteria were identified as companies that potentially offered ecotourism activities and were examined at length to understand the type, duration, and significance of the projects the company invests in.

4.2 Visitor Expectations and Investment Survey

To understand the types of tourists diving on the Andaman coast of Thailand, from January to May 2012, divers completed surveys that asked closed and open questions about their expectations, interest in conservation, and satisfaction as well as socio-demographic characteristics (Appendix IV). Divers either completed a paper questionnaire on board their dive boat, or an online version of the same survey during the weeks following their dive trip.

Twenty-three of the 116 companies operating on the Andaman coast of Thailand were selected based on their region of operation, the price of trips offered, and the types of activities offered. All divers on participating boats were asked to complete a survey about their expectations for their dive trip. Some visitors accessed dive sites on speed boats and could not complete surveys on board the boat therefore these divers were intercepted daily between March 17 and April 6, 2012 while returning from their trip and asked to complete an online survey.

During the 21 days of intercept surveying, 251 divers were contacted. Five percent of divers contacted did not want to provide their email address while 20 percent did not have enough time, could not speak English, or provided an illegible email address. In total there were 132 successfully sent surveys and of those, 60 were completed before the deadline of May 15, 2012. This figure represents a 45 percent response rate (60/132) of divers successfully contacted or 24 percent (60/251) of divers intercepted.

Using these two methods, 591 visitor surveys were collected, compiled in IBM SPSS Statistics, and clustered into several groups based on eight ecotourism indictor variables.

Ecotourism indicators include: importance of marine life as a motivation for diving, ownership of a fish field guide or a coral field guide, willingness to participate in reef monitoring, concern with climate change, interest in learning more about marine life and climate change, and the importance of dive shop commitment to the environment. Based on these variables, data were analyzed using a two-step hierarchical clustering procedure. This is a similar procedure to the one taken by Weaver (2002) who also used a clustering method to identify levels of ecotourism. The two-step clustering used in this study is designed to handle large datasets as it creates small sub-clusters to reduce the size of the dataset then sorts sub-clusters into internally –similar groups using an agglomerative hierarchical clustering method. Distances were calculated using log-likelihood to account for the use of categorical variables.

5. Results

5.1 Dive Operator Ecotourism Marketing

Of the 87 websites examined, six companies (7 %) included an ecotourism component on their website (Table 5). The type, duration and significance of the ecotourism component operators included on their website varied vastly, and was evaluated against the TIES ecotourism principles. As each company aims to provide a positive experience for visitors, and diving typically does not involve a community host, the focus of the evaluation was on the remaining principles.

Andaman Scuba and Yellow Submarine Divers were identified as potential ecotourism operators because both have websites that contain an eco-related logo or keywords. For example, Andaman Scuba has a 'Go Eco Operators[4]' logo on their website while Yellow Submarine Divers has a PADI Project Aware badge on their front page with the promise that "this is no 'soft' sales talk", and "we really do care about the environment". Neither company provides any substantive information to illustrate their involvement or

[4] Go Eco is a campaign initiated by Project Aware to educate tourists and tourism operators about responsible tourism. Businesses who agree to follow the "Go Eco" principles of responsible tourism can identify themselves as a "Go Eco" operator; assisting tourists to identify ecologically committed companies and promoting best practices within the industry.

affiliation with these organizations. Based on this information, neither company meets any of the ecotourism principles outlined by TIES.

Sign Scuba and Similan Dive Center both indicate some direct but limited involvement in environmental initiatives. SignScuba advertise their environmental projects such as a coral implementation program in 2010, on a page titled “Scientific Programs”. Similan Dive Center has sections on “Education” and “Conservation” on their home page under which they describe the PADI naturalist courses they provide and their mission to “promote environmental awareness and embrace sustainable business practices”. As evidence, they identify their participation in a Project AWARE reef cleanup. Another page, called “Coral Science” provides information on coral structure, growth, distribution, threats, and associated conservation efforts, while a page for “Social Projects” does not contain any information. These two companies both are making efforts to contribute to conservation and by doing so are meeting two of the TIES ecotourism principles yet they do not describe minimizing their impact, building environmental or cultural awareness, or providing financial benefits to local people.

Table 5: Summary of dive operators and ecotourism criteria

Company	Keywords	Affiliated Organizations	Ecological Awards	Type, Duration & Significance of Projects
Andaman Scuba		• Go Eco Operator		
Scubacat	• "Eco Portal"	• Go Eco • Project Aware • Greenfins	• Project Aware Environmental Achievement Award (2006)	• Reef monitoring in Similan islands (2008) • Artificial reef at Racha Yai • Reef check monitoring at Racha Yai
SignScuba	• "Scientific programs"			• Coral implementation project at Koh Tao (2010) • Training center for Similan National Park rangers
Similan Dive Center	• "Environment" • "Education" • "Conservation" • "Coral Science" • "Social Projects"			• Webpage with information on corals and conservation • Project Aware reef cleanup Koh Bon
Wicked Diving	• "Ethical" • "Education" • "Action"	• Track progress against Global Sustainable Tourism Criteria		• Two percent of revenue directed to ecosystem protection • Built artificial reefs • Trained local youth to be dive master • Manta ray identification program • Support livelihood options for local orphanage
Yellow Submarine Divers	• "Environment"	• Project Aware		

Only two companies, ScubaCat and Wicked Diving market substantive contributions to local environmental conservation and community investment. ScubaCat hosts a page called “Eco Portal” that describes the ecological initiatives they are involved in, including compliance with the recommendations of three different conservation organizations demonstrating efforts to minimize impacts. They elaborate on three specific projects they have participated in: reef monitoring in the Similan Islands in 2008, the development of an artificial reef, and reef check monitoring at Racha Yai. ScubaCat also received the Project Aware Environmental Achievement award in 2006 that recognizes them as a tour operator that is making an exceptional commitment to the marine environment. Based on these activities, ScubaCat makes substantive contributions to conservation and restoration, meeting at least three of TIES principles but does not demonstrate community investment or environmental education.

Wicked diving describe themselves as an “ethical diving company” and outline their ecological and community contributions on every page of their website. During liveaboard trips they do not offer air conditioning, opting to save energy by not running the generator. Two percent of all revenue is directed into ecosystem protection, community development, and education funds. These funds are used for projects such as developing alternative livelihood options for a local orphanage of tsunami survivors, training local Burmese and Thai youth to become dive masters, building artificial reefs, giving marine awareness presentations to local schools, and participating in a manta ray identification program. These programs indicate that Wicked diving has minimal impact, promotes environmental and cultural respect, provides direct financial benefits to both conservation and local communities and invests in conservation activities making it the only operator of the 86 examined that meets all TIES ecotourism principles.

5.2 Diver Ecotourism Characteristics

The second component to understanding the ecotourism value of the industry is the motivations and interest of visitors. In this analysis diver surveys were clustered based on eight variables and were separated into three groups. The most important predictors to

determine the visitor ecotourist type were their possession of a fish guide, willingness to do reef monitoring, and their ownership of a coral field guide (Figure 5).

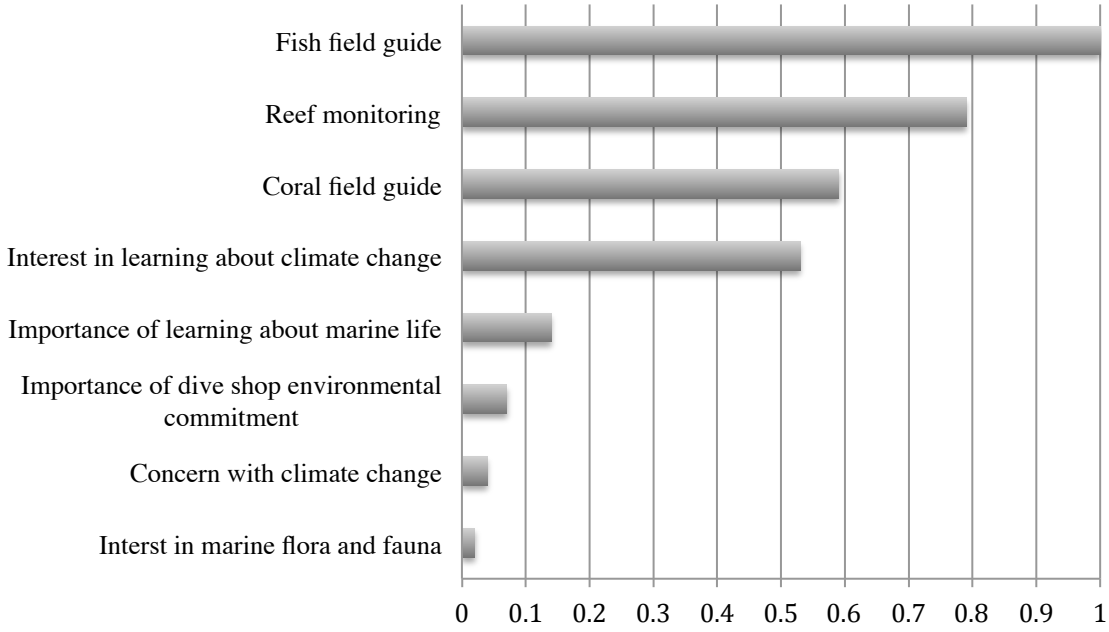

Figure 5: Relative predictor importance for diver ecotourist classification. 0= Least Important, 1 = Most Important. The higher the measure, the less likely the variation for a variable between clusters is due to chance and the more likely it is due to some underlying difference.

In all groups, most visitors rated seeing marine life as being very important. Similarly, most visitors in all groups rated the environmental commitment of the dive shop as being either important or very important. The lowest proportion of divers (15.6%) were included in a group we termed 'serious ecotourists'. Most of the divers in this group owned fish and coral guides, were interested in learning more about marine life and climate change, were willing to participate in reef monitoring, and were highly concerned about climate change.

Remaining divers were classified into one of two additional groups. Approximately half (50.3%) of divers were classified as 'casual ecotourists' and shared the same characteristics as serious ecotourists, except most did not own a fish guide or a coral guide. The remaining divers (34%) were 'non-ecotourists' and included the divers who were least interested in the ecotourism aspects of the trip. Most of these visitors did not

own any guidebooks, were not interested in learning about climate change or marine life and expressed slight concern with climate change.

Ecotourism groups were significantly related to both age ($p=0.00$; $\lambda=0.04$) and education ($p=0.01$; $\lambda=0.07$). Most serious ecotourists were 46 years of age or older while most visitors under the age of 46 were grouped as either casual or non-ecotourists. Most serious ecotourists had college education or bachelors degrees while visitors with no post-graduate education or those with masters or doctoral degrees were more often classified as casual or non- ecotourists.

There was no difference in overall visitor satisfaction amongst groups, their satisfaction compared to expectations, or their satisfaction with the environmental commitment of the dive shops. However, there was a significant difference ($p=0.01$; $\lambda=0.03$) in ecotourist groups' willingness to return. While overall 9.5 percent of all divers would not be willing to return based on their experiences, a greater proportion of serious ecotourists would be unwilling to return than casual or non-ecotourists.

6. Discussion

The website analysis suggests that the 2012 Andaman coast diving industry includes very few ecotourism operators. Several dive companies document substantial contributions to conservation but only one company of 86 examined, met each of the TIES principles for ecotourism operators. Consistent with this, based on our analysis, a small proportion (15.6%) of divers were identified as serious ecotourists who own fish and coral field guides, want to do reef monitoring, are concerned with and want to know more about climate change. The majority of divers (74.6%) were classified as either casual ecotourists (50.3%) or non-ecotourists (34%), demonstrating less interest in ecotourism activities. Despite different motivations within each ecotourist group, there was no difference in diver satisfaction based on group membership. In contrast, the more committed ecotourists were also the least likely to return based on their experiences.

6.1 Ecotourists

The study identified three groups of ecotourists within a largely non-ecotourism destination: a small group of serious ecotourists, a large group of casual ecotourists, and a mid-sized group of non-ecotourists. These results are similar to those found by Weaver (2002) who identified a small proportion of tourists as members of the most eco-centric group. Within a conventional tourism destination such as the Andaman coast, people travel primarily to spend time with family and relax, often opting to stay in luxurious accommodations with access to amenities such as shopping malls (Eagles 1992; Kontogeorgopoulos 2004). This contrasts with the ecotourism experience sought by people who prefer low impact travel and seek activities that provide the opportunity to learn about the environment or contribute to conservation. The different goals of ecotourists and conventional tourists could explain the small proportion of serious ecotourists found within a mainstream tourism destination. Despite the different motivations held by each group, this study found no difference in the satisfaction of more and less serious ecotourists on the Andaman coast, yet there was a significant difference in their willingness to return. There are three main ideas to explain this result: serious ecotourists self-satisfy by seeking rare ecotourism experiences, serious ecotourists on the Andaman coast are easily satisfied, or that divers accommodate undesirable conditions through a phenomena known as a 'product shift'.

The first explanation is that serious ecotourists who are motivated to learn about the marine environment and to contribute to conservation could be selecting their dive company based on these characteristics. Despite the low number of ecotourism operators, it is possible that a proportion of serious ecotourists chose to dive with those companies that offered the most in terms of conservation, learning, and community development opportunities and therefore, had a dive experience they were truly satisfied with.

The second explanation for the lack of difference in satisfaction amongst the groups is that although divers care about the environment and local communities, the diving population on the Andaman coast of Thailand is less discriminating than in other destinations. A study completed in Phuket showed that most divers care about

environmental conservation and community investment, and believe that diving makes important contributions to both these areas (Dearden et al. 2007). Despite this, divers may have flexible motivations and therefore, be easily satisfied by a range of different experiences. This non-discriminating attitude is demonstrated by divers in this study when asked about the importance of dive shops' environmental commitment. Most divers rated the environmental commitment of dive shops as being very important to their experience. Yet most also reported being satisfied or very satisfied with this same measure, despite our research showing that there is very little evidence for dive companies having invested in conservation, education, or local communities. It may be that there are many different types of visitors and that our use of simplistic categories to understand ecotourist motivations, preferences, and satisfactions may be misleading. For example, a diver may choose to be an ecotourist for a day and may seek the same type of environmental, social, and educative components to a trip that you would expect from the most serious ecotourists. Yet this more adventitious ecotourist may be more satisfied with a less intensive ecotourism experience than a more serious counterpart.

It is also possible that within a conventional tourism destination such as Thailand's Andaman coast, the most serious ecotourists with the most strict expectations are choosing to travel elsewhere. A 2000 evaluation of the ecotourism specialization of Phuket divers estimated that there was 20 percent highly specialized ecotourists (Bennett 2002). This is a substantially greater proportion than those identified in this study and could suggest that the most discriminating visitors are no longer visiting Thailand as predicted by Dearden et al. (2006). A similar shift was observed in Nigaloo Marine Reserve, as the destination became more popular and the companies more conventional, highly discriminating whale watchers were replaced with visitors who had lower expectations and were easily satisfied (Catlin & Jones 2010).

Finally, tourists may redefine their expectations for the experience to meet their reality better. This is known as a 'product shift' and can increase the acceptability of undesirable conditions (Shelby et al. 1988). In this study, divers completed the survey after finishing one or more dives and although they may have expected a particular type of ecotourism

experience, they may have shifted their expectations partway through their trip. Related to product shifts is the concept of 'cognitive dissonance' which describes the cognitive rationalization of unsatisfactory experiences (Breen & Breen 2008). Typically, tourists invest considerable time and money to seek out a specific activity and will want to avoid admitting dissatisfaction to themselves or a researcher. In the current study, serious ecotourists are not reporting lower satisfaction levels but are indicating that they are less willing to return based on their experience than divers with less ecotourism values. This suggests that while divers may avoid dissatisfaction, some are less likely to return, possibly due to an unsatisfactory experience.

6.2 Ecotourism Operators

Greenwashing is a common problem within many ecotourism industries that results in far more promotion of ecological projects than actually occur (Carrier & Macleod 2005). Based on these trends, it was expected that a high proportion of dive companies in Phuket and Khao Lak would generously promote themselves as ecotourism ventures regardless of their actual environmental contribution. Contrary to these expectations, this survey found only seven percent of companies advertise environmental protection and community development efforts. And of those, only one company met the ecological principles set by TIES. For greenwashing to occur, both visitors and companies must believe an ecological commitment is important enough to attract business. This study shows that although visitors care, they are not discriminating in their satisfaction. Despite this, there are select operators who offer ecotourism despite no guaranteed increase in return.

The presence of few dive companies that meet TIES ecotourism principles is similar to results of a study done by Kontogeorgopoulos (2004) that looked at the ecotourism characteristics of select nature-based activities in Southern Thailand such as sea canoe trips. In the study, Kontogeorgopoulos found few ecotourism operators amongst many conventional, mass-market operators. Some studies suggest that if surrounded by conventional tourism, ecotourism will not work (Diamantis 1999). Kontogeorgopoulos (2004) disagreed, suggesting instead that there may be a symbiotic relationship between

conventional tourism and ecotourism in Phuket. This study provides evidence that there are some seemingly isolated companies that operate based on ecotourism principles, despite a lack of ecotourism values within the industry overall. This finding supports Kontogeorgopoulos' (2004) assertion that ecotourism operators can function in unlikely contexts. It is possible that the ecotourism operators surrounded by conventional tourism play a more important role to spread knowledge about conservation than those in eco-specific destinations because they provide ecological and social values and knowledge to tourists who are not seeking it, and therefore, may not otherwise be exposed to these topics. This study identified one ecotourism company and it is unlikely that this company alone will accomplish substantial conservation and educative benefits for the industry overall. To do this will require the development of additional ecotourism operations.

Although developing ecotourism ventures can be an important part of conservation efforts, some companies on the coast may feel little incentive to do so because there is no difference in the satisfaction of ecotourists and non-ecotourists. This suggests that there would be little reward for investing in ecotourism or change in visitor satisfaction for not investing.

Another explanation for the small number of operators identified as ecotourism companies is that dive operators are in fact investing in conservation, education, and community development, but websites are no longer the primary form of communication between dive centers and their clientele. Therefore, advertisements for ecotourism programs and subsequent greenwashing are occurring in places other than the dive company website. Interviews with dive industry personnel illuminated that the primary communication device for some companies has shifted to social media such as Facebook, Twitter, blogs, online forums, travel advisors, and activity specific online platforms such as ScubaEarth. Within social media, dive companies communicate with prospective clients, promote their services, advertise their accomplishments, and create a network of dive operators in the region. Facebook groups and blog sites such as the PADI regional district groups promote companies as they meet new ecological standards, begin offering new services, or do other notable activities. Similarly, many dive companies host their

own blogs, either connected to, or independent of their websites. These blogs, Facebook sites, and Twitter appear to be the most commonly updated source of information on the projects and initiatives each company is involved with. Trip advisor and scuba diving forums are also becoming popular ways of promoting dive centers, perhaps shifting the focus away from individual dive company websites.

For instance, ScubaCat has recently become the first company in Phuket to be granted the recognition of being "100% Aware" by PADI Project Aware. Companies that are 100% Aware include a Project Aware membership and donation with every diving certification granted. This has been advertised on the ScubaCat Facebook page and blog, as well as the PADI regional district Facebook page and blog, but has yet to appear on their website. Similarly, another company, Andaman Ocean Safaris, was involved in a large marine debris clean up event and although it was described on their blog, it never appeared on their website.

This shift in communication techniques may be compounded by a lack of resources provided for conservation, community development, and awareness programs at many dive centers. For instance, some companies have designated conservation officers who complete program development in addition to their other responsibilities. These individuals are also responsible for the promotion of the programs they create, but do not have the capacity to promote them adequately in all avenues. This has occurred at Khao Lak Scuba Adventures where their initiatives to minimize impact have not been reported because conservation staff are also instructors and dive leaders.

Within this industry, companies are promoting themselves and communicating in new and dynamic ways, often opting for many forms of communication simultaneously. There are currently few ecotourism operators who are accessing ecotourists as well as mainstream tourists and could change the attitudes of some divers. Building on the existing population of ecotourists will be important to strengthen the diving industry's value as a marine ecotourism and conservation tool. A vital component to this will be developing environmental education based interpretation programs that are targeted at

mainstream tourists and designed to increase conservation behaviours. Similar programs have been shown to be effective in parts of Australia (Orams 1997) and will be required to increase the ecotourism values present within the industry. Another tool that can increase the ecotourism potential of the diving industry is the promotion of eco-labels. Eco-labels are a form of accreditation that identifies companies that meet specific ecotourism criteria. They can inform tourist purchasing, generate higher revenues for accredited companies, and create pressure among competitors to become more sustainable (Anderson et al. 2012). GoEco is one example of a voluntary eco-label. Increasing the awareness and use of such programs could aid in the broader dissemination of ecotourism values.

7. Conclusion

Diving on the Andaman coast of Thailand is largely nature-based conventional tourism although select companies and visitors exhibit ecotourism values and practices. This study grouped tourists based on their ecological motivations into three segments: serious ecotourists, casual ecotourists and non-ecotourists. There was no difference in visitor satisfaction based on these groups yet serious ecotourists were less willing to return based on their current experience, suggesting that their expectations were not met. To increase the conservation and community development potential of the industry, dive operators need to implement environmental education-based interpretation programs that cater to mainstream tourists. In addition, promoting eco-labels may increase the pressure for operators to participate more thoroughly in ecotourism activities, making a more substantial positive ecological and social contribution in the future.

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Paper 3

The impacts of climate change on diving as a conservation tool along the Andaman Coast of Thailand

1. Abstract

Rapidly changing coral reefs characterize the future of many tropical destinations that currently boast flourishing fisheries and tourism opportunities. Thailand is one such destination that has seen the devastating effects of coral bleaching. Using 591 visitor perception surveys, this study examines the possible implications of current and future climate change on SCUBA diving on the Andaman coast to better understand potential changes to marine conservation efforts within changing oceans. Key findings include:

- Most divers are concerned with climate change and are interested in learning more about its impacts on coral reefs
- In spite of declining conditions a market for diving will remain within the least experienced and least skilled segment of visitors
- Climate change damage will prompt an accelerated shift toward the least discriminating visitors
- Diver specialization is not a significant predictor of most climate change responses

Together these findings suggest that the conservation value of the diving industry will decline substantially with future climate change impacts. Capitalizing on opportunities for environmental-educated based interpretation about both climate change and coral reef conservation will be a key tool to combat these changes and preserve the conservation value of the industry.

2. Introduction

At the height of the dive season in January 2011, the Prime Minister of Thailand ordered the closing of many of the most popular reefs to diving. The reason behind this

unprecedented move was fears over reef health following the most dramatic coral bleaching witnessed on the Andaman coast and a perceived need to reduce any further potential stresses on reef ecosystems. The dive industry was severely compromised as divers throughout the world cancelled their dive holidays in the country.

The situation brought into sharp focus the potential future impacts of global climate change on recreational diving, the potential loss in income from the activity, and a reduction in the potential of SCUBA diving to act as an incentive-based conservation activity. The goal of this study was to gain greater understanding of some of the implications of current and future climate change on SCUBA diving on the Andaman coast of Thailand.

The Andaman coast is part of the Coral Triangle and home to some of the most diverse, and visited reefs in the world (Briggs 2005). Thailand's reefs and beaches are a major global destination for international travellers receiving over 22 million visitors in 2012 (TAT 2013b) while also supporting various other livelihoods. Between January and March of the same year, international tourists contributed $8.4 billion USD to the Thai economy (TAT 2013a). This large economic importance makes the future of reef tourism particularly relevant for Thailand.

Thai reefs have been subject to various human disturbances such as development, fishing, and pollution. Despite this, for the last two decades coral cover has remained constant until the coral bleaching of 2010 which saw 17 percent coral mortality in many regions (Phongsuwan 2013). Trends observed on the Andaman coast indicate that the damage is just beginning for Thailand's reefs. Over 50 years of sea surface temperature data for the region show increases similar to those predicted by Intergovernmental Panel on Climate Change (IPCC) climate change reports which predict that corals will face an increasingly hostile environment in coming years (Brown et al. 1996). Studies predict that by 2020, bleaching events will be an annual and severe event throughout most of Southeast Asia (Burrows et al. 2011). This growing threat of climate change has various implications for

reef conservation tools such as diving. The next section will review the literature on climate change, coral reefs, and tourism.

3. Literature Review

3.1 Coral Reefs and Global Climate Change

One of the major ways global climate change is impacting our oceans is by warming them. Ocean warming causes coral bleaching, a break down of the symbiotic relationship between coral and the photosynthetic zooxanthellae that give them their colour, making bleached reefs appear white. Bleaching was first documented in the early 1980's and regional events are now being observed almost annually as average global ocean temperatures rise (Burrows et al. 2011). The first global bleaching event occurred in 1998 and killed 16 percent of the world's coral reefs. The bleaching was particularly severe in much of the Indian Ocean where coral cover in the Maldives dropped from 46 – 56 percent before the bleaching, to just 0 – 10 percent following (Zahir 2000). Similar rates of coral loss were documented elsewhere, for example, Mafia went from 73 percent coral cover prior to bleaching down to 19 percent after (Andersson 2006; Uyarra et al. 2005). Regional and short-lived bleaching events have occurred regularly since then but have not been as severe nor as widespread as in 1998. In 2010 an El Niño was immediately followed by a La Niña, which, when coupled with rising overall ocean temperatures, resulted in the second global bleaching event, the worst to ever hit Southeast Asia. The total impacts of bleaching on coral reefs will be compounded by several other consequences of global climate change including ocean acidification, rising sea levels, and increased turbidity. Although these aspects of global climate change are serious, the focus of this paper is on bleaching and the implications of these additional climate change consequences will not be discussed in detail.

Marine protected areas are a common and effective conservation strategy (Agardy 1994; McCook et al. 2010) but have limited success increasing the resilience of ecosystems to climate change in part due to their restricted scope (Selig et al. 2012). For marine biodiversity to recover from current degradation, at least 30 percent of ocean habitat will

need to be protected (Fraschetti et al. 2009; Lester & Halpern 2008). With current protection only covering 1.6 percent of the ocean, a diversity of conservation approaches are needed (MPANews 2012). Many studies have called for local conservation efforts that minimize direct human impacts to maintain reef resilience (Knowlton & Jackson 2008; Selig et al. 2012).

SCUBA diving can aid conservation by shifting the economic base from environmentally degrading activities toward conservation-focused employment (Hutton & Leader-Williams 2003). Diving has demonstrated significant potential to generate funds for conservation and local economic development (Arin & Kramer 2002; Balmford et al. 2009). In Mu Ko Similan National Marine Park in Thailand, divers were documented as being willing to pay between $27.07 and $62.64 USD per annum to dive in the park amounting up to $2.1 million USD in revenue per year (Asafu-Adjaye & Tapsuwan 2008). In addition, divers contributed over $150 million USD per annum to the local economy in Phuket (Bennett et al. 2002). In many tropical places, the user fees paid by tourists benefit conservation by funding park management and providing employment opportunities for locals who would otherwise depend on extractive-based livelihoods (Carrier & Macleod 2005; Clifton 2005; Taylor et al. 2002). Marine parks such as those in Saba and Bonaire have become self-financing through these fees, allowing for conservation that would otherwise be impossible (Hawkins et al. 2005; Uyarra et al. 2009). Additional conservation benefits of SCUBA diving include the educational value of interpretative programs, volunteer reef monitoring, and post-disaster clean up (Main & Dearden 2007; Zeppel & Muloin 2008).

The importance of diving as a conservation tool becomes less certain within oceans undergoing rapid and severe changes. Diving, like other forms of tourism, is demand driven and continued reef degradation poses a significant threat to the viability of diving in the future. To plan for future conservation efforts in areas threatened with significant reef degradation, it is necessary to understand the likely reactions to divers of future global climate change.

3.2 Tourism and Global Climate Change

Research on tourism and climate change is relatively new and has focused primarily on winter destinations such as European and North American mountains (Becken 2013; Gössling et al. 2012). Although there is little research on the tropics, global climate and tourism simulations show significantly changing climatic conditions and many anticipate drops in visitation to these regions. For instance, high temperatures may push some tropical destinations outside of the comfort zone for holiday-goers (Braun et al. 1999). Similarly, rising transportation costs due to carbon taxes and rising fuel prices will make long-haul destinations less accessible (Gössling et al. 2012). These changes alone are not able to predict how visitors will respond to increasingly bleached reefs.

Many divers dive to see charismatic marine fauna and therefore are largely motivated by the natural characteristics of dive sites (Bennett 2002; Fitzsimmons 2008; Meisel-Lusby & Cottrell 2008). The declining quality of reefs expected under climate change conditions suggests that visitor satisfaction will decline, prompting a drop in demand as divers seek alternative destinations. In line with this assertion, some studies have found reduced visitation rates following coral bleaching and degradation events (Roman et al. 2007). Yet other cases document steady or increasing visitation following these events (Andersson 2006; Zahir 2000), which could be in part due to an emerging phenomena known as 'last chance tourism'. Last chance tourism has developed following the popularization of climate change impacts as visitors rush to see a destination before it, or its unique characteristics, disappear forever (Lemelin 2010). The growth of last chance tourism has been particularly pronounced in polar regions whose disappearing resources such as polar bears, glaciers, and ice caps, have been heavily publicized (Eijgelaar 2010; Lemelin 2010). Although coral reefs have not been subject to extensive last chance media coverage, they remain among the most threated ecosystems to climatic change and may be the focus of more distinct disaster tourism opportunities in the future. It is likely that there will be high variation to the response of visitors by region and better understanding

visitor response is an important part of estimating future industry sustainability and conservation potential.

Visitor response to any set of conditions can be highly variable and is determined by the values (basic modes of thinking) and beliefs (opinions determined by personal values) that in turn determine individuals' motivations for participating in an activity (Fulton et al. 1996). Visitors for whom the experience meets or exceeds their expectations, or motivations, are satisfied and are therefore more likely to return. For this reason motivations and satisfaction are important indictors of the sustainability of demand for an activity and have been the focus of much research (Bennett et al. 2002; Ziegler et al. 2011). Visitors within any activity are highly heterogeneous expressing different motivations, values, and responses to the same conditions. For instance, while most divers value seeing marine life, some are focused on using the latest equipment and others prefer exploring wrecks, each of whom will likely report different satisfaction levels for the same experience. Recreation specialization is one tool used to separate visitors into relatively homogenous and distinct groups based on characteristics such as their skill level, the importance of a particular activity, or their investment in obtaining a particular experience. Specialization levels have been used to understand visitor responses or preferences for different conditions (Ninomiya & Kikuchi 2004; Salz & Loomis 2005; Sorice et al. 2009).

Specialization may also impact visitor response to climate change. Highly specialized divers place greater emphasis on the natural environment and are more sensitive to social crowding, therefore these divers may be more impacted by reef degradation than less specialized divers who have broad expectations and are focused on attaining new skills (Dearden et al. 2006; Dearden & Manopawitr 2011). Supporting this, in Australia, Anderson and Loomis (2012) found that more specialized divers are less tolerant of compromised reef conditions such as those expected from climate change. Similarly, studies in both the Great Barrier Reef and South Sinai have found dramatic shifts in clientele toward divers with less experience following significant reef damage, bringing with them different preferences and motivations (Leujak & Ormond 2007; Prideaux et al.

2010). A study in Zanzibar and Mafia found that there remained some interest in diving on bleached reefs after the 1998 bleaching but only by a certain segment of divers, and that returning divers were unwilling to pay original rates, suggesting a potential loss of between 22 and 154 million USD per year to these destinations (Andersson 2006).

The Andaman coast diving industry has been the subject of several similar studies. For instance Dearden et al. (2006) examined the composition and sustainability of the dive industry in 2000 and found that highly specialized divers were not as satisfied as less specialized. Paper 1 in this thesis compared the Dearden et al. (2006) results with a repeat study in 2012 and found although overall numbers of divers remained stable, that market segments had shifted toward less specialized divers. Following the 2004 tsunami, Main and Dearden (2007) found that although many dive operators went out of business, the remaining companies collaborated to assist with rescue, relief, and restoration efforts. Recently, Biggs (2012) examined the resilience of the dive industry to shock events, such as a tsunami or coral bleaching, and found that many operators were ill prepared to deal with disasters. In addition, Dearden and Manopawitr (2011) suggest a framework to assess the relative sustainability of diving under future climate change conditions including modifications to reef health, visitor numbers, and industry structure.

So far, studies on coral reef tourism and climate change have focused on shifts to tourists' willingness to pay for their experience and their willingness to revisit changed conditions. As the impacts and awareness of climate change increase, there may be rapid shifts in visitation to many places. The direction of these shifts will be difficult to predict as there is little knowledge regarding visitor motivation and perceptions of climate change impacts. Gössling et al. (2012) has identified this knowledge of visitor perceptions as one of the largest gaps in research on tourism and climate change to date. The current study attempts to provide some of the vital data needed to begin filling this gap in knowledge by examining visitor perceptions about climate change as well as impending changes to the demand for diving and therefore, its use as a conservation tool. Specifically, it investigates the characteristics of divers based on climate change concern, interest in learning about climate change and coral reefs, and anticipated future participation.

4. Methods

From January to May 2012 diving visitors to the Andaman coast of Thailand completed surveys that asked closed and open questions about their level of experience, motivations, satisfaction with their dive trip, socio-demographic characteristics, willingness to return, and perceptions about climate change including level of concern, future participation, and interest in learning about climate change (Appendix IV). Divers either completed a paper questionnaire on board their dive boat, or an online version of the same survey during the weeks following their dive trip.

4.1 Paper Survey Method

Twenty-three of the 116 companies operating on the Andaman coast of Thailand were selected based on their region of operation, the price of trips, and the types of activities offered. All divers on participating boats were asked to complete a survey. Some visitors accessed dive sites on speedboats and could not complete surveys on board the boat therefore these divers were intercepted daily between March 17 and April 6, 2012 while returning from their trip and asked to complete an online survey.

In these cases, visitors were approached by the researcher or an assistant who would introduce themselves and ask each diver to complete a 15-minute survey online about their diving experience (Appendix VI). Two or three days after the intercept, each diver was sent an email that outlined the purpose of the study, provided a link to the online survey, and described the confidentiality promise (Appendix VII). Four weeks after the initial email was sent, respondents were emailed a second time thanking those who had completed the survey and reminding those who had not that they could participate until the end of data collection on May 15, 2012.

During the 21 days of intercept surveying, 251 divers were contacted. Five percent of divers contacted did not want to provide their email address while 20 percent did not

have enough time, could not speak English, or provided an illegible email address. This resulted in 165 addresses that were sent survey information, 33 of which were returned to sender. In total there were 132 successfully sent surveys and of those, 60 were completed before the deadline of May 15, 2012. This is a 45 percent response rate (60/132) of divers successfully contacted or 24 percent (60/251) of divers intercepted. Using these two methods, 591 visitor surveys were collected, compiled in IBM SPSS Statistics and analyzed.

4.2 Diver Specialization

Specialization was determined using a multivariate index applied in other studies of divers in Thailand (Bennett 2002; Dearden et al. 2006). The specialization index is based on three specialization dimensions suggested by Bryan (1977) including past diving experience, investment in diving, and centrality to life. The index used a series of seven questions that were converted to a binary scale and summed to assign each diver in this study a value between 0 and 7. Based on this value, divers were assigned to one of three groups: (0-3) low specialization, (4-5) medium specialization, or (6-7) high specialization.

5. Results

This study shows that 59 percent of divers on the Andaman coast are male and 41 percent female. This is reflective of a male dominated industry worldwide (PADI 2013). Most divers (55%) are diving in Thailand for the first time and are under the age of 65 (95%). The largest proportion of English speaking divers are from the United States (18%) followed by Britain and Australia (10% each), and Germany and Finland (7% each). The remaining divers are from 32 different countries. The importance of diving to their trip varies. For most respondents (53.2%), diving is a planned activity on their trip but not the main reason they chose to visit Thailand, for some (38%) it is the primary purpose of their trip, and for others (8.7%) it is an accidental or an unplanned activity. Seventy

percent of divers have a bachelor degree or higher level of education. Most divers are classified as low (45.4%) or medium (43.7%) specialization with only a few individuals classified as highly specialized (10.9%). Overall, divers are motivated primarily by environmental and service features but, as discussed in Paper 1, are most satisfied with the quality of the service they received.

5.1 Perceptions of Climate Change

Seventy percent of divers believe climate change is one of the top three threats to coral reefs in Thailand. Fishing is identified as the largest threat, followed by pollution, climate change, natural disasters, and diving. Based on possible climate change impacts, most divers (71%) identify increasing ocean temperatures as a large problem followed by reduced health of coral (69%), and altered abundance and diversity of fish (50%). The lowest proportion of divers identify ocean acidification (48%) and rising sea levels (38%) as large problems.

In anticipation of continued climate change impacts, 40 percent of divers expect to dive less in the future while 34 percent anticipate no change, 21 percent are uncertain of their response, and 6 percent expect to dive more. Most divers (62%) are interested in visiting reefs to see the impacts of climate change regardless of specialization level. Fourty-four percent report witnessing reef damage due to climate change during one or more of their dives. Of those that saw damage, most are highly specialized divers. There is no difference to diver's willingness to return between those who saw damage from climate change and those who did not. Similarly, there is no difference in the satisfaction level of divers who saw damage and those who did not. Overall, the mean satisfaction for the diving experience is 7.69 on a 10-point satisfaction scale.

5.2 Concern with Climate Change

Most divers (87%) express some level of concern about the impacts of climate change on the marine environment. Divers are more likely to be highly concerned with climate change if (Table 6) they are older, they are highly specialized, viewing marine life is an important motivator for them to dive, they are interested in reef monitoring, diving was the main purpose for their trip, or they saw reefs damaged from climate change. For each of these relationships, the converse is also true of divers who are less concerned with the impacts of climate change. Interestingly, this study shows no significant relationship between education, gender, repeat visitation, or satisfaction, and level of concern with climate change.

Table 6: Predictors of visitor concern with climate change

Predictor	**X^2**	**df**	**p***	**λ****	**Direction of relationship**
Specialization	25.298	4	**0.000**	**0.119**	Concern increase with specialization
Education	5.920	10	0.822	-	-
Age	20.409	10	**0.026**	**0.002**	Concern increases with age
Gender	1.112	2	0.574	-	-
Centrality of diving	13.979	4	**0.007**	**0.012**	Concern increases with increasing centrality of diving
First time diving in Thailand	3.609	2	0.165	-	-
Importance of marine flora & fauna	28.292	4	**0.000**	**0.078**	Concern increases with the importance of marine flora and fauna as a motivator
Satisfaction with marine life	4.099	4	0.393	-	-
Willingness to participate in reef monitoring	6.045	2	**0.049**	**0.000**	Concern is higher among those willing to do reef monitoring
Willingness to return based on current experience	5.473	4	0.242	-	-
Witness climate change damage	39.514	2	**0.000**	**0.170**	Concern is higher amongst those who saw damage from climate change

*alpha =0.05

**assuming symmetric relationships

5.3 Interest in Learning About Climate Change

Most divers (78%) are interested in learning more about climate change. Almost 80 percent of each specialization group are interested in learning about climate change while 20 percent of each group are not interested. Table 7 shows that divers are more interested in learning about climate change if they: are concerned about the impacts of climate change, saw reef damage due to climate change, are repeat divers in Thailand, are motivated to dive by seeing marine life, are willing to participate in reef monitoring, or are satisfied with the diversity of marine life. For each of these relationships the converse is also true for those who are less interested in learning about climate change. Several characteristics are not related to participants interest in learning including their age, education, gender, reason for diving, level of specialization, or satisfaction with their trip.

Table 7: Predictors of interest in learning about climate change

Predictor	**X^2**	**df**	**p***	**λ****	**Direction of relationship**
Specialization	3.460	2	0.177	-	-
Education	5.048	5	0.410	-	-
Age	7.614	5	0.179	-	-
Gender	0.652	1	0.419	-	-
Reason for diving	1.801	2	0.406	-	-
First time diving in Thailand	5.796	1	**0.016**	**0.000^**	Higher for return visitors
Importance of marine flora & fauna	16.096	2	**0.000**	**0.005**	Increases with importance
Satisfaction with marine life	21.914	2	**0.000**	**0.013**	Increases with satisfaction
Willingness to participate in reef monitoring	94.267	1	**0.000**	**0.256**	Increases with reef monitoring
Willingness to return based on current experience	5.662	2	0.059	-	-
Witness climate change damage	20.780	2	**0.000**	**0.000^**	Higher if saw damage
Concern with climate change	37.854	2	**0.000**	**0.075**	Increases with concern

* alpha = 0.05

**assuming symmetric relationships

^cannot be sure of value

5.4 Anticipated Future Participation

When considering their diving frequency in a future of continued climate change, few divers anticipate diving more. Table 8 summarizes these findings showing that those who do anticipate diving more are likely to be middle-aged, male, place neutral importance on seeing marine life, or are unconcerned with the impacts of climate change. Divers expect to dive less frequently in the future if they are older, male, strongly motivated by the prospect of seeing marine diversity, highly concerned about climate change, or they saw evidence of reef damage. Thirty-four percent of divers anticipate no change to their diving participation. Divers are more likely to anticipate no change if they are male, older, marine life is unimportant, did not see damage from climate change, or were unconcerned with climate change. Finally, many divers are uncertain of their response, particularly if they are female, young, highly concerned with climate change, satisfied with the marine life, or did not see reef damage. Divers' predicted future participation is not related to diver education, repeat visitation, reason for diving, or level of specialization.

Table 8: Predictors of future participation with continued climate change impacts

Predictor	X^2	df	p*	λ**	Direction of relationship
Specialization	5.334	6	0.502	-	-
Education	19.313	15	0.206	-	-
Age	27.001	15	**0.029**	**0.008**	Declines with age until 65, youngest are least certain
Gender	15.272	3	**0.002**	**0.023**	Lower for males, females less certain
Reason for diving	7.777	6	0.255	-	-
First time diving in Thailand	2.881	3	0.410	-	-
Importance of marine flora & fauna	13.761	6	**0.032**	**0.026**	Declines with increasing importance, uncertainty increases with importance
Satisfaction with marine life	12.494	6	0.052	-	-
Willingness to participate in reef monitoring	2.030	3	0.566	-	-
Willingness to return based on current experience	10.368	6	0.110	-	-
Witness climate change damage	13.600	3	**0.004**	**0.052**	Lower if saw damage, less certain if did not see damage
Concern with climate change	20.935	6	**0.002**	**0.030**	Declines with increasing concern, uncertainty increases with concern

*alpha = 0.05

**assuming symmetric relationships

Two questions aimed to understand demand for diving and how demand might change in a future with climate change. First, divers were asked, "Would you return to the Andaman coast for diving based on your experiences on this trip?" Later they were asked, "Assuming the impacts of climate change persist into the future, how is this likely to affect your participation in diving in Thailand?" Based on these questions, 71 percent of divers are willing to return based on their current experience. Of those, 36 percent anticipate diving less frequently given continued impacts of climate change, representing a significant potential loss of clientele. Ten percent of divers are not planning to return based on their current experience and also anticipate diving in Thailand less with

continued climate change. These divers will not be returning regardless, therefore this portion of the industry is not affected by future climate change impacts. Of the 71 percent of divers who anticipate returning, 78 percent expect no change to their diving in Thailand even if climate change impacts persist.

6. Discussion

Most divers on the Andaman coast of Thailand express some level of concern and want to learn more about climate change. Despite this interest, visitors have a low level of knowledge about related impacts. Most divers identify increasing ocean temperatures as the largest threat for coral reefs while few identify ocean acidification or rising sea levels. This is contrary to climate change projections which indicate that although increasing temperatures have highly visible and damaging consequences, ocean acidification will have a more severe impact (Kleypas & Yates 2009). In general, visitors have few accurate perceptions of climate causes and impacts (Gössling et al. 2012) which has also been found in Queensland divers who identified sea level rise as the most pressing concern (Prideaux et al. 2010) despite it not being the largest threat in the region. Although divers may not know specifics of climate change, most are concerned about it and interested in learning more.

A repetitive study in the European Union, found that despite regional variation, over half of respondents consistently identified climate change as one of the top two global problems (TNS 2011) suggesting that many people care about climate change. Concern can vary by region or by activity as a study in the Great Barrier Reef showed, finding that the overall level of concern was low among visitors (Prideaux et al. 2010). Concern with climate change has been related to several different characteristics. For instance, Whitmarsh (2011) found that concern was related to socio-economic status, gender, and political values. Another study identified older people as more frequent climate change sceptics (Poortinga 2011). Incongruent with this, the current study found that gender is not a significant predictor of concern while the age of respondents does relate to concern

with climate change. In general, older respondents express greater concern with climate change than younger respondents.

Extensive research has investigated the characteristics that determine if an individual is a climate change sceptic. While logic suggests that climate change beliefs are related to education or knowledge, there is rarely a relationship (Whitmarsh 2011). This supports our finding that education is not a significant predictor of concern with climate change. Instead, climate change beliefs are largely driven by environmental and political values and, to a lesser extent, socio-demographic characteristics and lifestyle (Whitmarsh 2011). Climate sceptics are often older, white males who have lower socio-economic status, and own cars. In addition, they are commonly politically conservative, pro-individualistic, anti-environmental, and highly religious (Leiserowitz 2005; Poortinga 2011; Whitmarsh 2009) Furthermore, there are several different types of climate change beliefs. For instance, a study of polar tourism found 97 percent of visitors believed in climate change, although 55 percent of those attributed it to natural causes and only 42 percent to anthropogenic causes (Eijgelaar 2010). These findings illustrate that although divers in Thailand state that they are concerned with climate change, concern may not translate into a sense of responsibility for protecting reefs. Consistent with the literature, in the current study, divers who place high value on environmental indicators such as the importance of diverse marine life and their willingness to participate in reef monitoring were more likely to express high concern with climate change. This suggests that response to climate change conditions will vary greatly and be heavily influenced by core visitor values.

6.1 Learning

Most divers are interested in learning about climate change. Divers are more likely to express interest in learning about climate change if they have previously dove in Thailand, place a high importance on marine life, or are satisfied with their diving experience. These characteristics are consistent with visitors whose experience will be most substantially degraded by the impacts of climate change. These visitors may be

interested in learning about climate change threats so they can help protect the reefs that they enjoy seeing.

The most significant predictor of interest in learning more about climate change is diver willingness to protect the reefs by participating in reef monitoring. In a previous study of divers in Phuket, Dearden et al. (2007) found willingness to participate in reef monitoring was the strongest indicator of environmental stewardship and increased dramatically if visitors witnessed reef damage. Despite this, the current study found no significant relationship between divers who saw reef damage and those willing to participate in reef monitoring. This could suggest two things; first, that reef damage from climate change does not invoke the same need to make an ecological contribution as seeing damage from diving, or second, that the clientele has shifted toward visitors who are less inclined to make a large ecological contribution opting instead for a smaller commitment such as learning about climate change.

Three quarters of diving visitors want to learn more about climate change, an important finding given that interpretation based on environmental education is one of the most important conservation contributions and behaviour changing elements of nature-based tourism such as diving (Medio et al. 1997). In addition, 62 percent of divers are interested in visiting reefs specifically to view the impacts of climate change. These findings present a significant case for the use of interpretation in destinations that have experienced reef damage and suggest that climate change education is desired and therefore, could provide a gateway for instilling conservation values within visitors. Combining trips to bleached reefs with trips to non-bleached reefs could create an eco-focused form of disaster tourism and capitalize on an essential education opportunity.

6.2 Future of Diving in Thailand

Understanding visitors' projected response to future reef conditions is an important step in estimating future demand for diving and determining the potential impacts of climate change on the future sustainability of the industry. This study found that climate change

may prompt the loss of approximately one third of returning clientele. Those who are most likely to be displaced include males, divers highly concerned about the impacts of climate change, and divers who saw climate change damage. Interestingly, seeing damage had no relation on visitors' current willingness to return, indicating that they are anticipating conditions in the future that are much different than those they experienced.

Surprisingly, over three-quarters of divers expect no change to their diving in Thailand if climate change impacts persist. This could be explained by three factors. First, as discussed earlier, they may not believe in climate change and therefore, have no reason to change their behaviour. Second, some divers may not detect climate change damage. Following the 2004 tsunami, Main and Dearden (2007) found that recreational divers were unable to distinguish much of the damage identified by experts. Based on this finding, it appears that there is a market for low quality reefs to a certain segment of the population, results that have also been found in several other studies (Anderson & Loomis 2012; Leujak & Ormond 2007). In these cases, it is typically divers with little experience that continue to return. Finally, the primary motivation for divers to visit Thailand could be something other than seeing coral reefs. A 2005 study compared the response of visitors to changes on two island destinations and found that willingness to return depended largely on visitors' motivation for selecting their destination of choice (Uyarra et al. 2005). Although Thailand has exquisite reefs that are a major tourist attraction, it also boasts many other attractive qualities including beaches, high quality resorts, relative safety, warm temperatures, accessibility, and exotic food. If diving visitors to the Andaman coast are primarily seeking non-reef attractions, they may have low sensitivity to changing reef conditions. Each of these explanations suggest that while demand for diving will not completely diminish with continued reef degradation, the conservation potential of diving may be compromised as return visitors will be motivated by non-reef activities, unable to detect damage, or may not believe in climate change.

The present study found that the specialization level of divers is low and will likely become even lower with continued climate change impacts. The scarce climate change knowledge found among dive tourists in this study could be due to a current dominance

of low specialization divers within the industry (Discussed in Paper 1). Supporting this assertion, a comparative study of Mafia and Zanzibar showed that climate change knowledge is significantly higher in destinations that attract more experienced divers (Andersson 2006). In general, highly specialized recreationists are motivated largely by natural features, therefore their satisfaction is exceedingly sensitive to the quality of the reefs (Dearden et al. 2006; Meisel-Lusby & Cottrell 2008). In contrast, less specialized divers are characterized as having lower expectations for their dive trips and therefore, are more easily satisfied by lower quality reefs (Catlin & Jones 2010). It is likely that as reef conditions continue to decline on the Andaman coast, the divers who visit will become proportionally less specialized, shifting the primary clientele to those who are more easily satisfied.

Similar changes in clientele toward those with less experience have been observed around the world as reefs became degraded (Catlin & Jones 2010; Leujak & Ormond 2007). Potential changes to diver specialization is of particular interest in this study because it has been linked with many characteristics related to the conservation value of the industry. Commonly, low specialization divers cause damage to reefs due to poor buoyancy control, low skill level, and little knowledge (Hawkins et al. 2005; Luna et al. 2009). In contrast, highly specialized divers are often high yielding, interested in learning, and make considerable investments of time and money in conservation (Anderson & Loomis 2012; Andersson 2006). This suggests that as the diving industry becomes increasingly dominated by less specialized divers, the conservation value of the industry will be progressively more compromised.

This study reports that specialization is not related to most visitor perceptions of climate change such as interest in learning or future participation. Distinctly, specialization level is a significant predictor of climate change concern as high specialization divers express a greater concern about global climate change impacts. Additionally, divers most concerned with climate change also report being less willing to return, offering further evidence that high specialization divers will be disproportionately displaced in a future of continued climate change impacts. Despite this, those visitors who remain wiling to

return to degraded destinations often expect a cheaper trip (Andersson 2006; Uyarra et al. 2005). Together these findings suggest that declining reef conditions may be accompanied by reduced economic revenue and interest in conservation as well as increased impacts on reefs from a growing proportion of less skilled divers. For nature-based tourism industries these changes can substantially impair conservation efforts.

7. Conclusion

Dearden and Manopawitr (2011) suggest that climate change will result in declining demand for coral reef diving in the future. The results of this study show that many divers anticipate diving less on bleached reefs. Recent coral reef surveys of the region show many dive sites have already undergone significant declines in coral cover (Phongsuwan 2013). Despite the documented degradation, most divers remain willing to return based on their current experience. This suggests that there is a discrepancy between stated and observed responses and brings into question the viability of predicted diver response to changing conditions. This discrepancy may be an artefact of the changing dive clientele identified in Paper 1 where divers in Thailand were equally satisfied compared to expectations and willing to return in 2012 as in 2000 despite a loss of coral between these years. Visitor response to global climate change will likely continue to adjust as some visitors adapt to shifting conditions, others are displaced, and as general baselines shift. Gossling et al. (2012) point out that perception is comparative and will evolve with generations. Divers may learn to accept new conditions or adjust their perception of what is acceptable, particularly in the case of global climate change where many impacts will occur slowly and at a global scale. These shifting baselines will likely maintain some market for diving although the anticipated increase in low specialization divers may compromise the conservation potential of the industry.

As climate change impacts continue and the dominant visitor market shifts, education will be a key part of maintaining diving as a conservation tool. Many divers are interested in seeing the impacts of climate change and in learning more about the associated consequences for coral reefs. Exploiting these interests can provide a gateway for

increased environmental education and potentially the diffusion of conservation values. Promoting diving as last chance tourism and providing opportunities for divers to witness climate change impacts may open an additional market. Combined with effective education, these ventures could contribute to increasing the conservation value of diving despite declining reefs. Together, education and the promotion of climate change awareness may begin to build the powerful and informed dive community that Dearden and Manopawitr (2011) cite as being an important asset in building and enhancing dive industry capacities in the face of climate change.

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Conclusion

Coral reef dive tourism on the Andaman coast of Thailand: Synthesis of key findings, recommendations, and suggestions for future research

1. Synthesis

The overall goal of this study was to track changes to the sustainability of diving as a conservation tool and predict how these trends might vary in a future with continued climate change impacts. As discussed in the preceding papers, this research evaluates and predicts changes to the sustainability and conservation value of the dive industry and makes recommendations for using diving to strengthen the conservation of the Andaman coast. These findings uncover lessons that are applicable to other dive destinations as well as various marine tourism industries.

This section synthesizes key findings from Papers 1, 2, and 3 to reveal similarities and synchronicities between them and highlight the primary contributions of this research. The individual objectives outlined in the Introduction are covered in the papers and are summarized within the section below. The following sections provide management recommendations based on the results of this work, a discussion on the limitations of the research methods, and finally, suggestions for areas of future research.

1.1 Specialization

Specialization is an important and commonly used construct to understand visitor uses, preferences, and responses to wildlife tourism activities. In this study, we aimed to *examine changes to diver specialization, motivations, satisfaction, and willingness to return in 2000 and 2012* (Objective b), each of which were discussed in detail in Paper 1. One of the most significant findings of this paper was the prominent drop in specialization level of divers between the years. The more generalist clientele of 2012 reported lower motivations for most dive specific features, and were most motivated by general aspects of the trip. In contrast, there were very few changes to diver satisfaction

with trip features between the years. The shift to less specialized visitors echoes findings in other marine tourism industries as they develop (Catlin & Jones 2010).

Additionally, Paper 1 *examined changes to the overall composition of the dive industry* (Objective a), finding that the number of companies had remained relatively constant between the years although a greater diversity of activities catered to the less specialized clientele. While specialization was highly related with various motivations and satisfaction in Paper 1, Paper 3 aimed to *investigate the characteristics of divers based on climate change perceptions* (Objective f) and found that specialization was related to very few climate change perceptions. The key exception to this was visitor concern with climate change, as highly specialized divers expressed significantly higher levels of concern with the impacts on coral reefs. Despite the difference found in divers' concern level, specialization had no relationship with their willingness to return to Thailand for diving if climate change persists. Despite this, it is likely that without dramatic interventions, such as the inclusion of activities attractive to specialists, the high proportion of generalists seen now will increase in the future.

1.2 Conservation Value

The low specialization level of divers in Thailand features several characteristics that suggest an associated decline in the conservation value of the industry. Paper 1 found that the total economic contribution of the 2012 generalist clientele was almost 40 percent lower than in 2000. The economic contribution of diving can act as an incentive for community members who typically engage in extractive activities, and without it, diving will be aiding conservation less. Similarly, the reduced amount spent on dive trips means that companies might be tempted to cut corners, compromising visitor safety and environmental protection. Additionally, generalists are often less interested in knowing or understanding coral reefs. The results of Papers 2 and 3 found just this, showing that only 15.6 percent of divers fell into the most serious ecotourist category and that on average, divers in Thailand have a low level of knowledge about climate change impacts. Although knowledge is not a direct assessment of contribution to conservation, it is often

an important indicator. Consistent with these findings, was the result in Paper 1 that the proportion of divers willing to participate in reef monitoring, to directly benefit the conservation of reefs, declined by 27 percent between 2000 and 2012. Related to this is the lack of interest in conservation contributions or other ecotourism values by visitors discussed in Paper 2, a finding that may be driving the low number of ecotourism operations in the region. Paper 2 *assessed the use of ecotourism principles as marketing mechanisms by dive companies* (Objective d) and found that only one out of 86 companies evaluated met the criteria for ecotourism and contributed directly to conservation.

The results presented by this thesis show a trajectory of declining conservation value within the Andaman coast diving industry. Studies show that under declining conditions visitors are willing to pay less to participate in the activity, suggesting that the economic contribution of diving will continue to decline (Andersson 2006; Uyarra et al. 2005). Similarly, this study, and several others before it have found that generalist divers, who are most accepting of adverse conditions, are least knowledgeable and interested in contributing to conservation. It is clear that the conservation value of the industry is lower than it was in 2000 and may continue to decline without dramatically improved interventions by managers and strong efforts by dive operators.

This research uncovered clear evidence of shifting baselines within the diving industry, and indications that baselines will continue to shift ever more rapidly in the future. Paper 1 highlighted an industry in 2012 dominated by divers with low specialization levels and generalized motivations. Key to this finding is that visitor satisfaction compared to expectations and willingness to return did not change between the years, despite documented declines in coral cover (Phongsuwan 2013). This accommodation of lowered conditions is expected by visitors with little prior experience who have few baselines to compare their dive experience with. Additionally, Paper 2 *determined the ecotourism values and motivations amongst diver clientele* (Objective e) and found few divers with ecotourist values present within the industry. Ecotourists are most interested in coral reefs and therefore are most likely to pay attention and be concerned by their declining

condition. Together, these findings along with the dominance of generalists within the industry suggest that baselines will continue to shift rapidly in coming years. Shifting baselines will accelerate the decline in the conservation value of the industry but may be a key factor to sustaining demand for diving in the region despite declining quality.

1.3 Duffus - Dearden Model

The findings discussed in the previous two sections illustrate several results that relate to the Duffus-Dearden (1990) wildlife tourism model. This work aimed to *use the Duffus-Dearden model to evaluate the sustainability of the diving industry in 2012 and compare this to findings in 2000* (Objective c). There were several key changes between 2000 and 2012 identified in Paper 1:

- The proportion of generalist divers grew
- The number of companies operating in the region increased
- There was a loss of specialist divers and research enthusiast companies

Together these findings show that the dive industry has progressed along the model (Figure 6) between 2000 and 2012 becoming less sustainable. This is evident by the growing number of tourists, measured by number of companies operating in the region, and the increased dominance of generalists over specialists. As discussed in the previous section, these findings have important implications for the conservation value of the industry, and based on the DD model, suggest that the current industry composition may push ecological conditions to decline until they can no longer support the dive industry.

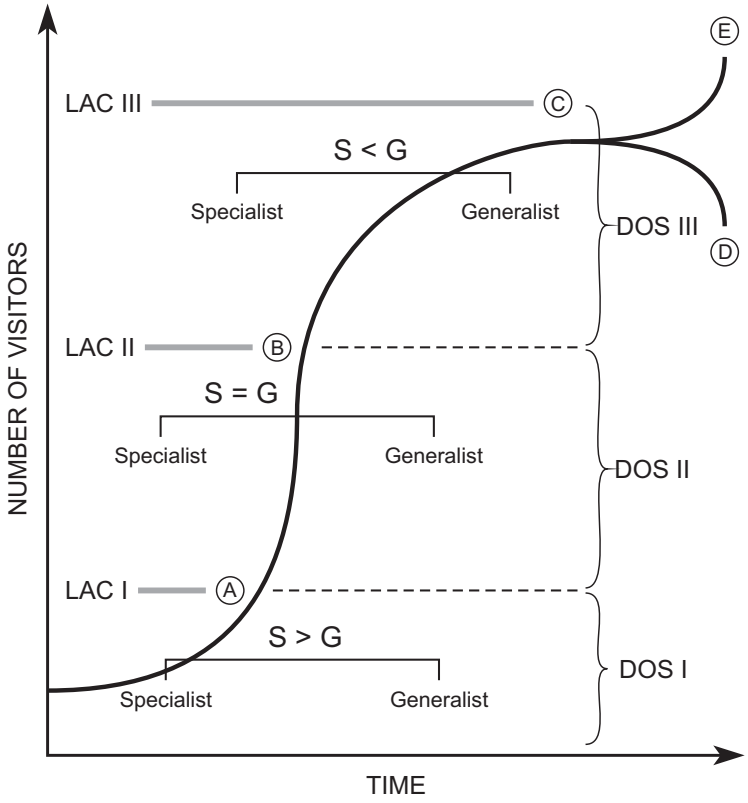

Figure 6: Duffus-Dearden model (Modified from Dearden et al. 2006). LAC = Limits of Acceptable Change, DOS = Diver Opportunity Spectrum, S=Specialists, G = Generalists

In addition to these findings, a study that monitored coral reefs along the Andaman coast for over two decades found that in 2011 coral cover dropped substantially (Phongsuwan 2013) due to coral bleaching, a direct effect of climate change and was discussed in Paper 3. Dearden and Manowpawitr (2011) offer several predictions about how climate may influence the progression of wildlife tourism industries outlined in the Introduction, which were used to *estimate future changes to the development of the diving industry in the face of climate change* (Objective g). For instance, they propose that due to the decline in reef quality, environmental LACs will be approached more quickly. Based on the results of this study, it appears that this has occurred on the Andaman coast although it does not appear to have prompted a decline in industry growth. In fact, the results from Paper 1 show that an activity can continue to exist beyond LAC III, albeit it with a significantly different composition. The tolerance for highly degraded conditions found in Paper 1 may be exacerbated in the future as climate change degrades reefs around the

world. Tourism is highly comparative and tourists weigh the opportunities and costs of visiting various destinations. If conditions in Thailand continue to decline but remain in comparatively better condition than other destinations around the world, demand may persist. Yet, even the most accepting of generalists will likely only tolerate so much damage. At a certain point, most divers will likely choose to participate in other activities rather than dive on damaged reefs. Paper 3 found under continued climate change impacts, a quarter of respondents anticipate diving less.

This research also found results that were unexplained by the model as it stands now including:

- An increased diversity of activities offered
- The development of a niched generalist dive market

This suggests the model needs to be clarified to describe the emergence of a highly segmented (niche) mass-market industry that can continue to grow beyond LAC III. Similar developments were found in the hill tribes of northern Thailand where visitors originally came to experience an ethnic trek, but eventually were offered various different types of activities (Dearden & Harron 1994). In both the research presented in this thesis and the hill tribe example, a certain segment (the most highly specialized) largely disappeared from the clientele, illustrating a definitive split in the development of both industries once they exceeded LAC III. Namely, a loss of the adventurous specialists and associated activities, and simultaneously, continued growth of a vastly different, niched mass-market industry. This splitting of the industry, with a concurrent decline in one portion and growth in another, suggests that the Andaman dive industry is currently at both points D and E on the DD model (Figure 6).

The emergence of a growing niche market may in part explain the low numbers of ecotourism operations found on the Andaman coast in Paper 2. As each company struggles to differentiate itself, only a small portion may be motivated to identify themselves as ecotourism operations. While it may be unlikely to achieve a true ecotourism industry on the Andaman coast, each company could, and I argue here should, implement measures that ensure each company meets a certain level of environmental

and educational standard. Additionally, the fact that there are now more companies observed than in 2000, is incongruent with the expectations of Dearden and Manowpawitr (2011) although international travel has not yet become the target of heavy carbon taxation which could change this dynamic rapidly.

2. Management Recommendations

This study has presented some predictions for the future of diving on the Andaman coast although in reality, demand for nature-based tourism is hard to forecast. In addition, effective management generally lags well behind such demand (Higham 2007). Effective management requires the simultaneous efforts of managers and operators. For while some operators do not have conservation as their core objective, the over-intrusion of management may prompt operators to not comply with any regulations (Catlin & Jones 2010; Sorice et al. 2006). Additionally, visitors vary in their reception of management restrictions, being more amenable in some situations than others (Needham & Szuster 2011). Based on the findings in the study in combination with recommendations from research on similar industries presented in Papers 1, 2, or 3, I suggest the implementation of some or all of the following interventions in order to maintain, or increase, the sustainability and conservation value of the dive industry.

2.1 Managers

This work recommends that marine parks and marine tourism managers within the Thai National Park, Wildlife, and Plant Conservation Department, and the Tourism Agency of Thailand, begin implementing adaptation strategies based on LACs for various climate change scenarios. To do so will require that management objectives are set for various regions within each park. Dearden and Manopawitr (2011) explore some of the aspects that need to be considered when doing this type of scenario planning. Overall, all reefs will be able to tolerate a lower level of stress from tourist use. Identifying indicators and setting low ecological thresholds will be necessary to account for the uncertainty involved in managing for climate change. Within this lower ecological threshold, dive

sites can be assessed based on their vulnerability to climate change impacts as well as their current health, and the tourist pressure appropriate for each site can be determined. For instance, placing new divers on resilient reefs, even if they are somewhat degraded will be important in order to protect the most vulnerable areas.

Several other management strategies can be used to enhance the conservation value of the industry. These include regulating access by restricting the number of boats allowed at each site (determined by the number of available mooring buoys) (Di Franco et al. 2009; Hasler & Ott 2008), and providing tailored opportunities for low and high specialization recreationists by employing the diver opportunity spectrum (Dearden et al. 2006; Thapa et al. 2006). In addition, the conservation value of the dive industry can be enhanced by capitalizing on user fees to fund conservation, particularly within protected areas (Depondt & Green 2006). Divers within Koh Similan National Marine park have been documented as being willing to pay over twice as much as they are currently charged (Asafu-Adjaye & Tapsuwan 2008). Both protected area managers and dive operators can increase the educational opportunities for visitors, providing in-depth interpretive programs that educate visitors on reef ecology, conservation, and climate change as well as informing visitors about appropriate behaviours when visiting parks. Similarly, protected area managers to provide training for dive leaders and instructors can learn safe ways to intervene when divers make contact with coral or associated fauna (Barker & Roberts 2004).

2.2 Operators

Important steps can also be taken by dive company operators to maximize the conservation value and sustainability of the dive industry into the future. For instance, implementing environmental-education based interpretive programs about coral reefs, climate change, and conservation is one of the key recommendation coming out of each of the three papers in this thesis. This interpretation will need to be tailored to mainstream visitors and integrated into regular diving programs, offering engaging ways to learn about coral reefs as well as concrete conservation actions that visitors can take

personally. In addition, including thorough pre-dive briefings that detail appropriate underwater behaviour will aid in reducing the impact that divers have, enhancing the net conservation value of the industry (Medio et al. 1997).

Another tool that can increase the ecotourism potential of the diving industry is the promotion of eco-labels. Eco-labels are a form of accreditation that identifies companies that meet specific ecotourism criteria. They can inform tourist purchasing, generate higher revenues for accredited companies, and create pressure among competitors to become more sustainable (Anderson et al. 2012) and the use of such programs could aid in the broader dissemination of ecotourism values. Additionally, dive operators can capitalize on the type of last-chance disaster tourism that can increase visitation to some regions. Operators can diversify the activities they offer to include conservation opportunities such as reef shading, coral replanting, and volunteer research. Finally, all operators can increase their efforts to minimize their impact on coral reefs by ensuring that oil run off is properly caught and stored, waste is properly disposed of, that they are using mooring buoys rather than anchoring, and taking steps to minimize their carbon footprint.

3. Limitations

There are several ways this research could have been strengthened discussed in three parts, research focus, sampling, and research instrument:

3.1 Research Focus

The research presented in this thesis evaluated changes to industry sustainability by comparing data collected in two different years. This temporal comparison strengthened this study, yet is also a limitation. While the comparison has provided great insight into change over time, some differences this research intended to detect using temporal analyses require the use of a high frequency long-term dataset. This is particularly important when looking at complex relationships (Higham 1998) such as some examined

in this thesis. Using data that was collected more frequently over a longer time span would strengthen the evaluation of long-term conservation-recreation trends.

Additionally, this research focused on visitor perceptions and responses and one of the main limitations to the study was the lack of data on coral reefs themselves, as well as a shortage of data on dive operators' perceptions. Data on specific coral reefs could inform our interpretation of visitor responses to those places. For instance, information on coral reef health at particular dive sites could be compared with visitor satisfaction and willingness to return to the same sites. Additionally, understanding the perception of dive operators to changes within the industry, and their responses to such changes, could help strengthen predictions about future responses to shifting clientele and coral conditions.

3.2 Sampling

There are two potential limitations in this study that relate to respondent bias. First, the standardized questionnaire used was relatively long and in some cases could have caused respondent fatigue, triggering some tourists to self select and not complete it. Research has shown that non-response bias can in some cases be explained by respondent values, beliefs, and motivations, masking potential findings (Lankford 1995). This limitation was identified at the outset of the field season and surveys were extensively pre-tested and modified in the field to make them as user friendly as possible. In addition, the high response rate achieved (between 90 and 100 percent on board boats) would have minimized the impacts of this type of bias. The second situation that respondent bias may have influenced this study is during the intercept surveys. Web surveys typically have a lower response rate (45 percent in this study) than personally delivered questionnaires, and therefore can be subject to greater respondent bias. We hoped to minimize this type of bias by using paper surveys wherever possible. Despite these efforts a comparison of survey methods shows that web respondents were significantly more specialized ($p=0.008$) than paper respondents. Web-results comprised ten percent of the overall sample, so the influence of this bias is somewhat limited. In addition, the overall conclusions made based on these results is that divers are becoming increasingly less

specialized, a finding that the sampling bias would have obscured, not highlighted, suggesting that despite the respondent bias present in the sample, it would not have changed the overall conclusions made by this research.

Additionally, the sampling strategy used in 2012 may have exacerbated some of the differences in diver expectations found in Paper 1. While the 2000 questionnaire measured diver motivation in a pre-dive survey and satisfaction in a post-dive survey, the 2012 questionnaire measured both in one survey administered after visitors had completed one or more dives. Recreationists have been documented to shift their expectations to match their experience and avoid disappointment (Papworth et al. 2009). This is known as cognitive dissonance where visitors avoid admitting dissatisfaction to a researcher or to themselves (Orams 1996). Cognitive dissonance is particularly present in recreational activities where visitors have selected the activity and invested time, money, and effort into their participation. In 2012, divers may have had higher expectations prior to their first dive, but shifted their expectations to match an unfulfilling dive experience.

3.3 Research Instrument

This study measured the specialization level of divers using a binary index rather than a single self-specialization question that is common in much of the current literature (Kerins et al. 2007; Needham et al. 2009; Scott et al. 2005; Sorice et al. 2009). Although both measures were included in the questionnaire, this study only reported results from the specialization index used in 2000 to maintain consistency for comparisons.

4. Future Research Priorities

- Identify specific thresholds of acceptable levels of reef damage to specialists and generalists.
- Directly comparing visitor characteristics, motivations, and satisfaction before and after a bleaching event to better understand the immediate impacts of bleaching on tourism

- Test how climate change has shifted wildlife tourism industries in other parts of the world against predictions by Dearden and Manowpawitr (2011).
- Compare ecological conditions at particular sites to visitor perceptions at those sites
- Test the impacts of climate change based interpretation programs on visitor perceptions of climate change

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Appendix I: Thai Research Permit

กรุณาเก็บจดหมายฉบับนี้ไว้ แสดงต่อพนักงานเจ้าหน้าที่ [illegible]

ที่ ทส ๐๙๐๗.๔/ ๖๓๔๓

สำนักงานคณะกรรมการวิจัยแห่งชาติ
รับที่ ๒๐๐๕
วันที่ ๑๘ เม.ย. ๒๕๕๕

กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช
๖๑ ถนนพหลโยธิน แขวงลาดยาว เขตจตุจักร
กรุงเทพมหานคร ๑๐๙๐๐

๑๒ เมษายน ๒๕๕๕

รับที่ 1825
วันที่ 16 เม.ย. 55
เวลา 16 น.

เรื่อง ขออนุญาตเข้าไปทำการศึกษาหรือวิจัยทางวิชาการในพื้นที่ป่าอนุรักษ์ (Dr. Philip Dearden : University of Victoria ประเทศแคนาดา)

เรียน เลขาธิการคณะกรรมการวิจัยแห่งชาติ

อ้างถึง หนังสือสำนักงานคณะกรรมการวิจัยแห่งชาติ ที่ วช ๐๐๐๒/๓๔๓๘ ลงวันที่ ๒๑ กุมภาพันธ์ ๒๕๕๕

สิ่งที่ส่งมาด้วย เงื่อนไขประกอบการเข้าไปทำการศึกษาหรือวิจัยทางวิชาการในพื้นที่ป่าอนุรักษ์

ตามหนังสือที่อ้างถึง ส่งคำขออนุญาตเข้าไปทำการศึกษาหรือวิจัยทางวิชาการในพื้นที่ป่าอนุรักษ์ เรื่อง "โครงการศึกษาวิจัยเพื่อปรับปรุงการจัดการอนุรักษ์พื้นที่คุ้มครองทางทะเลในฝั่งอันดามันภายใต้การเปลี่ยนแปลงสภาพภูมิอากาศ" ณ อุทยานแห่งชาติ ๑๒ แห่ง คือ อุทยานแห่งชาติลำน้ำกระบุรี อุทยานแห่งชาติแหลมสน อุทยานแห่งชาติหมู่เกาะระนอง อุทยานแห่งชาติหมู่เกาะสุรินทร์ อุทยานแห่งชาติหมู่เกาะสิมิลัน อุทยานแห่งชาติเขาหลัก-ลำรู่ อุทยานแห่งชาติอ่าวพังงา อุทยานแห่งชาติธารโบกขรณี อุทยานแห่งชาติหาดนพรัตน์ธารา-หมู่เกาะพีพี อุทยานแห่งชาติหมู่เกาะเภตรา อุทยานแห่งชาติตะรุเตา และอุทยานแห่งชาติทะเลบัน โดยมี Dr. Philip Dearden เป็นหัวหน้าโครงการวิจัย ระยะเวลาศึกษาวิจัยตั้งแต่วันที่ ๑ พฤษภาคม ๒๕๕๔ ถึงวันที่ ๓๑ พฤษภาคม ๒๕๕๖ เพื่อให้กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช พิจารณา นั้น

กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช พิจารณาแล้ว ขอเรียนว่าโครงการวิจัยดังกล่าวเป็นโครงการเพื่อประโยชน์ในการศึกษาหรือวิจัยทางวิชาการ ซึ่งต้องปฏิบัติการโดยพนักงานเจ้าหน้าที่ ดังนั้นจึงอนุมัติให้หัวหน้าอุทยานแห่งชาติทั้ง ๑๒ แห่งดังกล่าวข้างต้น และนางสาวศิริพร จันทร์สว่าง นักวิชาการป่าไม้ปฏิบัติการ อุทยานแห่งชาติหาดนพรัตน์ธารา-หมู่เกาะพีพี พร้อมทั้งมอบหมายให้หัวหน้าศูนย์ศึกษาและวิจัยอุทยานแห่งชาติทางทะเล จังหวัดภูเก็ต และหัวหน้าศูนย์ศึกษาและวิจัยอุทยานแห่งชาติทางทะเล จังหวัดตรัง ในฐานะพนักงานเจ้าหน้าที่เป็นผู้ปฏิบัติการ โดยมีหน้าที่ควบคุม กำกับ ดูแล การดำเนินการใดๆ ตามระเบียบซึ่งออกตามพระราชบัญญัติอุทยานแห่งชาติ พ.ศ. ๒๕๐๔ อย่างเคร่งครัด ภายใต้การสนับสนุนการดำเนินการศึกษาวิจัยของสถาบันวิจัยและพัฒนาทรัพยากรทางทะเลชายฝั่ง และป่าชายเลน โดย Dr. Philip Dearden หัวหน้าโครงการฯ และให้ปฏิบัติตามเงื่อนไขประกอบการเข้าไปทำการศึกษาหรือวิจัยทางวิชาการในพื้นที่ป่าอนุรักษ์ รายละเอียดปรากฏตามสิ่งที่ส่งมาด้วย ทั้งนี้ตั้งแต่บัดนี้ ถึงวันที่ ๓๑ พฤษภาคม ๒๕๕๖ และก่อนคณะนักวิจัยเข้าไปดำเนินการศึกษาวิจัยในพื้นที่ โปรดแจ้งเป็นหนังสือต่ออธิบดีกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ให้ทราบก่อนเข้าไปดำเนินการในพื้นที่อย่างน้อย ๑๕ วัน พร้อมทั้งแจ้งพนักงานเจ้าหน้าที่ในพื้นที่ทราบก่อนทุกครั้งจึงเข้าไปดำเนินการได้ และเมื่อสิ้นสุดโครงการวิจัยแล้วให้ส่งรายงานผลการวิจัยฉบับสมบูรณ์ จำนวน ๕ เล่ม พร้อมแผ่นบันทึกข้อมูล จำนวน ๑ แผ่น ให้กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ด้วย

จึงเรียนมาเพื่อโปรดทราบและพิจารณาแจ้งผู้วิจัยทราบและปฏิบัติต่อไป

ขอแสดงความนับถือ

(นายธีรภัทร ประยูรสิทธิ)
รองอธิบดี ปฏิบัติราชการแทน
อธิบดีกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช

สำนักวิจัยการอนุรักษ์ป่าไม้และพันธุ์พืช
โทร. ๐ ๒๕๖๑ ๐๗๗๗ ต่อ ๑๔๖๐
โทรสาร ๐ ๒๕๗๙ ๔๗๗๕ , ๐ ๒๕๗๙ ๙๕๗๖

เงื่อนไขประกอบการเข้าไปทำการศึกษาหรือวิจัยทางวิชาการในพื้นที่ป่าอนุรักษ์

1. ผู้ได้รับอนุญาตให้เข้าไปทำการศึกษาหรือวิจัยทางวิชาการต้องปฏิบัติดังนี้

(1) ต้องแจ้งเป็นหนังสือต่ออธิบดีกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ให้ทราบก่อนเข้าไปดำเนินการในพื้นที่อย่างน้อย 15 วัน และให้แจ้งพนักงานเจ้าหน้าที่ในพื้นที่ทราบก่อนจึงเข้าไปดำเนินการได้

(2) ต้องรายงานความก้าวหน้าของการวิจัยตามแบบที่กำหนด ให้กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช จำนวน 3 ชุด พร้อมสำเนาข้อมูลดิบทุก ๆ 6 เดือน พร้อมทั้งสรุปผลงานสะสมตั้งแต่เริ่มโครงการมาด้วย

(3) ในการเก็บตัวอย่างแต่ละครั้งต้องแบ่งตัวอย่างชนิดเดียวกันและ/หรือตัวอย่างหัวเชื้อ (Culture of Isolates) ที่เก็บได้ให้กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช จำนวน 1 ชุด ทุกครั้ง ในกรณีที่มีเพียงตัวอย่างเดียว กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ขอสงวนสิทธิ์เป็นเจ้าของร่วมในตัวอย่างนั้น ๆ

(4) เมื่อสิ้นสุดโครงการวิจัยแล้วให้ส่งรายงานผลการวิจัยฉบับสมบูรณ์ และเอกสารวิจัยที่นำไปเผยแพร่ในวารสารต่าง ๆ จำนวนอย่างละ 5 ชุด ให้กรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ด้วย

(5) ผู้วิจัยต้องปฏิบัติตามวัตถุประสงค์ แผนงาน วิธีการ และเงื่อนไขที่ระบุไว้ในข้อตกลงของโครงการวิจัยที่กำหนดไว้เท่านั้น

(6) ผู้วิจัยต้องปฏิบัติตามกฎหมายเกี่ยวกับการป่าไม้ และกฎหมายอื่นที่เกี่ยวข้องอย่างเคร่งครัด ตลอดจนต้องปฏิบัติตามระเบียบ ข้อกำหนด ประกาศ คำสั่ง วิธีการ และเงื่อนไขที่กำหนดไว้ในหนังสืออนุญาต และต้องปฏิบัติตามคำสั่งของพนักงานเจ้าหน้าที่ ซึ่งสั่งการตามอำนาจหน้าที่โดยชอบด้วยกฎหมายอย่างเคร่งครัด

(7) เมื่อผู้ได้รับอนุญาตฝ่าฝืนหรือไม่ปฏิบัติตามกฎหมาย ระเบียบ ข้อบังคับ ประกาศ คำสั่ง หรือส่อพฤติกรรมที่อาจจะเป็นภัยต่อสังคมหรือความมั่งคงของประเทศ หรือทำให้เกิดความเสียหาย หรือเป็นอันตรายต่อสภาพแวดล้อม ต่อชนิดพันธุ์และต่อพันธุกรรมแห่งพืช สัตว์ จุลินทรีย์ หรือทรัพยากรธรรมชาติอื่น ๆ อธิบดีกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช อาจระงับการอนุญาตและดำเนินการตามกฎหมายที่เกี่ยวข้อง

(8) ในกรณีผู้ได้รับอนุญาตมีความจำเป็นต้องขยายเวลาการทำวิจัย ให้ยื่นหนังสือขอต่ออายุโครงการต่ออธิบดีกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ก่อนสิ้นสุดโครงการไม่น้อยกว่า 30 วัน พร้อมทั้งชี้แจงเหตุผลความจำเป็น และให้รายงานความก้าวหน้าของผลการวิจัยที่ทำมาแล้วเป็นภาษาไทย จำนวน 5 ชุด แนบมาพร้อมหนังสือขอต่ออายุโครงการด้วย

(9) ในกรณีผู้ได้รับอนุญาตไม่ปฏิบัติตามเงื่อนไขนี้ สถาบันทางวิชาการหรือหน่วยงานราชการในประเทศไทยที่รับรองและร่วมรับผิดชอบโครงการ ต้องรับผิดชอบให้มีการปฏิบัติตามเงื่อนไขนี้

/2. ผู้ได้รับ...

2. ผู้ได้รับอนุญาตให้ทำการศึกษาหรือวิจัย หรือเก็บตัวอย่างทรัพยากรธรรมชาติ หรือทรัพยากรชีวภาพ หรือทรัพยากรพันธุกรรมล้านป่าไม้ แล้วนำผลการวิจัย และหรือ ตัวอย่างไปจดทะเบียนลิขสิทธิ์ (Copy Right) หรือทะเบียนสิทธิบัตร (Patent) หรือทะเบียนทรัพย์สินทางปัญญา (Intellectual Property Right) หรือทะเบียนการค้า (Trade Mark) หรือทะเบียนอื่นใดตามกฎหมาย เพื่อผลิตเป็นอุตสาหกรรมหรือทางการค้า หรือพิมพ์ผลงานเพื่อจำหน่าย ต้องได้รับอนุญาตจากกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช ก่อนจึงจะดำเนินการได้ และให้ถือว่า ลิขสิทธิ์ สิทธิบัตร ทรัพย์สินทางปัญญาและทะเบียนการค้านั้น เป็นสมบัติร่วมกันกับกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช และต้องทำความตกลงการแบ่งปันผลประโยชน์ที่จะเกิดขึ้นในภายหน้าให้กับกรมอุทยานแห่งชาติ สัตว์ป่า และพันธุ์พืช เป็นกรณี ๆ ไป

สำนักงานคณะกรรมการวิจัยแห่งชาติ
196 ถนนพหลโยธิน เขตจตุจักร
กรุงเทพฯ 10900
โทรศัพท์ 0-2579-2690,0-2579-2285
โทรสาร 0-2561-3049
Website: www. nrct-foreignresearcher.org

NATIONAL RESEARCH COUNCIL
196 PHAHOLYOTHIN RD., CHATUCHAK,
BANGKOK 10900, THAILAND
Telephone 0-2579-2690, 0-2579-2285
Fax (66) 2561-3049
Email: webmaster@nrct-foreignresearcher.org

No. 0002/ 3154

24 April B.E. 2555 (2012)

Dear Dr. Dearden,

We are pleased to inform you that the Office of the National Research Council of Thailand (NRCT) has permitted you and your colleagues (Mr. Nathan Bennett and Ms. Jessica Augustine) to conduct the research on "Project IMPAACT: Improving Marine Protected Areas on the Andaman Coast of Thailand under a Climate Change Regime" from May 2012 - May 2013.

Carrying out this research, you have to accord with the following conditions:

1. Inform the Director-General of Department of National Park, Wildlife and Plant Conservation (DNP) by letter, and officials in the site before commencing research.

2. Send three copies of progress report, copy of raw data every six months and summary of the project to DNP.

3. In regard to each specimen collection, you have to offer one set of species and/or culture of isolates to DNP in case the specimens exist more than one. Contrarily, if only one sample is collected, DNP reserves the right to be co-owner of that sample.

4. At the completion of the project, you have to submit five copies of complete report including research documents publicized in diverse journals to DNP.

5. Follow the objectives, work plan, methodology, terms and conditions specified in research proposal.

6. Accord strictly to forestry law and other concerned laws.

7. In the event that you do not accord with the law, regulations, terms, or have any conduct deemed to be detrimental to society, security of Thailand, environment, plant and animal genetics and other natural resources, the Director-General of DNP may cancel its permission for your research, then enforce the law.

8. Should you intend to extend a period of research time, kindly propose the letter applying for prolonging the project period to the Director-General of DNP at least 30 days

before the termination of the research period by informing reasons/necessity for extension, together with five copies of recent progress report in Thai version.

9. In case if you do not conform to these conditions, Thai institutions/organiztions endorsing or taking part in your project are in charge of getting you to act on these conditions.

10. In case you desire to take research results and/or samples to apply for copy right, patent, intellectual property right, trade mark, etc. for commercial advantages, you must get permission from DNP before doing that. Please note that the copy right, patent, intellectual property right, trade mark will become co-assets between you and DNP. Agreement (s) on the benefit sharing of the above commercial use must be made, and returned to DNP case by case in future.

According to our current immigration law, you and your colleagues are advised to apply for non – immigrant visa prior to your leaving for Thailand. Moreover, you and your colleagues are required to report to the Office of International Affairs, NRCT within seven days after your arrival in Thailand in order to pay a deposit of 10,000 Baht guaranteeing submission of the complete report to NRCT, then obtain concerned documents.

We look forward to welcoming you.

Yours sincerely,

(Ms. Jintanapa Sobhon)
Senior Advisor for Social Sciences Research
For Secretary - General

Dr. Philip Dearden
Department of Geography
University of Victoria, PO Box 3060
Victoria, BC., V8W3R4
Canada

สำนักงานคณะกรรมการวิจัยแห่งชาติ
196 ถนนพหลโยธิน เขตจตุจักร
กรุงเทพฯ 10900
โทรศัพท์ 0-2579-2690,0-2579-2285
โทรสาร 0-2561-3049
Website: www. nrct-foreignresearcher.org

NATIONAL RESEARCH COUNCIL
196 PHAHOLYOTHIN RD., CHATUCHAK,
BANGKOK 10900, THAILAND
Telephone 0-2579-2690, 0-2579-2285
Fax (66) 2561-3049
Email: webmaster@nrct-foreignresearcher.org

No. 0002/ 3135

24 April B.E. 2555 (2012)

Dear Mr. Bennett,

We are pleased to inform you that the Office of the National Research Council of Thailand (NRCT) has permitted you to participate in Dr. Philip Dearden's research project on "Project IMPAACT: Improving Marine Protected Areas on the Andaman Coast of Thailand under a Climate Change Regime" from May 2012 - May 2013.

In this connection, you and your family (Mrs. Elizabeth Nethery, Mr. Kai Dylan Nethery Bennett and Miss Sage Ilah Nethery Bennett) are advised to apply for non – immigrant visa prior to your leaving for Thailand. Moreover, you are required to report to the Office of International Affairs, NRCT within seven days after your arrival in Thailand in order to obtain concerned documents.

We look forward to welcoming you.

Yours sincerely,

(Ms. Jintanapa Sobhon)
Senior Advisor for Social Sciences Research
For Secretary - General

Mr. Nathan Bennett
Department of Geography
University of Victoria, PO Box 3060
Stn CSC, Victoria, BC, V8W3R4
Canada

สำนักงานคณะกรรมการวิจัยแห่งชาติ
196 ถนนพหลโยธิน เขตจตุจักร
กรุงเทพฯ 10900
โทรศัพท์ 0-2579-2690,0-2579-2285
โทรสาร 0-2561-3049
Website: www. nrct-foreignresearcher.org

วช.
NRCT

NATIONAL RESEARCH COUNCIL
196 PHAHOLYOTHIN RD., CHATUCHAK,
BANGKOK 10900, THAILAND
Telephone 0-2579-2690, 0-2579-2285
Fax (66) 2561-3049
Email: webmaster@nrct-foreignresearcher.org

No. 0002/ 3134

24 April B.E. 2555 (2012)

Dear Ms. Augustine,

We are pleased to inform you that the Office of the National Research Council of Thailand (NRCT) has permitted you to participate in Dr. Philip Dearden's research project on "Project IMPAACT: Improving Marine Protected Areas on the Andaman Coast of Thailand under a Climate Change Regime" from May 2012 - May 2013.

In this connection, you are advised to apply for non – immigrant visa prior to your leaving for Thailand. Moreover, you are required to report to the Office of International Affairs, NRCT within seven days after your arrival in Thailand in order to obtain concerned documents.

We look forward to welcoming you.

Yours sincerely,

(Ms. Jintanapa Sobhon)
Senior Advisor for Social Sciences Research
For Secretary - General

Ms. Jessica Augustine
PO Box 3060
STN CSC, V8W 3R4
Canada

Appendix II: Ethics Approval

University of Victoria
Human Research Ethics Board
Office of Research Services
Administrative Services Building
PO Box 1700 STN CSC
Victoria British Columbia V8W 2Y2 Canada
Tel 250-472-4545, Fax 250-721-8960
email ethics@uvic.ca Web www.research.uvic.ca

Certificate of Approval

PRINCIPAL INVESTIGATOR	J. Skye Augustine	ETHICS PROTOCOL NUMBER	11-495
UVic STATUS:	Master's Student	ORIGINAL APPROVAL DATE:	20-Dec-11
UVic DEPARTMENT:	GEOG	APPROVED ON:	20-Dec-11
SUPERVISOR:	Dr. Phil Dearden	APPROVAL EXPIRY DATE:	19-Dec-12

PROJECT TITLE: **Climate change and dive tourism in Phuket, Thailand: Assessment of industry sustainability**

RESEARCH TEAM MEMBERS: None

DECLARED PROJECT FUNDING: **SSHRC - Joseph Armand Bombardier Canada Graduate Scholarship**

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

Dr. Rachael Scarth
Associate Vice-President, Research

Certificate Issued On: 20-Dec-11

11-495 Augustine, J. Skye

Appendix III: Copyright and Moral Right Releases

Copyrights and moral rights have been released by Dr. Phil Dearden for 1) Figure 1 from the article Dearden, P., M. Bennett, and R. Rollins. 2006. Implications for coral reef conservation of diver specialization. Environmental Conservation **33**:353-363, and 2) Figure 11.2 from the article Dearden, P., and P. Manopawitr. 2011. Climate change-Coral Reefs and Dive Tourism in South-east Asia. Pages 144-160 in A. Jones, and M. Phillips, editors. Disappearing Destinations: Climate Change and Future Challenges for Coastal Tourism. CABI Cambridge. This release of rights from the author grants permission to reproduce a modified version of each figure in this thesis.

Additional copyright and moral rights have been released by Ms. Michelle Bennett for the diver questionnaire used in Bennett, M. 2002. Scuba Diving Tourism in Phuket. Thailand: Pursuing Sustainability. MA Thesis, Department of Geography, University of Victoria. This release of rights by the author grants permission to reproduce a modified version of the questionnaire in this thesis.

Appendix IV: Dive Visitor Survey

SCUBA DIVING ON THE ANDAMAN COAST OF THAILAND

A SURVEY OF DIVER PERCEPTIONS
UNIVERSITY OF VICTORIA, CANADA
2012

mparg
www.mparg.wordpress.com

Social Sciences and Humanities Research Council

Project IMPAACT
http://projectimpaact.asia

Welcome!

I am inviting you to participate in a brief 15-minute questionnaire, aimed at recording the quality of your dive experience today, and the quality of the dive environment. Completing this survey will assist efforts to protect coral reefs, and improve the quality of dive experiences in the future. The results of this study will be provided to this company, other dive companies, and Thai Tourism Authorities so that they can use your opinions to improve management.

This study is being undertaken by the University of Victoria (Canada) as part of an ongoing research project examining marine tourism and conservation in Thailand.

Sincerely,
Skye Augustine (skyea@uvic.ca)
MSc Candidate, University of Victoria

Scuba Diving on the Andaman Coast

In order to protect coral reefs and provide positive visitor experiences, it is important for us to know your motivations and expectations for your Andaman dive trip.

Q-1. Is diving on the Andaman Coast:

1 THE MAIN REASON FOR YOUR TRIP?
2 A PLANNED ACTIVITY ON YOUR TRIP?
3 AN UNPLANNED ACTIVITY ON YOUR TRIP?

Q-2. What type of dive trip did you take part in here in Thailand? (Please circle all that apply).

1 DAY TRIP
2 LIVE ABOARD
3 TRAINING DIVE TRIP
4 OTHER TYPE OF DIVE TRIP (please specify)_____

Q-3. How many days are you spending on the boat during your current dive trip?

_____ DAYS

Q-4. Is this your first time diving in Thailand?

1 NO ⇒ How many previous trips to Thailand for the purpose of diving have you made? _____
2 YES

Q-5. Aside from Thailand, in what other global regions have you been diving? (Please circle all that apply).

1 AUSTRALIA/NEW ZEALAND
2 SOUTH PACIFIC
3 NORTH AMERICA
4 CARIBBEAN
5 MEDITERRANEAN
6 SOUTH AMERICA
7 GALAPAGOS
8 ELSEWHERE IN SOUTH EAST ASIA
9 OTHER Please list:_____

Diving and You

Now we would like to ask you about your previous scuba diving experience.

Q-6. In what year did you become a certified diver?_____

Q-7. Which diving courses have you taken? (Please circle all that apply)

1 DISCOVER SCUBA DIVING/ OPEN WATER
2 ADVANCED OPEN WATER
3 RESCUE DIVER

4 DIVE MASTER
5 INSTRUCTOR
6 OTHER Please list: _____

Q-8. In the last two years, how many dives have you completed?

1 ZERO
2 1-5 DIVES
3 6-15 DIVES
4 16-25 DIVES
5 26-35 DIVES
6 more than 35 DIVES

Q-9. Do you own any of the following dive gear? (Please circle all that apply)

1 NO DIVE GEAR
2 BASIC DIVE GEAR (MASK/ SNORKEL / FINS)
3 STANDARD GEAR (BCD/ REGULATOR / GAUGES/COMPUTER)
4 SPECIALIZED GEAR (UNDERWATER CAMERA, VIDEO)
5 CORAL FIELD GUIDE
6 FISH FIELD GUIDE
7 OTHER_____
_____

Q-10. What company did you book your dive trip with?

_____

Q-11. Please choose one of the following that **best** describes the type of diver you are.

1 Type 1: "Diving is an activity that I participate in when it is convenient. I do not have any diving certifications and dive mainly to spend time with my friends/family or to have a new experience. I do not own any diving equipment and do not travel to destinations specifically to dive"

2 Type 2: "Diving is an enjoyable, but infrequent activity that is incidental to other travel and outdoor interests. I have some diving certification but am not yet highly experienced. I rarely read diving articles, and do not own much equipment beyond the basic necessities"

3 Type 3: "Diving is an important but not the exclusive outdoor activity in my life. I occasionally read articles on diving and own some diving equipment. I am well certified but my participation in diving is inconsistent and I am a moderately skilled diver"

4 Type 4: "Diving is a highly important outdoor activity. I go diving every chance I get, and invest considerable time and money in having various diving experiences. I am highly certified, I own specialized diving equipment, and am a member of diving organizations or subscribe to diving literature"

Why Dive?

Q-12. In order to provide a high quality diving experience, it is helpful for us to know why people participate in scuba diving. Please state how **IMPORTANT/ UNIMPORTANT** you feel each of the following features are to your diving experience on the Andaman Coast of Thailand. Please circle a number beside each statement that best reflects your feelings.

	WHY DIVE?	NOT AT ALL IMPORTANT ⇓	LOW IMPORTANCE ⇓	MEDIUM IMPORTANCE ⇓	HIGH IMPORTANCE ⇓	VERY HIGH IMPORTANCE ⇓
A.	Interest in marine flora and fauna…	1	2	3	4	5
B.	Seeking adventure……	1	2	3	4	5
C.	Interest in underwater photography.	1	2	3	4	5
D.	To explore new environments …….	1	2	3	4	5
E.	To expand my knowledge……	1	2	3	4	5
F.	To develop my skills and abilities...	1	2	3	4	5
G.	To be with family/ friends ……	1	2	3	4	5
	Are there any others? (Please list):					
H.	_____	1	2	3	4	5
I.	_____	1	2	3	4	5

The Diving Environment

Q-13. Please state how **IMPORTANT/UNIMPORTANT** you feel each of the following **environment and setting** features are to your Andaman diving experience (Please circle).

	ENVIRONMENT AND SETTING FEATURES	NOT AT ALL IMPORTANT ⇓	LOW IMPORTANCE ⇓	MEDIUM IMPORTANCE ⇓	HIGH IMPORTANCE ⇓	VERY HIGH IMPORTANCE ⇓
A.	Good underwater visibility……	1	2	3	4	5
B.	Variety and abundance of marine life.....	1	2	3	4	5
C.	Clear, unpolluted dive sites……...	1	2	3	4	5
D.	Pristine, undamaged dive sites……	1	2	3	4	5

E.	Easy dive conditions ……..	1	2	3	4	5
F.	Absence of crowding by other divers …..	1	2	3	4	5
G.	Good above water scenery……	1	2	3	4	5
H.	Presence of whale sharks……..	1	2	3	4	5
I.	Presence of other sharks……	1	2	3	4	5
J.	Presence of manta rays……	1	2	3	4	5
K.	Presence of turtles……	1	2	3	4	5
L.	Good photo opportunities……	1	2	3	4	5
M.	Opportunity to learn more about marine environments……	1	2	3	4	5
	Are there any others? (Please list):					
N.	_____	1	2	3	4	5
O.	_____	1	2	3	4	5

Q-14. Of the features listed in Q-13, which do you feel are the three **most important** to you? (Please write the corresponding letter from Q-13 in the appropriate box.)

☐ Most Important Second Most ☐ Important ☐ Third Most Important

Diving Services

Q-15. Please state how **IMPORTATANT/UNIMPORTANT** you feel each of the following **services** are to your diving experience on the Andaman Coast (Please circle a number).

	SERVICE PROVIDED	NOT AT ALL IMPORTANT ⇓	LESS IMPORTANCE ⇓	MEDIUM IMPORTANCE ⇓	HIGH IMPORTANCE ⇓	VERY HIGH IMPORTANCE ⇓
A.	On board services ……	1	2	3	4	5
B.	Information provided by dive master…… …….	1	2	3	4	5
C.	Friendliness of crew……..	1	2	3	4	5

D.	Appropriate safety procedures on dive boat……	1	2	3	4	5
E.	Expertise of dive master……	1	2	3	4	5
F.	Compatibility of fellow divers……..	1	2	3	4	5
G.	High quality of general service…..…	1	2	3	4	5
H.	Commitment to the environment by the dive shop and boat crew…..…	1	2	3	4	5
	Are there any others? (Please list):					
I.	_____	1	2	3	4	5
J.	_____	1	2	3	4	5

Q-16. Of the features listed in Q-15, which do you feel are the **most important** to you? (Please write the corresponding letter from Q-15 in the appropriate box.)

☐ Most Important ☐ Second Most Important ☐ Third Most Important

Satisfaction

Q-17. To help us understand what you liked or didn't like about your diving experience please indicate how **SATISFIED** you were with each of the following aspects of your dive trip. Please circle a number beside each statement that best reflects your feelings.

	SATISFACTION	VERY UNSATISFIED ⇓	UNSATISFIED ⇓	NEUTRAL ⇓	SOMEWHAT SATISFIED ⇓	VERY SATISFIED ⇓
A.	Good underwater visibility……	1	2	3	4	5
B.	Variety and abundance of marine life...	1	2	3	4	5
C.	Clear, unpolluted dive sites……..	1	2	3	4	5
D.	Pristine, undamaged dive sites……	1	2	3	4	5

E	Explore new environments……..	1	2	3	4	5
F.	Easy dive conditions..……	1	2	3	4	5
G	Seeking adventure……	1	2	3	4	5
H.	Absence of crowding by other divers…	1	2	3	4	5
I.	Good above water scenery……	1	2	3	4	5
J.	Presence of whale sharks……..	1	2	3	4	5
K.	Presence of other sharks……..	1	2	3	4	5
L.	Presence of manta rays……	1	2	3	4	5
M.	Presence of turtles……...	1	2	3	4	5
N.	Good photo opportunities……	1	2	3	4	5
O.	Develop skills and abilities……	1	2	3	4	5
P.	Opportunity to learn more about marine environments……	1	2	3	4	5
Q.	To be with family/ friends……	1	2	3	4	5
R.	Expertise and information provided by dive master……	1	2	3	4	5
S.	High quality of general service……	1	2	3	4	5
T.	Commitment to the environment by the dive shop and boat crew……	1	2	3	4	5

	Did this trip provide any additional opportunities? (Please list):					
U.	_____	1	2	3	4	5
V.	_____	1	2	3	4	5

Q-18. Of the features listed in Q-17, which were the **most satisfying**?
(Please write the corresponding letter from Q-17 in the appropriate box.)

☐ Most Satisfying ☐ Second Most Satisfying ☐ Third Most Satisfying

Your Diving Experience

Q-19. On a scale of 1 to 10, with 1 being very unsatisfied and 10 being very satisfied, please indicate how satisfied are you **overall** with your Andaman Sea scuba diving experience.(Please circle the number that best reflects your feelings)

1-----2-----3-----4-----5-----6-----7-----8-----9-----10
VERY UNSATISFIED VERY SATISFIED

Q- 20. Overall, how would you rate your current diving experience compared to your expectations?

1 MUCH WORSE
2 SOMEWHAT WORSE
3 ABOUT THE SAME
4 SOMEWHAT BETTER
5 MUCH BETTER

Q-21. Which dive sites did you visit during your current dive trip? (Please circle all that apply).

1 RAJA NOI / RAJA YAI
2 PHI PHI ISLANDS
3 SHARK POINT
4 KOH DOK MAI
5 HIN DAENG / HIN MUANG
6 SIMILANS
7 SURIN
8 RICHELIEU ROCK
9 KOH BON
10 KON TACHAI
11 MYANMAR
12 OTHER Please list:

Q-22. Did you dive in a National Marine Park?

1 NO
2 YES (Please indicate which National Marine Park:_____)
3 NOT SURE

Q-23. Would you return to the Andaman Coast for diving based on your experiences on this trip?

1 NO
2 YES
3 NOT SURE

Impacts of Diving

To promote satisfactory environmental conditions that provide visitors with positive experiences, it is useful for us to learn the impacts you feel diving and dive trips have on the reef environment.

Q-24. On your dive trip, you may have seen some evidence of positive and negative **impacts of diving,** some of which are listed below. Please indicate the extent to which you feel diving affects the environment (Please circle):

		STRONGLY DISAGREE ⇓	SOMEWHAT DISAGREE ⇓	NOT SURE ⇓	SOMEWHAT AGREE ⇓	STRONGLY AGREE ⇓
A.	Negative impact on fish……	1	2	3	4	5
B.	Negative impact on coral……	1	2	3	4	5
C.	Negative impact on water quality…	1	2	3	4	5
D.	Provides economic support for the protection of the reef……..	1	2	3	4	5
E.	Provides education to divers, which encourages protection of the reef……	1	2	3	4	5
F.	Anchor damage……	1	2	3	4	5
G.	Garbage /Waste……	1	2	3	4	5

H.	Crowding…… …..	1	2	3	4	5
	Did you notice any other positive or negative impacts? (Please list):					
I.	_____	1	2	3	4	5
J.	_____	1	2	3	4	5

Q-25. Overall, do you feel the impact of diving on reefs is:

1 VERY NEGATIVE
2 SOMEWHAT NEGATIVE
3 SOMEWHAT POSITIVE
4 VERY POSITIVE
5 NOT SURE

Q-26. Did you see any evidence of negative impacts on the reef environment created by participants in your dive group?

1 NO
2 YES Please describe:

Q-27. Would you be interested in participating in a reef-monitoring project designed to help maintain environmental quality and minimize negative visitor impacts?

1 NO
2 YES
3 UNSURE

Q-28. Would you like to comment on the quality of the dive sites or the impacts that you or your dive group may have had on the environment? If so, please use the space below.

Changes to Thailand's Coral Reefs

Q-29. Please rank the top three largest threats to coral reefs in Thailand:
(Please write the corresponding letter in the appropriate box.)

a. Natural disasters
b. Pollution
c. Fishing
d. Climate Change
e. Diving
f. Other (Please specify) _____

☐ First Largest Threat ☐ Second Largest Threat ☐ Third Largest Threat

Q-30. To what extend do you think each of the following is a problem for coral reefs in Thailand?

		NOT A PROBLEM ⇓	SMALL PROBLEM ⇓	LARGE PROBELM ⇓	NOT SURE ⇓
A.	Climate change increases ocean temperatures...	1	2	3	4
B.	Climate change alters the chemical composition of the ocean (makes it more acidic)……......	1	2	3	4
C.	Climate change is reducing the health of coral…..	1	2	3	4
D.	Climate change is altering the abundance and diversity of fish……..	1	2	3	4
E.	Climate change is increasing sea levels……	1	2	3	4

Q- 31. Did you see evidence of reef damage by climate change on this trip?

1 YES
2 NO
3 NOT SURE

Q- 32. How concerned are you about the impacts of climate change on the marine environment?

1 NOT AT ALL CONCENRNED
2 SLIGHTLY CONCERNED
3 HIGHLY CONCERNED
4 NOT SURE

Q- 33. Would you be interested in learning more about the impacts of climate change on coral reefs?

1 YES
2 NO

Q- 34. Would you be interested in visiting dive sites to see the impacts of climate change?

1 YES
2 NO
3 NOT SURE

Q- 35. Assuming the impacts of climate change persist into the future, how is this likely to affect your participation in diving in Thailand?

1 DIVE MUCH LESS FREQUENTLY
2 DIVE SLIGHTLY LESS FREQENTLY
3 NO CHANGE
4 DIVE SLIGHTLY MORE FREQNENTLY
5 DIVE MUCH MORE FREQUENTLY
6 NOT SURE

About You

To help us understand your opinions, we are interested in learning a bit about you.

Q-36. Are you

1 FEMALE
2 MALE

Q-37. What is your nationality?_____

Q-38. It is important for us to understand the contribution that dive tourism makes to the Thai economy. Approximately how much money will you spend during your time in Thailand? (Please Indicate Currency:_____)

_____DIVE TRIP

_____OTHER TRIP EXPENSES (Food, accommodation, travel within Thailand, entertainment, etc.)

_____TRIP TOTAL

Q-39. What is the highest level of education that you have completed?

1 GRADE SCHOOL
2 HIGH SCHOOL
3 COLLEGE
4 BACHELOR'S DEGREE
5 MASTER'S DEGREE
6 DOCTORAL DEGREE
7 OTHER_____

Q-40. What is your age?

1 UNDER 25 YEARS
2 26-35 YEARS
3 36-45 YEARS
4 46-55 YEARS
5 56-65 YEARS
6 OVER 65 YEARS

Finally, is there anything else you would like to tell us about your scuba diving experience? If so, please use the space below to express your views.

THANK YOU FOR YOUR HELP!

PLEASE PLACE YOUR COMPLETED SURVEY IN THE ENCLOSED ENVELOPE AND RETURN IT TO YOUR DIVE MASTER.

- -

If you would like to be contacted when the results of this survey become available, please leave us your email address here.

Appendix V: Dive Master Instructions

SCUBA DIVING ON THE ANDAMAN COAST OF THAILAND
University of Victoria, Canada, 2012

Project Description
Please participate in a 20-minute survey about the quality of your dive experience and the quality of the dive environment. Completing this survey will assist efforts to protect coral reefs and improve the quality of dive experiences in the future. The results of this study will be provided to this company, other dive companies, and Thai Tourism Authorities so that they can use your opinions to improve management.

This study is being undertaken by the University of Victoria (Canada) as part of an ongoing research project examining marine tourism and conservation in Thailand.

Skye Augustine (skyea@uvic.ca)
MSc Candidate, University of Victoria

Instructions:

1) Questionnaires are to be distributed only to visitors who have completed **one or more dives** with your company.
2) Respondents must be **18 years of age** or older.
3) At least **50% of eligible divers** on a given trip must complete the survey for results to be useable.
4) The dive leader distributing the questionnaires records the **date**, the **number of eligible divers,** and the **number of questionnaires completed** on the log sheets attached.
5) Completed questionnaires can be collected. (A collection bag/box/envelope can be provided if needed).

NOTE: We encourage dive masters and instructors to also complete a questionnaire if they are interested. Any questionnaires completed by a dive master, instructor, or employee of a dive company along the Andaman Coast of Thailand must be clearly indicated on the front page of the questionnaire.

If you or your visitors have any questions, concerns, or comments, please do not hesitate to contact me:

Skye Augustine
skyea@uvic.ca
Thai cell (088-4517975)

mparg
www.mparg.wordpress.com

Social Sciences and Humanities Research Council

Project IMPAACT
http://projectimpaact.a

Appendix VI: Intercept Script

Hello, my name is _____ and I am doing research on Diving in Thailand. I have three questions I would like to ask you. It should take 2-3 minutes.

If "No" – " Thank you" and move on, record reason for refusal

If "Yes":

First, what is your nationality?

Second, how many dives have you completed in the last two years? (Just your best estimate is fine).

"Would you be willing to answer a short online survey about your diving experience today once you get home? It will take about 15 minutes."

If "No" - Thank you for your time, that is all"

If "Yes" – May I get your first name and your email address? Hand them a form to write it down.

"Thank you very much for your time"

Appendix VII: Intercept Emails

Subject: Diving in Thailand: A Survey by Project IMPAACT

Dear_____.
My name is Skye Augustine and we met at the Tap Lamu Pier in Thailand when you were returning from your diving trip.

Please complete my 15 – minute survey about the quality of your dive experience in Thailand. The survey can be accessed at this link: https://www.surveymonkey.com/s/thaidiving.

The information collected in this survey will help me complete my masters thesis and will be used to develop management actions to preserve coral reefs and satisfactory dive experiences for the future. If you are interested to learn more about the research our team is conducting, I invite you to visit our project website: http://projectimpaact.asia. Here you will find information about our mandate, project initiatives, and our various partners, including Thai Universities, the Phuket Marine Biological Centre, and the Thai National Parks Authority.

Confidentiality Promise: The information you provide in this survey is in no way linked to your identity, and will only be used for the research purposes described above. Your contact information will be destroyed and will not be provided to any other organization.

Thank you again for your participation.

Regards,

Skye Augustine
MSc Student - Marine Protected Areas Research Group
University of Victoria, Canada

Project IMPAACT - Phuket, Thailand
skyea@uvic.ca

Appendix VIII: Website Survey Data

Inventory of Dive Companies in Phuket and Khao Lak for Ecotourism Website Survey

Company	Identified By	Type of Dive Operation	Region	Language	Notes	Decision
Abby's Pro Dive	Thai Diving Association	Booking Agency	Phuket			Not included
Adventure Diving	Thai Diving Association	Booking Agency	Phuket			Not included
All 4 Diving	Thai Diving Association	Diving Tours, Instruction, Equipment Sales and Repairs	Phuket (Patong)	English		Included
All 4 Scuba	Search Engine	Booking Agency, Equipment Sales	Khao Lak		No Website	Not included
Allabout Scubadiving	Search Engine	Database	Phuket (Patong)			Not included
Aloha Tours	Search Engine	Boats Rental	Phuket (Chalong)			Not included
Andaman Discovery Diving Center	Search Engine		Phuket (Chalong)		No Website	Not included
Andaman Dive Village	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Phuket			Included
Andaman Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Patong)			Included
Andaman Ocean Safaris	Search Engine	Diving Tours, Instruction, Booking Agency	Phuket (Chalong)			Included
Andaman Scuba	Thai Diving Association	Diving Tours, Booking Agency	Phuket (Karon), Khao Lak			Included
Anggun Charter	Thai Diving Association		Phuket	Japanese		Not included
Aqua Divers	Thai Diving Association	Diving Tours, Instruction,	Phuket (Nai Thon)			Included

Aqua ONE Watersports Phuket	Search Engine	Diving Tours, Booking Agency	Phuket (Nai Yang)			Included
Aqualand Diving	Thai Diving Association		`	Japanese		Not included
Aquamarine Divers	Thai Diving Association	Diving Tours, Booking Agency	Phuket (Rawai)			Included
Aquamaster	Thai Diving Association	Equipment Sales and Repairs	Phuket (Rawai)			Not included
Armins Dive Team	Thai Diving Association		Phuket	German		Not included
Asian Adventures	Thai Diving Association	Search Agent	Phuket (Patong)			Not included
BBC-dive	Search Engine		Phuket (Chalong)		No Website	Not included
Big Blue Diving Khao Lak	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Blue Dolphin	Thai Diving Association		Phuket (Karon)		Website no longer exists	Not included
Blue Label Diving	Search Engine	Instruction, Booking Agency	Phuket (Chalong)			Included
Bubble Blue Scuba	Thai Diving Association		Khao Lak	Japenese		Not included
Bubble Vision	Thai Diving Association	Underwater Imaging	Phuket			Not included
Calypso Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Kata)			Included
Chalong Sea Sport	Thai Diving Association	Diving Tours, Instruction	Phuket (Chalong)			Included
Chontara Bea	Search Engine	Diving Tours, Booking Agency	Khao Lak			Included
Colona Group	Thai Diving Association	Diving Tours	Phuket (Chalong)			Included
Coral Grand Divers	Thai Diving Association	Diving Tours, Instruction	Phuket			Included

Coral Island	Search Engine	Boat Charters	Phuket (Chalong)	English, Japanese		Not included
D.O Dive Outlet	Thai Diving Association	Equipment Sales and Repairs	Phuket			Not included
Deep Blue Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Rawai)			Included
Dive 2 Phuket	Search Engine	Instruction, Diving Tours, Booking Agency	Bang Tao			Included
Dive Asia	Thai Diving Association	Diving Tours, Instruction	Phuket (Kata)			Included
Dive Community-Tauchschule	Thai Diving Association		Phuket		Website no longer exists	Not included
Dive Dimension	Search Engine	Diving Tours, Instruction, Booking Agency	Khao Lak			Included
Dive Marine	Search Engine		Phuket (Chalong)		No Website	Not included
Dive Master	Word of mouth	Diving Tours, Instruction, Equipment Sales and Repairs	Phuket			Included
Dive Supply	Thai Diving Association	Equipment Sales and Repairs	Phuket			Not included
Dive the World	Thai Diving Association	Booking Agency	Phuket (Patong)			Not included
Divers Land	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Dream Team Phuket	Thai Diving Association	Team Building Consultancy	Phuket			Not included
e Dive Khao Lak	Search Engine		Kaho Lak	Japenese		Not included
Eden Divers Phuket	Thai Diving Association	Diving Tours, Instruction	Phuket (Patong), Khao Lak			Included
Euro Divers Worldwide	Thai Diving Association	Diving Tours, Instruction	Phuket			Included

Gekko Scuba Divers	Word of mouth	Diving Tours, Instruction	Phuket			Included
H2O Sportz Phuket	Search Engine	Diving Tours, Instruction	Phuket			Included
InDepth Dive College	Search Engine	Diving Tours, Instruction	Phuket (Chalong)			Included
International Dive Academy HKT	Thai Diving Association		Phuket (Patong)		No Website	Not included
International Dive Center	Thai Diving Association	Instruction	Phuket (Kata)			Included
IQ Dive	Search Engine	Diving Tours, Instruction	Kaho Lak			Included
Jack Similan	Thai Diving Association	Boat Charters	Phuket (Muang)			Not included
Jolly Roger Dive Center	Thai Diving Association	Diving Tours, Instruction	Phuket (Chalong)	Russian		Not included
JoyDive	Search Engine	Diving Tours	Phuket (Rawai)			Included
Kamala Dive Center	Search Engine	Diving Tours, Instruction	Phuket (Kamala)			Included
Khao Lak Diving	Search Engine	Booking Agency	Khao Lak			Not included
Khao Lak Explorer Dive Center	Search Engine	Instruction, Booking Agency	Khao Lak			Included
Khao Lak Fun Divers	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Khao Lak Holiday	Search Engine	Online Agency	Khao Lak			Not included
Khao Lak International Diving School	Thai Diving Association	Diving Tours, Instruction	Khao Lak		No Website	Not included
Khao Lak Liveaboards	Search Engine	Booking Agency	Khao Lak			Not included
Khao Lak Scuba	Search Engine	Booking Agency	Khao Lak		Little information on website	Included

Khao Lak Scuba Adventures	Search Engine	Diving Tours, Instruction, Equipment Sales and Repairs	Khao Lak			Included
Khao Lak See and Sea Scuba	Search Engine		Khao Lak		No Website	Not included
Kingfisher Diving	Thai Diving Association	Booking Agency	Phuket			Not included
Kontiki Diving Phuket	Thai Diving Association	Diving Tours, Instruction	Phuket			Included
Liquid Adventure	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Loma Diving	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Manta Expeditions	Word of mouth		Khao Lak		No Website	Not included
Manta Point Co.	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Marina Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Karon), Khao Lak			Included
Marine Quest Divers Co., Ltd.	Thai Diving Association		Phuket (Patong)	Japanese		Not included
Marmin Co., Ltd.	Thai Diving Association		Phuket (Kathu)	German		Not included
Merlin Divers	Thai Diving Association	Diving & Snorkelling Tours, Instruction	Phuket (Kamala)			Included
Moby Dick Adventures	Thai Diving Association	Instruction, Booking Agency	Phuket (Karon)			Included
Nautilus Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Kata)			Included
Ocean Divers	Thai Diving Association	Diving Tours, Instruction, Equipment Sales and Repairs	Phuket (Kathu)		Website no longer exists	Not included

Ocean Lovers - Le Mahe	Thai Diving Association	Instruction, Booking Agency	Phuket (Karon)	English, Italian, French		Included
Ocean Zone Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Chalong)			Included
Oceanic Divecenter	Thai Diving Association	Diving Tours, Instruction	Phuket (Karon)			Included
Offspray Leisure	Thai Diving Association	Boat Charters	Phuket (Chalong)			Not included
Padi Tech Wreak	Search Engine	Equipment Sales and Repairs	Khao Lak		No Website	Not included
Paradise Diving	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Phuket (Nai Yang)			Included
Philkade Liveaboard	Thai Diving Association	Booking Agency	Phuket			Not included
Phuket Coral Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Rawai)			Included
Phuket dash Scuba dot Com	Thai Diving Association	Diving Tours, Instruction, Booking Agency, Equipment Sales and Repairs	Phuket (Kata)			Included
Phuket Divers Co., Ltd.	Thai Diving Association	Diving Tours, Booking Agency	Phuket (Muang)			Included
Phuket Diving Lodge	Thai Diving Association		Phuket		No Website	Not included
Phuket Pro Dive and Sail Co.	Thai Diving Association	Diving Tours, Booking Agency, Boat Charters	Phuket (Chalong)			Included
Phuket Scuba Club	Thai Diving Association	Diving Tours, Instruction	Phuket			Included
Poisedon diving	Search Engine	Diving Tours, Instruction	Phuket (Karon)			Included
Prestige Diving	Search Engine	Diving Tours, Instruction, Boat Charters	Phuket (Boat Lagoon)			Included
Private Dive Phuket	Thai Diving Association		Phuket (Kathu)	German		Not included

Private Holiday Dive and More Shop	Search Engine		Khao Lak		No Website	Not included
Pro Tech Dive College	Thai Diving Association	Diving Tours, Instruction	Phuket (Chalong)			Included
Racha Seamaster Divers	Thai Diving Association		Phuket (Rawai)		Website no longer exists	Not included
Rainbow Divers	Word of mouth	Diving Tours, Instruction	Phuket (Trang)	English, German		Included
Rainbow Scuba and Tour	Search Engine	Booking Agency	Phuket			Not included
Raya Dive Center	Search Engine	Diving Tours, Instruction, Equipment Sales and Repairs	Khao Lak			Included
Rumble Fish Adventure	Thai Diving Association	Booking Agency	Phuket (Kata)			Not included
Santana Diving and Canoeing	Thai Diving Association	Diving Tours, Instruction	Phuket (Patong)			Included
Scandinavian divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Chalong), Khao Lak			Included
Scuba Cat Diving	Search Engine	Diving Tours, Instruction	Phuket (Patong)			Included
Scuba Dive Phuket	Search Engine	Instruction, Booking Agency	Phuket (Patong)			Included
Scuba Diving Phuket	Search Engine	Booking Agency	Phuket (Patong)			Not included
Scuba Diving Water World Asia	Search Engine	Booking Agency	Phuket (Patong)			Not included
Scuba Guards Dive Center	Thai Diving Association		Phuket		Website no longer exists	Not included
Scuba Quest Dive Center	Thai Diving Association	Diving Tours, Instruction	Phuket (Kamala)			Included
Sea Bees Diving	Thai Diving Association	Diving Tours, Instruction	Phuket, Khao Lak			Included

Sea Dragon Dive Center	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Sea Hawk Divers	Thai Diving Association		Phuket (Patong)		Website no longer exists	Not included
Sea King Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Rawai)			Included
Sea Moth Dive Centre	Search Engine		Phuket	Japanese		Not included
Sea World Dive Team	Thai Diving Association	Diving Tours, Instruction, Equipment Sales and Repairs	Phuket (Patong)	English, French		Included
Seafarer Divers-Phuket	Thai Diving Association	Boat Charters	Phuket (Chalong)	English, French, Thai		Not included
SeaFun Divers	Thai Diving Association	Diving Tours, Instruction	Phuket			Included
Seemann Enterprise Co., Ltd.	Thai Diving Association	Equipment Sales and Repairs	Phuket (Chalong)			Not included
Sharkey Scuba	Thai Diving Association	Diving Tours, Instruction	Phuket (Karon)			Included
Shell Diving	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Phuket			Included
Siam Adventure Divers	Thai Diving Association	Diving Tours, Instruction, Sailing	Khao Lak			Included
Siam Dive n Sail	Thai Diving Association	Booking Agency	Phuket (Chalong)			Not included
Siam Diving Enterprises	Thai Diving Association	Equipment Sales and Repairs	Phuket			Not included
Sign Scuba Diving	Thai Diving Association	Diving Tours	Khao Lak			Included
Similan Dive Center	Search Engine	Booking Agency, Equipment Sales and Repairs	Khao Lak			Not included
Similan Diving Safaris	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included

Similan Paradive	Search Engine	Diving Tours, Instruction	Khao Lak			Included
Similan ProDive	Thai Diving Association	Diving Tours, Instruction	Phuket (Kathu)			Included
Similan Scuba Adventures	Thai Diving Association	Diving Tours, Instruction	Khao Lak			Included
Similan Seven Sea Club	Search Engine	Diving Tours, Instruction, Booking Agency	Khao Lak			Included
Smily-Divers	Thai Diving Association		Patong	German		Not included
South East Asia Liveaboards	Thai Diving Association	Diving Tours, Instruction, Sailing	Phuket		Broken website	Not included
South East Asia Scuba Divers	Thai Diving Association	Booking Agency	Phuket			Not included
South Siam Divers	Thai Diving Association	Diving Tours, Instruction	Phuket (Karon)			Included
Sub Aqua Dive Center	Thai Diving Association	Booking Agency, Diving Tours, Instruction	Phuket (Karon), Khao Lak	English, German		Not included
Sunrise Divers (Same as Phi Phi Diving?)	Thai Diving Association	Booking Agency	Phuket (Karon)			Not included
Thailand Divers	Search Engine	Diving Tours, Instruction	Phuket			Included
The Divers Emporium	Thai Diving Association	Booking Agency, Equipment Sales and Repairs	Phuket (Patong)			Not included
The Junk	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Phuket (Kata)			Included
Viking Cruises	Thai Diving Association		Phuket		No Website	Not included
Warm Water Divers	Thai Diving Association	Diving Tours, Instruction, Equipment Sales and Repairs	Phuket (Patong)			Included
Warm Waterland	Thai Diving Association		Phuket		Website no longer exists	Not included

Water World Asia Co.	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Phuket (Kathu)	English, German	Included
West Coast Divers	Thai Diving Association	Diving Tours, Booking Agency	Phuket (Chalong)		Included
Wetzone Divers	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Khao Lak	English, German	Included
White & Blue Harmony Dive Club	Thai Diving Association	Diving Tours, Booking Agency	Phuket (Chalong)		Included
Wicked Diving	Thai Diving Association	Diving Tours, Instruction, Booking Agency	Khao Lak		Included
Worldwide Dive and Sail	Search Engine	Diving Tours, Booking Agency	Phuket (Muang)		Included
Yellow Submarine Divers	Search Engine	Instruction, Booking Agency	Phuket (Chalong)		Included