



**A Surf Resource Sustainability Index for Surf Site
Conservation and Tourism Management**

Steven Andrew Martin

**A Thesis Submitted in Fulfillment of the Requirements for the Degree of
Doctor of Philosophy in Environmental Management
Prince of Songkla University
2013**

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Conservation and Tourism Management

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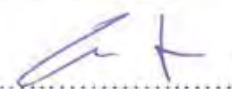


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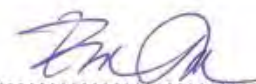
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ชื่อวิทยานิพนธ์: ดัชนีความยั่งยืนด้านทรัพยากรสำหรับการเล่นกระดานโต้คลื่นสำหรับพื้นที่อนุรักษ์เพื่อการเล่นกระดานโต้คลื่นและการจัดการการท่องเที่ยว

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บทคัดย่อ

พื้นที่สำหรับการเล่นกระดานโต้คลื่นทั่วโลกกำลังได้รับแรงกดดันเพิ่มขึ้นอย่างไม่เคยมีมาก่อน จากการท่องเที่ยว การพัฒนาชายฝั่ง มลพิษ และปัจจัยอื่น ๆ งานวิจัยนี้ได้นำพาพื้นที่สำหรับการเล่นกระดานโต้คลื่นให้เป็นทรัพยากรธรรมชาติแบบองค์รวม วิทยานิพนธ์นี้ได้พัฒนาดัชนีความยั่งยืนด้านทรัพยากรสำหรับการเล่นกระดานโต้คลื่น (Surf Resource Sustainability Index: SRSI) ซึ่งนำเสนอผ่านบทความทางวิชาการที่ได้รับการตีพิมพ์ในวารสารที่มีคณะกรรมการตรวจสอบ SRSI ถูกออกแบบให้สามารถใช้เป็นต้นแบบระดับโลกและเป็นกรอบแนวคิดของดัชนีชี้วัดและขั้นตอนในการประเมินคุณลักษณะของพื้นที่อนุรักษ์เพื่อการเล่นกระดานโต้คลื่น การทบทวนวรรณกรรมอย่างเป็นระบบในงานวิจัยด้านการท่องเที่ยวที่เกี่ยวข้องกับการเล่นกระดานโต้คลื่น และการใช้ประสบการณ์และการอภิปรายกับนักเล่นกระดานโต้คลื่นที่มีประสบการณ์ รวมถึงนักวิชาการทำให้เกิดเป็นดัชนีชี้วัดความยั่งยืน จำนวน 27 ตัว ซึ่งการกำหนดบริบทของเนื้อหาเกณฑ์และการนำไปใช้ของดัชนีชี้วัดแต่ละตัวจะพิจารณาภายใต้กรอบของดัชนีทางสังคม เศรษฐกิจ สิ่งแวดล้อมและการบริหารจัดการเป็นหลัก หลังจากนั้นได้ดำเนินการทดสอบดัชนีชี้วัดกับพื้นที่ศึกษาในจังหวัดภูเก็ตซึ่งเป็นจุดเริ่มต้นของการเกิดตลาดการท่องเที่ยวของกิจกรรมกระดานโต้คลื่นที่เป็นส่วนเพิ่มเติมจากเศรษฐกิจการท่องเที่ยวที่คึกคักและประเด็นด้านการจัดการการเคลื่อนไหวของทรัพยากรชายฝั่งที่มีอยู่แล้วบนเกาะภูเก็ต SRSI ได้พิสูจน์ประสิทธิภาพในการประเมินพื้นที่และการชี้ประเด็นหลักที่ต้องพิจารณา เมทริกซ์ของ SRSI ใช้ได้กับการประเมินแบบภาคตัดขวางของพื้นที่สำหรับการเล่นกระดานโต้คลื่น และสามารถทำหน้าที่โดยตรงในการจัดลำดับพื้นที่ซึ่งรักษาไว้เพื่อการพัฒนาเป็นพื้นที่สำหรับกิจกรรมกระดานโต้คลื่น ซึ่งผลจากการศึกษาดังกล่าวจะสร้างประโยชน์กับการจัดการการท่องเที่ยวผ่านทางนวัตกรรมและการใช้งานของกระบวนการทางความคิดใหม่ๆ

คำสำคัญ: การจัดการชายฝั่ง การอนุรักษ์ ตัวชี้วัดการพัฒนาอย่างยั่งยืน ดัชนีความยั่งยืนด้านทรัพยากรสำหรับการเล่นกระดานโต้คลื่น การท่องเที่ยวร่วมกับการเล่นกระดานโต้คลื่น ภูเก็ต ประเทศไทย

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ABSTRACT

Surf sites around the world are under ever-increasing pressures from tourism, coastal development, pollution and other anthropogenic factors, and this research introduces and illuminates surfing areas as integral natural resources. The dissertation develops a Surf Resource Sustainability Index (SRSI) and presents it through a series of three peer-reviewed journal papers. The SRSI is designed as a global model and framework of indicators and methods for the assessment of surf site conservation attributes. A systematic literature review of surf tourism research was used in conjunction with the author's personal experience and discussion with experienced surfers and scholars to develop twenty-seven sustainability indicators. Framing them as social, economic, environmental and governance indices, the study defines the criteria, implications and applicability for each indicator in context. A progression of field studies was carried out in Phuket, Thailand, where an emerging surf tourism market segment is additive to the island's bustling tourism economy and escalating coastal resource management issues. The SRSI has proven effective in assessing sites and pinpointing key areas of concern. SRSI metrics are particularly applicable to the cross-sectional evaluation of surf sites and serve as a direct method in the prioritization of sites for surfing reserve development. This research contributes to the fields of surf resource conservation and tourism management through the innovation and application of a new and pragmatic methodology.

Key words: coastal management, conservation, sustainability indicators, surf resource sustainability index, surf tourism, Phuket, Thailand

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Steven Andrew Martin

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LIST OF PUBLISHED PAPERS

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- Martin, S. A., & Assenov, I. (2012). The genesis of a new body of sport tourism literature: A systematic review of surf tourism research (1997-2011). *Journal of Sport and Tourism*, 17(4), 257–287. doi: 10.1080/14775085.2013.766528
- Martin, S. A., & Assenov, I. (2013). Developing a surf resource sustainability index as a global model for surf beach conservation and tourism research. *Asia Pacific Journal of Tourism Research*. doi: 10.1080/10941665.2013.806942
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1. INTRODUCTION

Surf sites around the world are under ever-increasing pressures from tourism, coastal development, pollution and other anthropogenic factors, and this research introduces and illuminates surfing locations as valuable and vulnerable natural resources.

1.1 The Research

Three refereed international journal papers comprise this dissertation: (i) a systematic review of surf tourism research (Martin & Assenov, 2012a); (ii) the development of a *Surf Resource Sustainability Index* (SRSI) for surf site conservation (Martin & Assenov 2013a); and (iii) an application of the SRSI on the resort island of Phuket, Thailand (Martin & Assenov, 2013b). In addition, a review of surfing-related topics is provided (section 1) and includes an introduction to surfing, surfing in Phuket, Thailand, surfers and surf sites, surf economics, surf tourism and sustainability, and the physical and social dimensions of surf system boundaries. The objectives of the study are given (section 2) and the research design (section 3) covers relevant aspects of methodology and linkages among individual pieces of research. The results and discussion (section 4) provide unpublished studies on SRSI indicator importance and weighting, and offer critical analysis on the limitations, biases and reliability of the research process. Recommendations and suggestions for further research conclude the dissertation.

Three Journal Papers

When compared with other types of sport tourism, surf tourism is a relatively new market segment and research gaps have been identified and addressed in the following three journal papers. **Paper 1** (Martin & Assenov, 2012a) determines that a genesis in surf-related research activity has taken place since the beginning of the twenty-first century and that „surf tourism research“ has emerged as a new and fast-growing field of study. They found that the study of surf tourism necessarily shares the interdisciplinary nature of tourism research, crossing the boundaries between ecology, environmental management and the social sciences, and that the concern for the

custodianship and protection of surfing areas are of key importance but not well described in the literature. The sustainability of surf sites was identified as a central theme providing common ground for discussion among academics, graduate students and consultants, within both the commercial and not-for-profit sectors.

To address concerns over surf site sustainability, *Paper 2* (Martin & Assenov, 2013a) introduces a methodology designed to outline and measure *conservation aptitude*. Conservation aptitude represents the summation of assessable qualities or attributes a site possesses which can contribute toward sustainability (see section 3, page 53). This theoretical framework forms the Surf Resource Sustainability Index (SRSI), a multidimensional approach which places sustainability indicators into qualitative and quantitative modules for analysis. The premise of the SRSI is that the conservation of surf tourism sites can benefit from the innovation of an index methodology. Accordingly, the broad intention of the research is to develop a systematic and open source method for use by stakeholders from diverse backgrounds. In this approach to conservation field studies, the key objective is to create a user-friendly research instrument geared for achieving results rather than a system of measurement exclusively for academics (TNC, 2007).

The SRSI model is empirically tested through the case trials provided in *Paper 3* (Martin & Assenov, 2013b). Nine beaches on the resort island of Phuket, Thailand, provided appropriate SRSI case study sites due to the rapid growth of surf culture and surf tourism, increasing local attention on sustainability issues, and the emergence of the island as a new surfing destination. Phuket had been identified in previous studies as the key surfing location in Thailand based on its natural resources, the consistency and quality of waves, and the proximity of surf sites (Martin, 2009, 2010a, 2010b; Martin & Assenov, 2008a, 2008b, 2011b). The island has over 700 hotels and an estimated 45,000 registered hotel rooms (C9hotelworks, 2013) and environmental and sustainability issues which impact surf tourism include the transportation system, coastal access, carrying capacities, ocean safety, marine debris and water quality.

1.2 Introduction to Surfing

Surfing is an adventure sport which can only be practiced at sites with very specific geographical features. Surfing involves catching and riding an ocean wave while

standing on a surfboard (see Figure 1). Other types of wave riding, such as lying prone on a *bodyboard* or simply *bodysurfing* are also restricted to the same sites, whereas *kite surfing* and *windsurfing* can be practiced at other locations and therefore test the conventional interpretation and definition of surfing.

Figure 1 Surfer Riding a Wave, Phuket, Thailand



Source: Steven Martin, 2008

Surfing is part of the legacy of the Pacific Islands. The ancient Hawaiians once built wooden surfboards and stone temples (*heiau*) dedicated to surfing where they made religious offerings (Martin 2010a). Even today, visitors to the Bishop Museum in Honolulu can see historic Hawaiian surfboards fashioned from local hardwoods around the time of the arrival of English explorer Captain James Cook. Those who travel to the surf break at Kahalu“u Beach Park, Kona, Hawaii, can visit the *Kuemanu Heiau* (Kuemanu Surf Temple) archeological site (see Figure 2) (Martin 2010a).

Figure 2 The Kuemanu Heiau, Hawaii



Source: Steven Martin, 2004

According to signage at the *Kuemanu Heiau*, the site was restored by the County of Hawaii in 1986, and Martin (2010a) notes that the site has become the island's most prolific area for surf tourism and surfers once again pray for good surfing conditions.

Hawaiian legends tell of men chanting to the sea in praise of good surf and *Ali'i* (royalty) competing in surfing competitions. Walker (2005) attests to the Hawaiians' deep and spiritual connection to the sport:

Primarily through chants, ancient Hawaiian histories and traditions preserve great surfing love stories, surfing prayers, surfing *heiau* [temples], surfing priesthoods, competitions, and many legendary surfers... surfing has been a part of our history for thousands of years, and when you surf you have that connection, you connect spiritually and physically to all the elements around you, this is a part of you, it's a Hawaiian thing. (p. 580)

However, Christian missionaries, who judged surfing to be morally inappropriate, outlawed the sport in 1821. Subsequently, surfing nearly vanished from the Hawaiian culture until it was revived and introduced to the world in the 1920s by Hawaiian surfer and Olympic gold medalist swimmer Duke Kahanamoku (1890-1968).

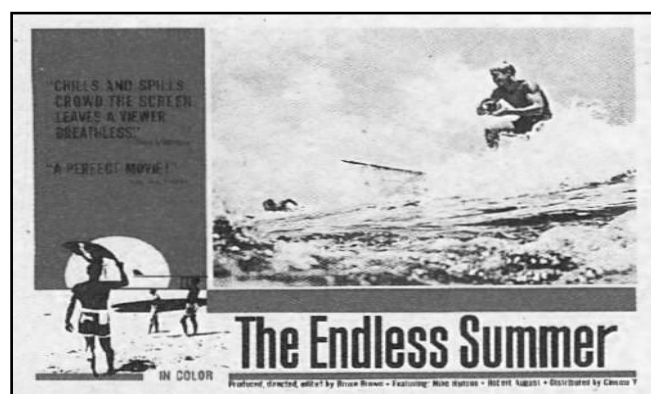
Introduction to Surf Tourism

Surf tourism characterizes travel for the purposes of surfing, learning to surf, or attending a surfing event; more broadly, it may include surfing while on vacation. Data presented at the *Global Surf Cities Conference*, Gold Coast, Australia, identifies as many as 35,000 surfers in the world and suggests that the global surf industry, including surf tourism, generates between \$70 and \$130 billion dollars annually (O'Brien & Eddie, 2013). Market interests include multinational surfcraft manufacturers and distributors (such as *Cobra International Co., Ltd.*, and *Starboard Co., Ltd.*, in Thailand), surf clothing corporations and retailers (such as *Quiksilver*, *Billabong* and *Rip Curl*), amateur and professional sporting events, and domestic and international tourism (including surf schools, camps, hotels, etc.). Furthermore, *Global Surf Cities* have emerged around coastal areas where surf sites and surfing activities play a leading role in a region's image, commerce and tourism-based identity (Global Surf Cities Conference, 2013). Examples include the Gold Coast in

Australia, Hossegor in France, and Donostia-San Sebastián in Spain (World Surf Cities Network, 2013a). The AEC Group (2009) found that the direct contribution of the surf industry to the Gold Coast's local economy in 2007-2008 was approximately USD 1.3 billion in output, with around 9,400 full-time equivalent employment positions. They pinpoint two major surfing competitions, the Quiksilver Pro and Roxy Pro, which generated an estimated retail and accommodation expenditure by overnight visitors of USD 1.68 million. In Donostia-San Sebastián, Spain, surfing represents a direct annual turnover of USD 18.6 million including USD 10.6 million in added value (Donostiako Sustapena, 2012).

While surf exploration can be traced back to the seafaring peoples of ancient Polynesia who discovered new surfing areas across the Pacific, the notion of surfing as a western touristic activity first appeared in the journals of early travel writers, such as Jack London and Mark Twain. Martin and Assenov (2011a, 2013a) note that although surf tourism research began in the 1990s, the term „surf tourism“ did not appear in the literature until 1999. One of the most common explanations behind the modern impetus for surf travel is the release of the 1966 film *The Endless Summer*, which featured two surfers from California who followed the changing surf seasons around the globe in search of new and undiscovered surfing sites, a utopian concept which struck an essential chord in surfers far and wide (see Figure 3).

Figure 3 The Endless Summer Poster



Source: The Endless Summer, 2013

As surfers began to explore new surfing areas at home and abroad, surf travel became en vogue for an entirely new generation of surfers and the phenomenon of

surf tourism was born. For the purposes of this study, the broad definition of „surf tourism“ has been adopted from Tourism New South Wales (2009):

An activity which takes place 40 km or more from the person's place of residence, where surfing or attending a surfing event are the primary purpose for travel. Surf tourists stay at their destinations for at least one night or can undertake their visit as a day trip. (p. 3)

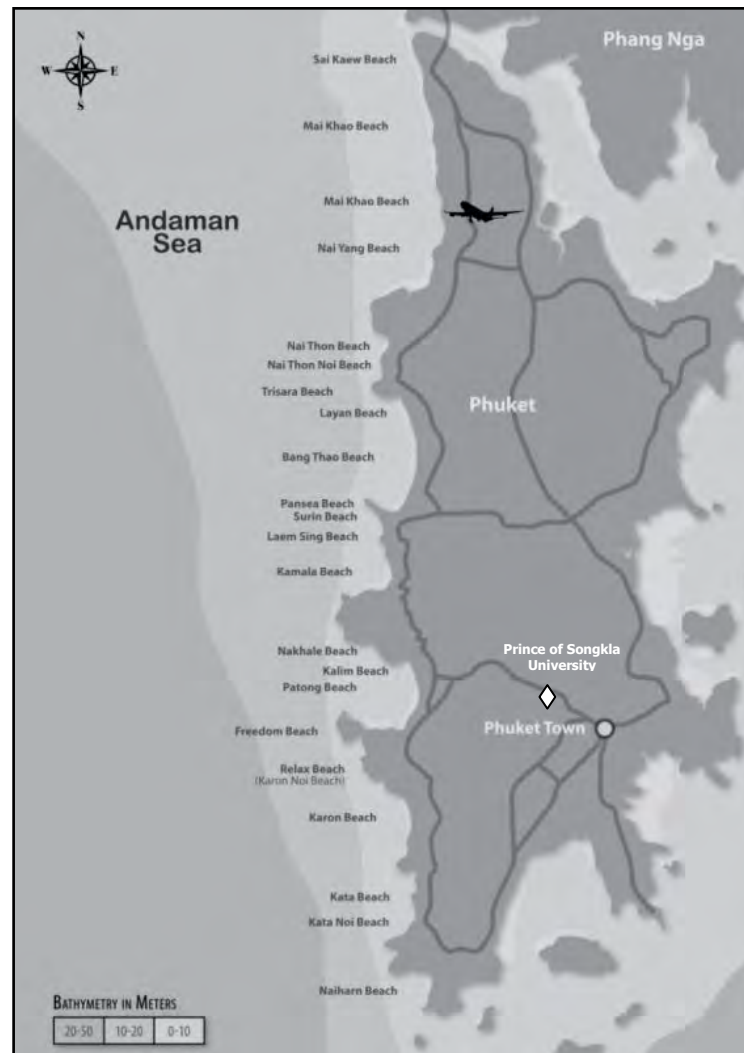
Among the first journal articles to identify the early development of surf tourism, Augustin (1998) described the Aquitaine coast of southern France as a new sport tourism destination seen as a “sure commercial bet” given the driving forces of territorial dynamism, regional self-promotion, and the creation of a new image for coastal resorts. The study describes surfing events as corollary to the growth phenomena and driven by surf clubs, corporate sponsors, media linkages, and especially in the case of France, supported by the regional government. In the example of Puerto Rico, Poizat-Newcomb (1999a, 1999b) examined the dynamics which the sport provides in terms of stewardship and positive ties for the island's history, economy, and developmental strategies; and the study places the evolution of surf tourism as a positive element within the country, exploring the issues of conservation, ecology, territoriality, and in contrast to Augustin (1998)'s France study, the Puerto Rican government's limited attention to the market segment.

Within a few years of these decisive studies, the appearance of commercial surf tourism brought the sport into focus as an emergent and significant world-wide industry. Buckley (2002a) found that increased pressure on natural or cultural host environments provided immediate and financially measurable indicators, suggesting that sustainability thresholds are generally low in response to surf site carrying capacities. In the context of water-based tourism, Jennings (2007) cites four key areas of concern: carrying capacities, conflicts between user groups, management strategies, and sustainability issues, and Ryan (2007) notes that surfers are frontline to environmental activism and not-for-profit organizations which campaign for clean and safe recreational waters (such as the United Kingdom-based *Surfers Against Sewage*).

1.3 Surfing in Phuket, Thailand

In recent years recreational surfing has gained a notable degree of popularity in Thailand in terms of participation in the activity and attention in the domestic and international media. While the tropical resort island of Phuket is the hub of surfing activity in Thailand (see Figure 4), much of the Andaman Coast (736 kilometers) and the Gulf of Thailand coast (1,874 kilometers) were only recently charted for coastal surfing resources (Martin, 2009, 2010a, 2010b; Martin & Assenov, 2008a, 2008b, 2011b).

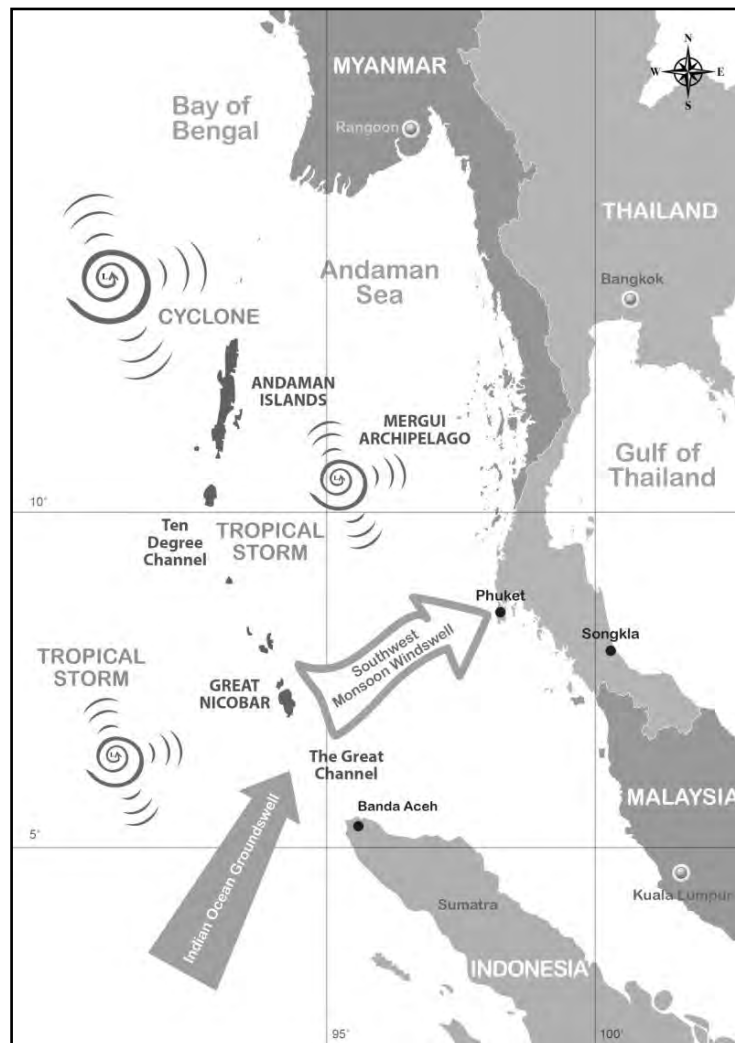
Figure 4 Surf Beaches of Phuket, Thailand



Source: Adapted from Martin (2010a, 2010b)

Martin (2009, 2010a, 2010b) and Martin and Assenov (2008a, 2008b, 2011b, 2013a) identify that the surfing season in Phuket is synonymous with the rain and winds of the Southwest Monsoon of the Andaman Sea (May through October). Surf tourism is a new and welcome market segment serving to address the issues of seasonality as it coincides with the Phuket tourism industry's low season. While the surf on the Andaman coast is generated mainly by locally-occurring monsoon winds, groundswells from the Indian Ocean intermittently pass through the Great Channel (between Banda Aceh, Sumatra, and the Great Nicobar Island) and deliver clean high quality waves at any time of the year (see Figure 5).

Figure 5 Surf Meteorology of Phuket, Thailand



Source: Adapted from Martin (2010a, 2010b)

Australian, American and European travelers introduced the sport of surfing to Phuket in the 1970s and 1980s (Martin & Assenov, 2013b). By the early 1990s a small group of Thais had become avid surfers. Australian Paul King recalls the era and notes that Suchin Aksorndee („Chin”) was probably the first Thai surfer to fully embrace the sport and lifestyle in Phuket in the 1980s: “He made his own surfboards and lived in a grass shack on the beach” (P. King, personal communication, September 22, 2011) (see Figure 6). Irish-born Nicky Martin first surfed Nai Harn Beach in southern Phuket in 1977 (see Figure 7) and returned in 1986, deciding to stay after discovering high-quality waves at Kalim Beach. N. Martin (personal communication, September 23, 2011) recounts the early days at the Kalim Reef: “I remember in the 1980s when the kids at Kalim Beach used to try and catch waves using pieces of wood; later, some of those kids managed to get real surfboards.”

Figure 6 Kata Noi Beach, 1996



Source: Paul King, 1996

Figure 7 Nai Harn Beach, 1977



Source: Nicky Martin, 1977

On September 25, 1999, Thailand's first international surfing contest was held at Kata Beach in Phuket. Fostered in part by employees from *Cobra*, the world's largest surfboard manufacturing company (located in Chonburi, Thailand), the contest has remained an annual event. At the beginning of the twenty-first century a new generation of Thai surfers was evident and their numbers are estimated to be on par with those of the foreign resident surfing population. Martin and Aseenov (2013b) estimate that there are approximately 300 Thai nationals and 300 foreign residents who surf in Phuket and surrounding areas (including those who reside in Phuket only during the surf season) in addition to an undetermined number of surf tourists.

In 2002, several private surf clubs and organizations began to form in the Phuket area. These include the Phuket Boardriders Club (a not-for-profit organization), and later the Kata-Karon Surf Club and the Kamala Go Surfing Club. These organizations were instrumental in the promotion and development of surfing in Phuket. Spawned by organizers from the Phuket Boardriders Club in 2009, a new era in Thai surfing began with the commitment to a three year sponsorship by the corporate surf clothing manufacturer *Quiksilver Inc.*, thus placing the promotion and marketing of major surfing competitions under one organizer. Corporate sponsorship was viewed by local surfing organizations as a strategy to promote a regional network of surfers and contest venues in Asia, especially to Indonesia and Malaysia (Martin, 2010a). In 2009, for the first time in Thai history a Thai surfer, 11-year-old Anissa Flynn, received sponsorship from a major international surf clothing sponsor which included travel expenses to attend a surfing competition in Bali, Indonesia.

In 2010, the Phuket Boardriders Club was reorganized as *Surfing Thailand*, a new entity then recognized as the official organizer of the sport in Thailand by the International Surfing Association (ISA). Subsequently, 13-year-old Panu Wisetsombat was awarded the first-ever student scholarship from the ISA in Thailand's history. Also in 2010, the first magazine dedicated to surfing was published in Thailand (*Thailand Surfrider*), featuring and promoting the activity of surfing nation-wide and attracting international surf clothing advertisements from American and Australian corporations.

Surf Tourism in Phuket, Thailand

Surf tourism is particularly important when viewing surfing resources through a socioeconomic lens. However, Thailand's dynamic *Amazing Thailand* tourism advertising campaign (which promotes tourism in all its forms, including beach, adventure and ecotourism as well as the luxury hotel market and shopping), has overlooked surf tourism as a market segment (Martin, 2009, 2010a, 2010b, 2013a; Martin & Assenov, 2008a, 2008b, 2011b). At the time of writing, international surfers visit Phuket annually for surfing events, surf travel or to experience surfing in combination with other tourism activities. The new surf tourism market has kindled entrepreneurial spirit among Thais in recent years, as is evidenced by the dramatic increase in board rental enterprises at Phuket surf beaches since 2008 (Martin 2009; Martin & Assenov, 2008a, 2008b, 2011b).

Australian surfboard maker Lauri Thompson recognized the potential for surfing in Thailand in 1990 and drew up the first-ever plan to explore and promote the sport as a tourism activity in the Kingdom. His unpublished proposal was met by the Tourism Authority of Thailand, Phuket Office, with perplexity: "You must be mistaken; there are no waves in Thailand" (L. Thompson, personal communication, April 6, 2011). However, surf tourism would eventually be seen as a way to address the island's seasonality issues, as beach concessionaires embrace the opportunity to rent surfboards and provide lessons during the low tourism season (May to October). For these new surf tourism entrepreneurs, the „low season“ became the „surf season“, offering new opportunities for economic exploitation of coastal surfing resources. Thus, the development of domestic and international surf tourism and related social and economic issues are highly significant to the Phuket tourism industry and this study. Figure 8 shows a new generation of affluent Thai youth partaking in a promotional surf lesson at Kalim Beach during the 2008 Kalim surfing contest.

Figure 8 Domestic Surf Tourists, Phuket, Thailand



Source: Steven Martin, 2008

1.4 Surfers and Surf Sites

Surfers are known to be individuals who ride waves and have deep encounters and experience with the marine environment. However, B. Farmer (personal communication, November 2, 2011) suggests that everyone who interacts with the surf zone or catches a wave is a surfer, and this is very significant in the context of surf site conservation which can benefit from the social, economic and political influence of the largest possible surfing community. In this perspective, even the American President Barack Obama, who once lived in Hawaii and enjoys bodysurfing, is a surfer (See Figure 9).

Figure 9 Barack Obama Bodysurfing in Hawaii



Source: Huffington Post, 2008

Thus, surfing activities may occur in a variety of forms which test the traditional boundaries of the sport. The following seven types of wave riding are the most popular (Martin, 2010):

- Board surfing: riding an ocean wave while standing on a surfboard (e.g., shortboard or longboard).
- Body boarding: a small board used to ride waves while lying down.
- Body surfing: surfing on one's body; riding a wave without a board.
- Kite surfing: harnessing the wind with a large controllable kite in order to ride across the water and waves on a specialized kiteboard.
- Stand-up paddling (SUP): the use of a hand-held paddle to propel a large surfboard while standing (rather than lying prone when paddling).
- Tow-in surfing: when a personal watercraft is used to tow a surfer into a wave.
- Windsurfing: riding wind or waves on a large surfboard (a sailboard) powered by wind on a sail. Also called *sailboarding*.

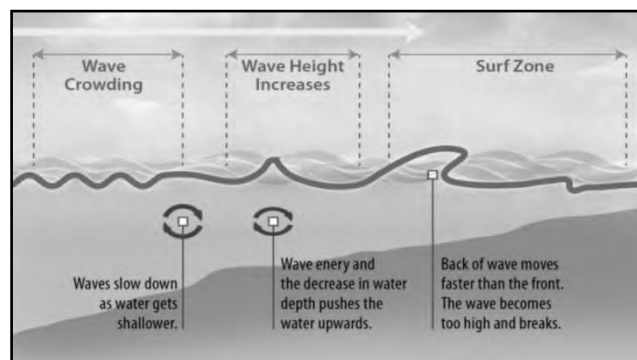
Martin and Assenov (2008a, 2011b) classify three types of surf tourists. First there are *hard surf tourists*, surfers who travel for the express purpose of surfing, including those who come for a surf vacation or surf event and likely have high motivation and deep experience. Secondly, there are *soft surf tourists*, surfers who travel with the objective of surfing, although it is not the primary motivation; members of this group are likely to be experienced, or at least competent, in surfing. Thirdly, there are *incidental surf tourists*, surfers who have little or no prior knowledge of surfing, but while visiting the beach on vacation make a spontaneous decision to participate in the activity.

Types of Surfing Waves

Surfing waves are generated when surface air (wind) transfers energy to the water surface. They propagate away from the generating area, changing shape as they hit shallow water and break. Like other types of waves, ocean waves have measurable wavelengths (the distance between crests) and heights respectively, as orbital paths of water molecules travel across the surface of the sea. Wavelength is normally expressed in the terms of „wave period“ (the time between crests) by surfers. Perry

(2011) describes ocean waves as nearly friction-free energy capable of traveling great distances within the surface of the ocean, and this energy is typically released within the surf zone as the waves begin to „feel bottom“, slow dramatically, and then break. Figure 10 illustrates the phenomena of ocean swells approaching and cresting near a beach.

Figure 10 Dynamics of a Breaking Wave



Source: Adapted from Wilson, 2007

Surfing waves are normally classified into three types or classes of breakers: plunging, spilling or surging. Surging breakers are waves that surge up the beach like powerful walls of white water and are unsuitable for surfing given the lack of rideable wave face. Spilling breakers (Figure 11) are waves which break gradually over a considerable distance and are in most cases satisfactory for surfing (Martin, 2010a).

Figure 11 Spilling Breakers in Phuket



Source: Steven Martin, 2008

Plunging breakers (Figure 12) are waves which tend to curl over and break with a round-hollow shape, sometimes in a single crash; at other times they can produce the round and hollow shape sought by experienced surfers (Martin, 2010a).

Figure 12 Plunging Breaker in Phuket



Source: Steven Martin, 2008

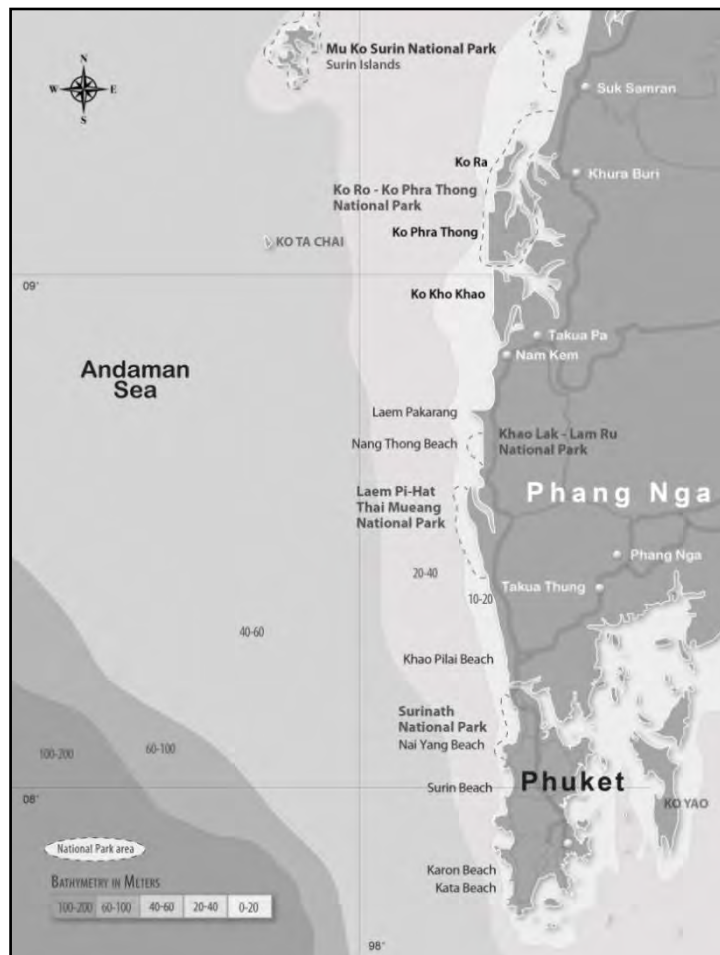
Coastal Topography and Surf Sites

Surfers generally identify three types of surf sites as those providing: point breaks, reef breaks, and beach breaks. Point breaks are waves which break around headlands, deltas, or other points of land and are generally long, evenly tapered, and predictable. A point break is a „single direction“ wave whereby a surfer can only ride the wave in a single direction (i.e., away from the headland). Reef breaks are single or bi-directional waves which are centered on a permanent high spot in the underwater topography, such as a coral reef, a rock formation, or a rock ledge. Beach breaks occur as either single-peak or multiple-peak waves. Single-peak beach breaks are normally simultaneous left- and right-breaking waves which take shape over a sandy beach and are dependent on sand bars, while multiple-peak beach breaks may form and break in different areas along the beach, and are less predictable than single-peak waves. Surf found at beach breaks is typically more variable and unpredictable than that found at point breaks or reef breaks.

Seafloor topography (bathymetry) determines where waves break and is a key characteristic of where sites are located along a given coast. Butt, Russell, and Grigg (2004) define bathymetry as the multi-dimensional shape of the sea-floor, resulting in

different water depths at different positions. As bathymetry may vary considerably in different coastal areas, the effect on surfing waves can be substantial. Normally, waves approaching a particular coast from deep water will travel faster and contain more energy than waves approaching over shallow water. For example, a wide and shallow continental shelf may slow and reduce the power of incoming waves, while waves approaching from deep water are essentially more „punchy“, and more challenging for surfers to ride. As an example, Figure 13 indicates the deep coastal waters near Phuket relative to the adjacent coast, a key factor in the quality of waves which arrive on the island.

Figure 13 Andaman Coastal Bathymetry



Source: Martin (2010a)

1.5 Surf Economics

Although the socioeconomic and environmental values of surf sites and the role of stakeholders in the management process are not well understood, establishing that surfing areas have value can be leveraged toward their protection. However, Lazarow, Miller, and Blackwell (2007, 2008) identify that unlike other sports, such as recreational fishing, surfing has not been able to use the weight of economic or social welfare evidence to argue for the maintenance of or improvement to surfing sites. Nonetheless, in recent years research into the socioeconomic aspects of surfing areas has to some degree answered a call from the surfing community to conserve and protect surfing amenities. For example, Nelsen, Pendleton, and Vaughn (2007) characterized the domestic demographics, visitation patterns, and expenditures of surfers who visit Trestles Beach in San Clemente, California, identifying that a considerable number of surfers used the area and contributed a significant amount of revenue to the local community. Lazarow (2010) and Lazarow et al. (2007, 2008) note that globally, only a handful of studies have investigated the economic impact of recreational surfing in any detail, and therefore the best way to estimate the overall value of the surfing industry is at the human user level through broad approaches such as the estimation of the number of surfers in the world, surfer visitation to sites, or through examining lifeguard data. R. Richie (personal communication, January 15, 2011) notes that on the whole:

The populace has in the past hopelessly underestimated the value of surfing to coastal communities; Australian communities discovered that they were dependent on the surf economy after it was too late and sites were destroyed, such as after constructing coastal groynes and dredging estuary openings.

Foundationally, surfing sites have intrinsic and extrinsic values. For example, an intrinsic value to a surfer could include personal preference or wave quality (some sites offer waves of particularly consistent and high quality) whereas the extrinsic value of a surf spot to a local community could include secondary effects, such as the influx of tourists and the money they bring (Butt, 2010).

The Socioeconomic Value of Surfing

The market impact of surfing is usually assessed by examining how much money surfers contribute to the local economy through spending related to access, equipment, goods and services. Butt (2010) develops the concept of a „surrogate“ value, which is twofold: the first model is „revealed preference“, based on how much money it costs to go surfing or enjoy surfing resources (e.g., costs in fuel, transport, surfboards and other equipment), noting that every surf session costs something; the second method is „stated preference“, based on how much money a surfer would hypothetically pay to save or prevent a surfing area from damage or destruction. While market data is conceivably straightforward in terms of appraisal, nonmarket studies related to surfing are somewhat ambiguous and include social and cultural values. Broadhurst (2001) suggests that social and cultural values reach well beyond a site’s significance as a tourism asset and should be considered, including the enjoyment of the environment by future generations. Lazarow (2010)’s research illustrates these multifaceted values within market and nonmarket economic areas of the surfing industry (Table 1).

Table 1 Components of the Surfing Industry

Market values	Nonmarket values
Surf wear sales	Cultural value
Gear and equipment sales	Social importance
Travel	Image value
Multiplier effect	Health and fitness aspects
Impact on general tourism	Injuries
Impact on real estate	Surf quality
Surf schools	Existence value of surf breaks
Surfing events	Bequeathment value of surf breaks
	Vicarious value of surf breaks

Source: Adapted from Lazarow (2010: 232)

Lazarow (2010) and Lazarow et al. (2007, 2008) describe the socioeconomic value of surfing and categorize the significant social, economic and cultural importance of surfing amenity alongside the need to consider negative impacts resulting from development or coastal protection works on surf breaks and the natural environment. These studies introduce a typology of *Surfing Capital* as a means of identifying

market and nonmarket aspects of surfing areas, including physical and social categories (see Table 2).

Table 2 Typology of Surfing Capital

Item	Description	Natural or Human Impact
Wave quality	Dominant local view of how the wave breaks. Both beauty and physical form become assessable.	Construction of coastal protection/amenity structures (e.g., groynes, seawalls, piers, seawalls, river walls, breakwaters, artificial reefs)
Wave frequency	„Surfable“ waves measured against an accepted standard.	Sand management (e.g., beach fill, dredging, sand bar grooming)
Environmental	Environmental or biophysical conditions that may mitigate against a surfers“ physical health.	<ul style="list-style-type: none"> - Biological impacts (e.g., water quality or nutrient loading) -Climate change/variability (e.g., temperature change, sea level rise, fewer or more storms, less or more often) -Amenity of the surrounding built and natural environment -Marine predators (e.g., sharks)
Experiential	Societal conditions surrounding the surfing experience.	<ul style="list-style-type: none"> -Legislation/regulation that might grant, restrict, or control access (e.g., community title, private property, payment strategies, craft registration, proficiency requirement, policing) -Code of ethics (e.g., road rules for the surf) -Signage & education strategies -Surf rage, aggression, intimidation -Self-regulation/localism/lore -Mentoring, sharing, physical activity, challenge, joy and laughter, well-being, community spirit self-fulfillment -Local aesthetic

Source: Adapted from Lazarow, Miller, and Blackwell (2008: 148)

Surfing competitions and events are a particular area of interest when evaluating surfing resources and are highly prevalent topics in surf tourism research, yet these studies are conducted internally by surfwear corporations (i.e., commercial in confidence) and are therefore rarely available for public or academic review (Martin & Assenov, 2012a). Overall, studies have been mainly market-based, using estimated expenditures based on socioeconomic surveys. Surf contests are only one aspect of the estimation of market values and they are essentially marketing strategies to promote sales of clothing and related products. Buckley (2003) notes that the sale of surf-branded clothing and accessories to non-surfers represents the greater share of the surf retail market; and therefore non-surfers are inextricably linked to the values

associated with the surfing industry. Butt (2010) identifies a number of variables, complexities, and interrelated factors when attaching a monetary value to a surfing area. For example, there is the value of waves to surfers and there is the value of waves to non-surfers. While surfers obviously have a vested interest, assessing relative values to specific surf sites is multifaceted. For example, Figure 14 features non-surfers participating as spectators at the 2009 Phuket Surfing Contest.

Figure 14 The 2009 Phuket Surfing Contest



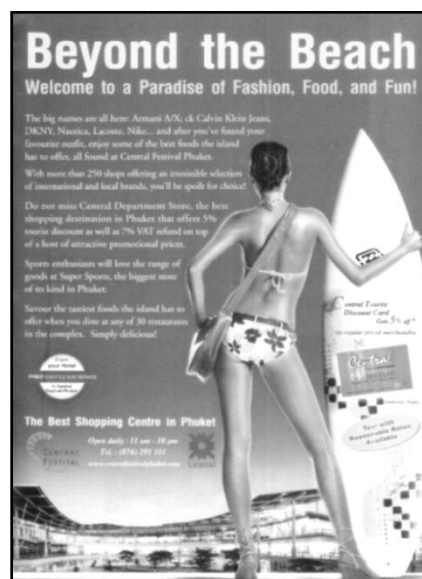
Source: Tim Hain, 2009

The Commodification of Surfing

Commodification (a term from Marxist theory which denotes the assignment of economic values to resources which were previously available at no financial cost) has become synonymous with the exploitation of surf imagery as a marketing tool (Buckley, 2003; Ormrod, 2005; Ponting, 2007, 2009a, 2009b; Reed, 1999; Wearing & Ponting, 2009). Ponting (2009a: 1) resolutely states, “Imagery of perfect uncrowded surf in paradisiacal tropical destinations has been the dominant theme in the surf media since its inception,” while Ormrod (2005) traces the commodification of surfing as emanating from California and spreading to the global stage in the wake of the 1966 film *The Endless Summer*, particularly in the context of surf exploration, romance, and youthful consumers. From a sociological perspective, surf imagery and travel have been portrayed as valuable commodities and influences on lifestyle choice through early surf films, magazines and the media. Reed (1999) looked at the social construction of surfing in the contexts of commodification, gender, mobility, and

natural seascapes in media depictions of the surfing lifestyle, offering a discourse on the history and meaning of surf travel in the framework of colonization, social resistance, and the globalization of the surfing subculture. Long-recognized by corporate surf clothing manufacturers, the marketing value of surfing is highly significant (Buckley, 2003). For example, the surfboard is often used as an icon of tourism and holiday beach wear as illustrated in Figure 15.

Figure 15 Shopping Advertisement: Phuket, Thailand



Source: Phuket Magazine, 2006

Buckley (2003), in a study of the surfing industry, identified the sponsorship of skilled surfers as an effective marketing exercise which persuades customers to buy the sponsors' products through their high exposure in specialist magazines and websites. In this context, Ponting (2009a, 2009b) explored tourism demand through the symbolic elements of surfing tourist space as the drivers of a multibillion-dollar global surf industry focused on corporate interests. Thus, surf tourism is a highly commodified global industry whose management models may indeed fail to protect the well-being of local communities (Ponting, 2007, 2009a, 2009b; Wearing & Ponting, 2009).

Surf Tourism Values

In Hawaii, Buckley (2002a) identifies the value of surfing as a touristic activity outside of the realm of those who actually surf. For example, surfing, and particularly surf competitions, may contribute more to the Hawaiian tourist economy as spectator sports than as adventure tourism. Desmond (1999) makes a case for *the viewer and the viewed*, a concept whereby the race, gender, and cultural aspects of surfing in Hawaii have since the turn of the century formed the basis of hugely profitable tourist industries. These studies may point to surfing and the surfing environment as touristic draw cards that deliver a broader value to the image and economy of a destination than the surf tourists themselves.

In the context of international tourism, Pendleton (2002) explored the valuation of coastal tourism, including „slow tourism“ whereby expatriate surfers can influence the market considerably over time. This is also the case in Phuket, Thailand where a strong expatriate surfing community has been instrumental in the development of the sport and industry (Martin, 2010a). Murphy and Bernal (2008) recognized the impact of surfing on the local economy of Mundaka, Spain, as one of the region’s leading economic sources, and described the consequences of the partial destruction of the area’s best surfing destination resulting in the cancelation of international surf competitions and a discernible loss of tourism revenue. However, in some cases, surf tourism economic impacts can be particularly difficult to estimate. For example, Buckley (2002a) notes that surf travel is generally not differentiated specifically as surf tourism, so its total economic scale and value currently remain unknown. The study notes that surfers visiting Australia may also purchase surfboards; and surfers and non-surfers alike may purchase surf clothing and accessories. Thus overall, while surfers may constitute only a small component of the surf tourism industry, their total numbers are sufficient to make a significant economic contribution.

Tourism and environmentalism, although fundamentally related, co-exist in a paradoxical model. There may be little communication between the tourism industry and those who seek to preserve the natural environment where the touristic activities take place. Buckley (2008: 3) explains that “The tourism and conservation sectors exist independently of each other; neither exists to serve the other; and to a large degree they operate with little interaction or overlap. Where they do overlap significantly, however, the interactions between them become critical to both.” Broadhurst (2001) argues that the environment must take precedence due to its intrinsic value, which outweighs its value as a tourism asset. He notes that its long-term survival must not be prejudiced by short-term considerations.

Kay and Alder (2005) note that it wasn’t until well after the industrial revolution, in the late nineteenth century, that the environment and natural resources came to be considered as finite. This attitude was mainly attributed to the advances in economic theories on supply and demand, the developing realization that society had the ability to destroy the environment, social reforms, and studies attempting to plan for resource management. Thus, if the tourism industry is to move toward sustainable management, it must adopt the responsibility to adapt to the ongoing processes and systems of the natural environment and conserve every resource. Broadhurst (2001) suggests tourism guidelines in an environmentally sustainable context:

- Tourism should be recognized as a positive activity, with the potential to benefit the community and the place as well as the visitor.
- The relationship between tourism and the environment must be managed so that the environment is sustainable in the long term. Tourism must not be allowed to damage the resource, prejudice its future enjoyment, or bring unacceptable impacts.
- Tourism activities and developments should respect the scale, nature, and character of the place in which they are sited.
- In any location, harmony must be sought between the needs of the visitor, the place, and the community.
- In a dynamic world, some change is inevitable and change can often be beneficial. Adaptation to change, however, should not be at the expense of any of these principles.
- The tourism industry, local authorities and environmental agencies all have a duty to respect the above principles and to work together to achieve their practical realization. (p. 232)

Sustainable Tourism

Sustainability is the ability of the earth's various systems, including human cultural systems and economies, to survive and adapt to changing environmental conditions (Miller, 2006). Esty et al. (2005) offer the following insight into the complexity of determining and measuring sustainability:

Sustainability is a characteristic of dynamic systems that maintain themselves over time; it is not a fixed endpoint that can be defined. Environmental sustainability refers to the long-term maintenance of valued environmental resources in an evolving human context. The best way to define and measure sustainability is contested. Economists often emphasize an accounting approach that focuses on the maintenance of capital stocks. Some in the environmental realm focus on natural resource depletion and whether the current rates of resource use can be sustained into the distant future. (p. 11)

To ensure sustainability in the face of the broad spectrum of tourism environs, a conceptual description by the United Nations World Tourism Organization (UNWTO, 2004) is focused on three dimensions, specifically the environment, economics, and socio-cultural aspects:

Sustainable tourism development guidelines and management practices are applicable to all forms of tourism in all types of destinations, including mass tourism and the various niche tourism segments. Sustainability principles refer to the environmental, economic and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability. (p. 7)

By design, sustainable tourism is an industry committed to minimizing impacts on the environment and local culture, while generating income and employment for local people. Sustainability implies the protection and conservation of resources for future generations, as opposed to unconstrained depletion (Pizam, 2010). The aim of sustainable tourism is to ensure that development is a positive experience for all stakeholders, such as local people, tourism businesses, and travelers and vacationers to whom products are marketed. In this way, sustainable tourism may take into account the culture, politics, and economy of the community and country in a multitude of aspects. The UNWTO (2004) suggests that stakeholders should

incorporate the following course of action as the guiding principles of sustainable tourism:

- Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity.
- Respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.
- Ensure viable, long-term economic operations, providing socio-economic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation. (p. 7)

Thus, the knowledgeable participation of all applicable stakeholders and influential political leadership are needed in order to facilitate participation and consensus building through the constant monitoring of impacts as an unremitting process, along with introducing precautionary and restorative measures (UNWTO, 2004).

Sustainable Surf Tourism

In an examination of the body of surf tourism research literature Martin and Assenov (2012a) found that the sustainability of surf sites and host communities are among the most prolific areas under discussion. They note that central arguments in sustainability include socioeconomics, coastal management and tourism. Among these positions, the not-for-profit sector is particularly active in building cases for environmental sustainability and surf break protection through stressing the economic importance and social implications of surfing and surf tourism at sites (Butt, 2010, 2011; Coffman & Burnett, 2009; Murphy & Bernal, 2008; Pendleton, 2002; SAS, 2009; Short & Farmer, 2012; Wagner, Nelsen & Walker, 2011).

On the global stage, surf tourism sustainability concerns vary among urban and rural settings. The protection of surfing breaks and subsequently the need for coastal management policy development stand out in the case of urban environments, while the ramifications which surf tourism activities have on rural communities in the developing world are focused mainly on the negative social impacts to indigenous host communities (Martin & Assenov, 2012a). New models aim to address these

issues and empower local communities. For example, O'Brien and Ponting (2012) cite the case of Papua New Guinea where indigenous communities serve as the traditional resource custodians of coastal areas and have brought this model to the sustainable management of surfing sites. Particularly for these and other developing communities, Ponting et al. (2005) offer a framework of three key prerequisites for sustainable surf tourism: (i) movement away from economically neoliberal approaches to development; (ii) the establishment of formalized, coordinated planning that recognizes the need for limits to growth; and, (iii) systematic attempts to foster cross-cultural understanding where host communities are central in defining their own standards, symbols and ways of representation and interpretation.

In the case of iconic surf sites with high wave quality, such as those in Indo-Pacific islands, Buckley (2002a, 2002b) asserts that capacity management is the foundational issue for sustainability. Limited surf site carrying capacities and the consequences related to overcrowding are common threads in the surf tourism research literature and this is particularly the case in the developing world and on islands where user impacts have direct social and environmental implications.

To address the mounting concerns over sustainability in the surf tourism sector, San Diego State University (SDSU)'s Center for Surf Research (2013a) acknowledges that surf tourism can have positive as well as negative consequences, attesting to the objectives of maximizing positive impacts and minimizing negative impacts. The Center's certification program for tour operators is based on global sustainable tourism criteria (GSTC) adapted to the specific requirements of the surf tourism industry and offers five broad sets of criteria (Center for Surf Research, 2013a):

- Sustainable Management
- Social and Economic Impact Management
- Cultural Heritage Impact Management
- Environmental Impact Management
- Surf Tourism Specializations

The Center suggests that innovation in sustainable surf tourism should include: "Creating and disseminating specialist knowledge to governments, the surf industry, tourism developers, destination communities, non-profits, and tourists," and that this can be accomplished through stakeholder engagement in the social and economic

development of destination communities and conservation of their critical environments (Center for Surf Research, 2013b).

Butt (2010) places emphasis on ensuring that nobody destroys or degrades the waves through promoting the following four principles at surf sites:

- Conserving and enhancing natural and cultural heritage.
- Sustainable use of natural resources.
- Understanding and enjoyment of the environment through recreation.
- Sustainable social and economic development of local communities. (p. 42)

While surf-activism for the protection of sites was born in the not-for-profit sector, such as the *Surfrider Foundation*, *Save the Waves Coalition*, and *Surfers Against Sewage* (Martin & Assenov, 2012a), government-based surf break conservation and sustainable surf tourism management is a relatively new construct. Given the increased significance of surfing resources and surf tourism activities, the Gold Coast City Council (2013) is developing a „Surf Management Plan“ under their current *Draft Gold Coast Ocean Beaches Strategy 2013-2023*:

The *Surf Management Plan* will recognize the importance of surfing to the City's lifestyle and economy. The plan will be developed in consultation with the community, businesses and key interest groups. It will identify and prioritize surfing research, prioritize actions to improve surf etiquette and surf tourism, celebrate our surf economy and facilitate growth in surf related information, education, recreation, management and investment. (p. 12)

Sustainable Surf Events

Hill and Abott (2009) note that surfing competitions have become the mainstream ideal linked with the expansion of surf media, marshaling the growth and popularity of surfing on a global scale. Tourism New South Wales (2009) suggests that these events build awareness and enhance local surf culture, retail and fashion industries, dining and accommodation, and help to define coastal destinations for tourism. However, while surf events are a key area of inquiry in the discussion of surf tourism (Martin & Assenov, 2012a), a review of ten journal papers on surf events revealed very little discussion on the environment. The main emphasis of surf competition research is on the socioeconomic implications and the motives and impacts of the

corporate surf clothing manufacturers who sponsor contests (in terms of surf site sustainability) are not well defined. O'Brien (2007), who has conducted studies on the *triple bottom line* (social, economic, and environmental contexts) of surf event leveraging, concludes that research on environmental benefits regarding the nexus between sustainability and sport events is nearly non-existent.

Nonetheless, surf events have paradoxical implications which include the exploitation, crowding and environmental impacts at sites, which may, to some extent, be offset by economic benefits for host communities and linkages to the wider economy. To address these issues, the „greening“ of surf events is gaining ground (Ahmed, Moodley, & Sookrajh, 2008; Sustainable Surf, 2013a). In a study of the *Red Bull Surfing Event* near Cape Town, South Africa, which takes place in an environmentally sensitive area within the Cape Peninsula National Park, Ntloko and Stewart (2008) found that no facilities such as waste bins/bags or toilets were provided at the event site or nearby area, and this may have played a part in negative or irresponsible behavior of some spectators such as dumping of bottles and cigarette butts which could have resulted in fire risk and hazards. They note a poor level of control with little attempt to minimize damage to the natural vegetation. In some instances paths were not used, with spectators trampling over the natural vegetation. They suggest more measures for crowd and environmental control as crucial in the event, and attest that negative environmental impacts are evident. They signal a strong link between management and impact and emphasize a need to maximize the positive impacts and minimize the negative impacts.

Thus, a knowledge gap is evident in surf event sustainability, particularly in the environmental context, which begs the question: How can surf events benefit the conservation of coastal surfing resources?

1.7 Surf Resource System Boundaries

Surf system boundaries include more than the beach and sea, and there are numerous interrelated and intersecting stakeholder interests and factors related to the scope of the „whole“ surf system as a sustainable and dynamic model. The following discussion serves to review and broaden the knowledge of surf system boundaries and

provide clarity to the context of the Surf Resource Sustainability Index (SRSI) in two sets of dimensions: the physical boundaries of surf sites and the resource stakeholders.

Physical Dimensions

Our Common Future (United Nations, 1987) suggests that mankind is increasingly challenged by the realities of ecological and economic interdependence – and nowhere is this more true than in shared ecosystems and in „the global commons“, such as the oceans. The report emphasizes that the oceans cover over 70 per cent of the planet's surface and provide the balance in the Earth's wheel of life:

They play a critical role in maintaining its life-support systems, in moderating its climate, and in sustaining animals and plants, including minute, oxygen-producing phytoplankton... they provide protein, transportation, energy, employment, recreation, and other economic, social, and cultural activities. (p. 179)

Thus, the oceans are marked by a fundamental unity from which there is no escape, where interconnected cycles of energy, climate, marine living resources, and human activities move through coastal waters (United Nations, 1987). Coastal areas, such as beaches, along with the accompanying dunes and shoreline environments, were established after stabilization of sea level less than 7,000 years ago and are part of an interconnected single natural system (GOP, 2013). Surf sites are dynamic features of the littoral, comprised of a particular set of geographic features and phenomena that unite the physical system in such a way that waves form and break in a manner that is conducive to surfing. They include the surf zone (the area where waves break as they approach the shore) as well as the areas affected by local tides and local flora and fauna and are part of a wider natural system (GOP, 2013). The physical dimensions of sites include the sea and the waves, the beach and sand bars, the reefs and biodiversity, the adjacent terrestrial environment and a number of physical processes. Research accounting for the wider natural surf system has only recently appeared in the literature, particularly in reports by the not-for-profit sector (Surfrider Foundation, 2013a; Butt 2010, 2011). Increasingly, geomorphic and bathymetric features are being recognized as baseline to the integrity of sites (Bicudo & Horta, 2009; Scarfe, 2008; Scarfe et al., 2009; Surfrider Foundation, 2013a).

Accordingly, the physical boundaries of surf sites encompass more than the littoral and their integrity is linked to and dependent on adjacent terrestrial areas and open sea. For example, surf sites include those at river mouths where changes in sediment outflow can alter morphology of the area; thus what happens inland can directly affect the site. The natural watershed of San Mateo Creek is a highly publicized example where a naturally-occurring outflow of cobblestones geologically creates several world-class surf sites known as *Trestles* and organizations such as the *Surfrider Foundation* are protesting the development of a toll road which will alter the outflow of the watershed (Surfrider Foundation, 2013; Sustainable Surf, 2013b; Nelsen et al., 2007).

Surf sites are also sensitive to offshore developments which might slow or obstruct ocean swells from traveling to a given coast, such as artificial reefs or Wave Energy Converters (WECs) which can block or slow waves from reaching sites (Butt, 2010). In consideration of these examples, surf site boundaries can be extended well beyond the immediate area to include the wider terrestrial and ocean natural systems, and this concept can be extended to include the winds and weather systems that produce the waves. Consequently, surf site integrity is intrinsically tied to the implications of climate change and sea level rise (Beaches, Surfing and Climate Change in Australia, 2013; Griffith Centre for Coastal Management, 2013).

Surfing Habitat

Surf sites are part of a wide and encompassing system of natural processes. Sustainable Surf (2013b) defines *surfing habitat* to include waves, clean oceans, marine animals (fish, seals, whales, sea birds), coral reefs, ecosystem flora and fauna (plankton, kelp), and watersheds on land. R. Richie (personal communication, January 15, 2011) explains:

The conservation of surfing sites is much like conserving elephants; it requires the protection of habitat which encompasses not only a large area but also any number of other resources and species... therefore, conservationists who seek the protection of habitat like the idea of protecting surfing areas for this reason.

Direct human impacts on surfing habitat include threats identified to have a multiplier effect on the environment, such as over-fishing, urban pollution (sewage, urban runoff, industrial discharge), marine debris, coastal development, oil spills, and watershed land-use change (Sustainable Surf, 2013b). In the face of these issues, Buckley (2002a) suggests that surf sites, depending on how commercial surf tourism is managed, are jointly vulnerable to major environmental impacts and hold the potential to help with the conservation of native habitats and traditional cultures.

Sustainable Surf (2013b) suggests that global threats to surfing habitat include sea level rise, ocean acidification and ocean warming. First, given that the geologic processes needed for most surfbreaks to form require thousands of years, a rapid increase in sea level would inundate surf breaks. Secondly, ocean acidification (related to the increase of atmospheric CO₂ levels) results in high acid levels and negative implications for coral reefs, shellfish, and phytoplankton. Lastly, slight changes in ocean warming cause coral bleaching, given the narrow temperature tolerance of coral.

Surf Habitat Conservation

Conservation is in effect the sensible and careful use of natural resources by humans whereby individuals are concerned with using natural areas in ways that sustain them for current and future generations of human beings and other forms of life (Miller, 2006). As the concept of coastal conservation often includes stakeholder use and community involvement with the ultimate aim of maintaining environmental integrity, significant to the implementation of conservation ideals is the proactive management and use of various coastal planning approaches (Kay & Alder, 2005), and these actions are most effective when accounting for the environmental capital of a given area. Thus, when placing sites in the context of protection or conservation, we must account for a number of sensitivities which may determine the design or structure of the management plan (Barrow, 2005).

The recognition of surfing areas as a coastal resource worthy of protection is a relatively recent development sparked in part by the prolific growth of domestic and international surf travel which has spread surf tourism to cities and rural areas around the world. Surf tourism has awakened coastal communities and local and regional

governments to the significance and consequences associated with the loss or degradation of the resource. Only recently has research validated the importance of surf sites when conducting Environmental Impact Assessments (EIA) in coastal projects (Butt, 2010; Scarfe, 2008; Scarfe et al., 2009). Butt (2010) identifies a number of ways in which waves can be lost, including the construction of solid structures (which are common and permanent), dredging river mouths and canals, chemical pollution and sewage, oil spills, nuclear waste, and litter and marine debris, in addition to problems with access. In terms of conservation ecology, R. Richie (personal communication, January 15, 2011) explains “We must consider that surfers require clean water and beaches, and water quality is a serious issue – if you get sick surfing an area you will likely not come back – nobody wants to surf or vacation at a polluted area.” Strategies to manage the resource base and user impacts at surf locations may include numerous considerations and approaches. To address these concerns, Lazarow (2010) offers four key strategies: do nothing; legislate/regulate; modifications to the resource base; and educate/advocate (see Table 3).

Table 3 Managing the Resource Base at Surf Locations

Do nothing	Legislate/regulate	Modify the resource base	Educate/advocate
x	<ul style="list-style-type: none"> ▪ Restrict users through strategies such as payments, restricted access or parking, craft registration, restricted time in the water ▪ Modify user behaviour using legislation such as requiring proficiency to surf particular areas or policing a surf break on jet skis ▪ Community title (for example, Tavarua, Fiji) ▪ Declaration of surfing reserves 	<ul style="list-style-type: none"> ▪ Groynes ▪ Seawalls ▪ Artificial reefs ▪ Sand bypass systems ▪ Beach and nearshore sandbar grooming ▪ Nourishment campaigns ▪ Break becomes unsurfable due to water pollution 	<ul style="list-style-type: none"> ▪ Code of ethics (road rules for the surf) ▪ Signage ▪ Education strategies ▪ Surf rage, aggression, intimidation ▪ Self regulation/localism ▪ Lore ▪ Declaration of surfing reserves ▪ Direct action ▪ Protests and demonstrations ▪ Lobbying and the promotion of alternative strategies ▪ Provision of new information

Source: Adapted from Lazarow (2010: 254)

Demarcation of Surf Sites

A contemporary and conceptual recognition of surf sites first arose without the consideration of the physical boundary or demarcation of the surfing area per se; rather plaques and statues were displayed at sites in favor of cultural icons or tourism, such as in Freshwater Beach (Australia), Pipeline and Waikiki (Hawaii, USA), Santa Cruz (California, USA), and Uluwatu (Bali, Indonesia) (Farmer & Short, 2007). While these plaques and statues may signify a strong association with surfing at a given site, none are capable of protecting or enhancing the site for surfing. For this to occur, as well as visual recognition, a reserve system can be employed to identify and protect iconic surfing sites (Farmer & Short, 2007).

The earliest demarcation of surf sites was in ancient Hawaii where sociopolitical management systems emphasized the significance, use and physical boundaries of sites. K. Koholokai (personal communication, June 22, 2013) notes that the stories and legends of the Hawaiian surf sites give credit to the contemporary concept of the surfing reserve because the native people have been surfing these sites over many centuries:

Ancient surfing sites like *Ku'emanu Heiau* adjacent to Kahalu'u Beach Park [Kona, Hawaii] and *Hale'a'ama Heiau* at Kamo Point [Kona, Hawaii] (today called the "Lyman point break") were afforded a type of protection according to traditional Hawaiian culture. Since ancient *He'e Nalu* (Hawaiian surfing) was a religious expression especially for the Ali'i or chiefly clans, it required surfing protocols of *Pule* (prayers), *Oli* (chants), *Ho'okupu* (offering), and *Kapu kai* (ceremonial sea bath), so surf sites like *Ku'emanu* and *Hale'a'ama Heiau* were several of the many physical and spiritual sites set aside for *He'e Nalu* (surfing). Even though there were *Ahupua'a* (land division units) within a *Moku* (island districts) of a *Mokupuni* (island), there were *ili* (strips of land) within an *Ahupua'a* that was dividing into smaller parcels of land like *Mala'ai* (plantation or gardens) and even *ili Kupono* or *ili Ku* (reserved chief lands) and *ili lele* (small parcels of land here and there). For example, Kamo Point is an *ili Ku* land division unit set aside for surfing and other sports activities; thus *ili Ku* was not subject to tax or tribute by a *Konohiki* (landlord) of the *Ahupua'a*.

Although the contemporary lifestyle, sport and industry behind surfers and surfing have become globally-occurring phenomena, Short and Farmer (2012) note that surf

breaks are the very core and have been “largely been taken for granted.” They point to surf tourist destinations where the expanding surfing sector has done little to prevent the loss or contamination of sites; for example, the adjacent environment has not been protected from inappropriate development. Key issues include surf sites being overwhelmed by development, population pressures, and the associated shadowing, pollution, sewerage and stormwater (Short & Farmer, 2012).

Farmer and Short (2007) note that surf sites have physical and social dimensions which include the beach and adjacent surf zone. They note that surf sites include not only the physical features of the marine and coastal zone which intrinsically enhance aspects of the surfing experience; they may include structures such as surf clubs. Social attributes include the surf site history or places considered sacred by surfers for a particular reason.

Surfing Reserves

While the conservation of coastal areas has a long history in many regions around the world, the protection and management of surf sites is a relatively recent construct. The surfing reserve concept opens a new dialogue for the theoretical, practical and political applications of surf site recognition and conservation. The first-ever surfing reserve was formed in 1973 at Bells Beach, Victoria, Australia and serves as a milestone in surf conservation history. The original legislation was land-based, essentially protecting only the foreshore and terrestrial park area (FFLA, 2010).

Coastal conservation favors human use and interaction as integral to the sustainability of a given area and many coastal zones are set aside as parks and reserves intended to serve as habitat for wildlife, provide space for recreation and tourism, access to fishing grounds, or for other purposes aimed at the conservation of natural resources. Broadhurst (2001) identifies that parks and reserves have different meanings in different circumstances, the former suggesting some return of benefit to the user, the latter being concerned more with conserving the potential to provide a return for future generations. However, Kay and Alder (2005) suggest that the ability of conservation areas to meet the multiple-use demands of coastal users while providing for conservation is questioned by environmental preservationists who seek multiple-use as only a trade-off between economic development and preservation.

Broadhurst (2001: 145) asks, “If we designate a place as special, does that mean that other places are not special?” In theory, the conservation of special places exists only in the human mind, as an abstract concept aimed at changing people’s behavior or the side effects of their behavior. In practice, for conservation to work, people must first agree to have a conservation area, and what rules to apply, and the stakeholders must understand what to do or what not to do in the context of a wider and variable chain of events (Anthoni, 2001). Thus, while one particular area may be resistant to various human or natural impacts that cause environmental change, another area may be highly susceptible, and the designations of environmental zones need to be site-specific and take into account a range of criteria (Broadhurst, 2001).

In marine environments, Jessen et al. (2011) identify that sustaining ocean health requires ecosystem-based approaches to management and that Marine Protected Areas (MPAs) are a central tool in this context. Dimmock (2007) describes MPAs as any area of the coastal zone or ocean conferred a level of protection for the purpose of managing use of resources and ocean space, or protecting vulnerable or threatened habitats or species.

The most comprehensive strategy to date for the protection of surf sites is the concept of the „surfing reserve“ (Farmer & Short, 2007; Short & Farmer, 2012). Lazarow (2010) suggests that the promulgation or „symbolic declaration“ of surfing reserves has four important aspects which include the model of *Surfing Capital*:

- It recognises surfing as the primary or one of the most important uses of a particular area.
- It puts all parties on notice that the surfing community in an area care passionately about surfing capital in a particular area.
- It recognises the socio-economic and cultural value of surfing to a particular area.
- It recognises that the surfing community is interested in developing a long-term plan of management to manage and protect surfing capital in a particular area, ideally in conjunction with the local land management authority. (p.266)

A surfing reserve is designed to formally recognize surfing sites and in doing so to provide a focus for the ongoing protection of those sites and to assist in the concerted management and development of the adjacent land area; it is a proactive step to surf

site conservation and represents a mechanism to redress the “casual attitude” of surfers to their surf breaks (Short & Farmer, 2012).

Lazarow (2010) offers a descriptive justification for surf break protection through a reservation system:

In some places coastal areas are well managed or are remote enough not to require any sort of management framework as there are relatively few competing interests. However, with an ever-increasing and mobile surfing population, environmental and development pressures in the coastal zone and a less than impressive record of mass tourist development and destruction that has followed on from surf break discoveries in many third world locations, there are a number of very good reasons for moving down the path of surf break protection through a reservation system as a means of protecting these valuable natural capital assets into the future. (p. 265)

Short and Farmer (2012) note that surfing reserve boundaries vary considerably from one site to another, ranging in size from just a few hundred meters of coast to several kilometers of coast. Sites should extend from the shoreline out at least 500 to 1000 meters seaward to make sure the breaks themselves are included. They provide examples in Australia where the reserves include the surf breaks, the coast, and the surrounding ocean and range in extent from 600 meters of coast and 50 hectares in size to over 7 kilometers of coast and 400 hectares. While surfing reserves may not have any direct bearing on adjacent land use, they may provide a substantial support in the debate about land use and coastal development (Short & Farmer, 2012). Figure 17 shows the boundaries of the Malibu Surfing Reserve.

Figure 17 Malibu Surfing Reserve Boundaries



Source: Save the Waves Coalition, 2010

Stakeholder Dimensions

Economic Linkages

Understanding the broad scope of relationships among surf resource stakeholders is a relatively new endeavor. Researchers and economists have only recently begun to investigate the value of waves and identify the significance of various stakeholder groups. Most evident are the individual surfers who bring money to local businesses and the wider coastal economy when they go surfing (for example, making local purchases of provisions and petrol). While surfers are an obvious stakeholder group, their capacity goes beyond riding the waves and includes their employment in various businesses and surf-related industries intrinsically tied to a particular coastal area. For example, Butt (2010) identifies that surf resource stakeholders include surfers and other members of the community who own or work in surf-related establishments where the visitors spend their money, including surf shops, surfboard manufacturers or surfing schools. Similarly, there are businesses that may derive income based on the existence of a good surfing wave in their town through extrinsic and less obvious sources, such as airlines, rental car companies, petrol stations, restaurants and bars, etc. Case in point, are the surf businesses on the Gold Coast, Australia which create local employment for a number of high-skill occupations tangibly connected to the resource, including graphic designers, filmmakers, journalists, web designers, legal and finance professionals, as well as the more obviously related areas of surfboard shaping, clothing and hardware design, surf schools, educators and surf media (AEC Group, 2009). Butt (2010) recognizes that although non-surfers, such as hotel employees, managers, shop owners, politicians or anybody else with a relationship to the site, may not have a direct stake in riding the waves, they can have indirect stakes, including social and economic interests.

Another dimension of stakeholders in surf sites are interests connected with surfing events. O'Brien (2007) notes that impacts on host communities and linkages among stakeholders include contest sponsors, surf shops, hotels, advertisers, banks, stores, restaurants and bars, resulting in short and long-term benefits and enhanced business relationships. He notes that key sectors include surfing hardware, surf accessories and services, accommodations, and event-related infrastructure. Additionally, in order to

setup and run the surf event, local suppliers provide infrastructure: scaffolding, tents, public address systems, trophies and prizes and t-shirts; and services, such as “qualified judging, travel, accommodation and hospitality solutions, media and photographic services, and entertainment venues for event augmentations” (O’Brien, 2007: 152).

Stakeholders and Surf System Sustainability

Martin and Assenov (2012a)’s study of surf tourism research suggests a need to define the complete system boundaries of surf sites, including the significance and activities of new regional and demographic markets, surfwear manufacturers and the sponsorship of surf events, cultural shifts in the surfing subcultures, and the impacts of technology and coastal engineering innovations such as artificial surfing reefs. While these topics are of growing interest in the academic community, published research attesting to the physical and human „surf system“ as a holistic spectrum of social, economic and environmental criteria and implications for sustainability is limited. To address these concepts, sustainable surf site policy and management must attend to the broad system as a diverse yet integrated element with essential linkages spanning people, place and the impacts on a vulnerable resource base consisting not only of the water, waves, reefs and coastal morphology, but also of the coastal users and a broad base of stakeholders.

The argument that waves are resources, and that a wide-range of stakeholders are players in their sustainability, has only recently appeared in academia, particularly as a result of graduate research and the not-for-profit sector (Martin & Assenov, 2012a). For example, Butt (2010) (in a report commissioned by *Surfers Against Sewage*) suggests that the coast and the waves are indeed resources and can be used to benefit everyone in a sustainable and stable way. He notes that while the wider consequences of degrading or destroying surf breaks are not well understood and may seem inconsequential, the implications should be taken seriously:

We don’t know where the threshold is; we don’t know how much we can modify the system before it goes out of balance. After all, by burning too many fossil fuels and by removing too many trees – both of which we also thought were insignificant – we have succeeded spectacularly in seriously altering the atmosphere. (p. 45)

Based on Lazarow et al. (2007, 2008)'s concept of *Surfing Capital*, the following list of direct stakeholders can be drawn: biologists; climate change specialists; coastal developers, engineers and managers; environmentalists; legislators and politicians; social scientists; a wide breadth of amenity stakeholders in the built and natural environment; and a wide breadth of stakeholders in issues of public access and safety, public and private property. Thus, the sustainability of the integral surf system relies on the ability of diverse stakeholders to engage in dialogue, education, and the elucidation of surf sites as emergent and dynamic coastal resources to be recognized as natural capital whereby sustainability can only be achieved by their wise and careful management. Miller (2006: 8) places the concept of managing natural capital in the context of one's own economic integrity: "Protect your capital and live off the income it provides. Deplete, waste, or squander your capital, and you will move from a sustainable to an unsustainable lifestyle." It is in this context that *Surfing Capital* (Lazarow et al., 2007, 2008) brings the argument of natural capital sustainability into the context of surfing through itemizing the natural or human impacts relative to wave quality and frequency along with environmental and experiential dynamics. Based on these criteria, Lazarow et al. (2008) pose a rhetorical question to all surf resource stakeholders:

What threats are there to surf quality and what are surfers and the surf and tourist/recreation industry doing about it? In the face of an ever-increasing litany of threats, many of them human induced, such as pollution and inappropriate development, natural climate variability, and the potential and realized impacts of human-induced climate change, is it possible to reinvent coastal space with a deteriorated amenity and how will this affect the tourist experience, the local community, and the industries that rely on it? (p.148)

Surfers as Resource Stakeholders

Surfing is an important recreational and cultural use of the coastal zone and surfers are a viable coastal stakeholder group; they have strong cultural passion and sense of ownership of their surf spots as "natural cultural resources" (ASBPA, 2011). Counter to the stereotype of surfers as unwaged beach bums, experienced surfers often have college degrees and are often in the upper middle-class income bracket (Nelsen et al., 2007). However, surfers constitute a coastal interest group that has historically been

ignored in coastal management (Scarfe et al., 2009). Butt (2010) writes extensively on the role of surfers as a significant stakeholder group directly affected by the integrity of surf site sustainability. He notes that if a surf site is destroyed, polluted or degraded for some reason, the surfers in the town will not only suffer because they won't be able to surf it, but they might also suffer because their jobs depend on that wave bringing money-spending tourists into town. Evidence of this was noted by Murphy and Bernal (2008) when the world-class wave at Mundaka, Spain was degraded by a coastal dredging project resulting in an unprecedented loss in revenue to the local community.

ASBPA (2011) note that the role of surfers is essential when considering the identification, preservation or mitigation of surfing resources in coastal planning and project development. Accordingly, by engaging surfers, inputs or concerns can be addressed early in the coastal management process. Scarfe et al. (2009) suggest that as the social, economic, and environmental benefits of surfing breaks are realized, surfers are increasingly integral players in coastal resource management. Butt (2010) suggests that surfers can pinpoint areas of special interest that developers should avoid, and that they have a role to play in promoting the following basic principles: conserving and enhancing natural and cultural heritage; sustainable use of natural resources; understanding and enjoyment of the environment through recreation; and sustainable social and economic development of local communities.

Surfers are the core stakeholders in providing impetus to the surf site management process, particularly in the case of urban sites which surfers identify as their local breaks and at sites where good wave quality attracts locals and traveling surfers alike, including world-renowned iconic breaks (Short & Farmer, 2012). Therefore, surfers are at the core of reserve identification and implementation at regional, national and world levels.

Grassroots Surf Organizations

ASBPA (2011) identifies that surfers are becoming increasingly organized as stakeholder groups in protecting existing surf spots and supporting coastal management policies that take into consideration social, economic and environmental implications. At the local, regional and national not-for-profit level, some well-known

examples include: *Save the Waves Coalition*, *SurfAid*, *Surfers Against Sewage*, *Surfers Environmental Alliance*, *Surfrider Foundation*, *Waves for Development*, and *Wildcoast*. The *Save Trestles* campaign represents a not-for-profit organization-driven community action to protect a wave threatened by direct human activity. The movement was initiated primarily by surfer-stakeholders who organized to protest development that threatens the California surf site named *Trestles* (Sustainable Surf, 2013b). In 2008, surfers and activists organized the largest turn-out (3,500 people) for a public hearing in California's state history resulting in the Coastal Commission denying the development plan (Surfrider Foundation, 2013).

Surfers may also form local and regional boardriders and lifesaving clubs, and these organizations are usually based at or centered on surf sites and form independent stakeholder groups. Augustin (1998) notes that when united, these clubs can comprise national federations and play an essential role in the local promotion of surfing through synergies inspired among surfing sponsors, the media, and the local communities. Surf lifesaving clubs may form independently or under the auspices of local or regional governments, and can become grassroots stakeholder groups directly related to site integrity in terms of community, education and safety (AECOM, 2010).

Surf Tourism Stakeholders

In terms of surf tourism, Buckley (2002a) offers four interconnected groups of stakeholders which influence the role of surf tourism in sustainable development. They include individual surfers, commercial tour operators, local residents and government officials. He notes that the ethics among surfers form a complex fabric of stakeholder responsibility along with the desires and codes among tour operators, the traditional and modern perspectives of host communities, and the requirements of governments. To address these concerns, San Diego State University's Center for Surf Research (2013b) identifies that stakeholder engagement in the sustainability and development of rural destination communities is paramount. Thus, they recommend stakeholder leadership in creating and disseminating specialist knowledge to governments, the surf industry, tourism developers, destination communities, not-for-profit organizations and tourists.

Bearing in mind the global surf tourism industry, surf resource sustainability is of growing significance to a wide range of stakeholders in very different socioeconomic and cultural settings. The most obvious differentiation is between urban „surf city“ economies in the developed world, such as the Gold Coast, Australia, or San Sebastian, Spain, and rural island settings in developing countries, such as the Mentawai Archipelago, Indonesia, and Lobitos, Peru.

In the case of the former, *Surf Cities* are coastal communities where surfing plays an instrumental role in the character and fabric of the community and tourism industry. The World Surf Cities Network (2013b) defines a Surf City as an urban area where surfing, surf culture and employment in surf industries are relevant to the economic, social and cultural base of the city and the surf industry is formally recognized by the city government in terms of the following elements:

Location, population, natural resources, surf industry (surfboard design and manufacturing, accessories and equipment), services (surf tourism, surf retail, surf schools, surfing events and competitions, surf training, surf media, surf real estate), culture (number of surfers and surfing associations, surf culture events, surf icons and history), and surf industry importance recognition by the city.

In the case of rural island settings, coastal communities in the proximity of surfable waves inevitably became key stakeholders in surfing resources with various positive and negative outcomes. Apart from the negative effects and influences brought by the unplanned and in some cases unwanted and rapid advance of the surf tourism industry in various locations around the world, positive outcomes include surfer-volunteerism programs in community outreach, environmental health and entrepreneurship empowerment (Waves for Development, 2013). Similarly, SurfAid International (2013) is a well-publicized example of a not-for-profit organization focused on community development through improving the health, wellbeing and self-reliance of people living in isolated regions, particularly in Indonesia. Thus, the concept of the surf tourism stakeholder broadens to include those who provide, receive and benefit from community-based health and education in these regions.

Traditional Resource Custodians

Traditional resource custodians at surf sites include host communities, such as fishing villages on islands and in developing countries with long-standing access rights and interaction with coastal resources. Previous to the global exploration and exploitation of surfing resources in such areas, the significance and value of surf resources were not recognized by local communities. As a result, with the arrival of the global surf tourism industry, including groups of traveling surfers on land and by boat, rural host communities had no experience in managing these resources and were unprepared for the social and economic implications and impacts. Buckley (2002a, 2002b) relates that commercial surf charter boats and land-based surf camps have typically operated as enclaves with little meaningful interaction with local host communities. J. Ponting (personal communication, February 29, 2013) identifies the contrast between traditional resource custodians and surf tourism operators: “The million-dollar boat and the impoverished community.”

Research by Ponting et al. (2005) indicates that unregulated free-market approaches to surf tourism development in less developed regions alienate local people as a single and comparatively powerless stakeholder group amongst many others. Consequently, local people are often the last to benefit from economic development based upon the exploitation of their resources, yet shoulder the bulk of negative impacts; indigenous communities risk exclusion from the surf tourism economy (Ponting et al., 2005) and the surf tourists may miss an important cultural exchange to add value to their experience (O’Brien & Ponting, 2013).

A. Abel (personal communication, February 28, 2013) explains that in the case of Papua New Guinea (PNG), host communities are “traditional resource custodians”, rather than the contemporary concept of “land owners”, and this leaves them marginalized in terms of the use of their coastal resources by surf tourists. Abel has worked to educate and empower local communities through a consultation process aimed at social and economic sustainable development:

The model we saw in the region put the cart before the horse, wherein the cart is the local community and the horse is the tour operator; now we are building a new conceptual „bottom-up“ model to surf tourism, where indigenous communities manage their resources in a sustainable

fashion as stakeholders and this has even helped to promote protection of the surf reefs through abandonment of harmful fishing practices which once used dynamite and cyanide; now they [indigenous communities] embrace the benefits of surfing waves as a renewable resource based on their own terms, limiting the number of users of sites to manage social and environmental impacts, while providing economic benefit to the community and a unique cultural and quality surfing experience for the surf tourists.

O'Brien and Ponting (2013) note that *Surf Management Plans* have been developed and put in place to solve a variety of issues in PNG where reefs are owned by local villages or clans and the rights to natural resources do not end at the high-water mark as they do in most countries; rather their traditional grounds include the reefs where the surfing activities now take place. Thus in the case a commercial surf tourism operation which utilizes an area to conduct business, it is appropriate for the traditional resource custodians of the reefs to benefit. However, managing surfing reefs is in itself a foreign concept to such communities as revealed in the following interview conducted by O'Brien and Ponting (2013) in PNG:

This was a resource that they didn't realize they [the indigenous community] had. They had the potential to develop, manage, promote, and at the same time, derive a sustainable source of income without denigrating their day-to-day way of life, their culture, or their heritage. ... This is actually a resource that's sustainable and has to be managed and developed properly so that when we're gone, there's a legacy that's been created to ensure a sustainable source of income for the people. So they now realize that, hey, there's an alternative where we can still go fishing, we can still do our dancing, and our craft and everything, but we can generate a source of income without having to chop down all the trees. (p. 168)

At the time of writing, PNG's surf tourism sector arguably serves as the only example in the world of a formalized attempt by indigenous surf resource custodians to collaborate with stakeholders to sustainably manage surf tourism resources and activities through a community-centered strategy. This approach engages resource owners in planning acceptable use of their surfing resources and appropriate compensation (O'Brien & Ponting, 2013).

Fiji serves as another case study in the Asia-Pacific. Ponting and O'Brien (2013)'s research notes that traditional fishing grounds have been a source of controversy dating back to the colonial era, and this has been exacerbated by the development of

the lucrative commercial surf tourism industry, which consists of as many as 75 tour operators at 120 surf sites. Recent changes in access to these resources by the government have caused tensions to escalate among individuals and communities and created an environment of social and political uncertainty. Ponting (2007) notes that local Fijians and others may pretend to be resource owners in order to seek “ad hoc payments” from recreational surfers and tour operators. At the time of writing, new open-access policies to Fijian surf sites have come at the cost of “de-territorialization” of customary resources and marks a transition from communally-owned common pool resources – and the impacts to sustainability are yet to be determined (Ponting & O’Brien, 2013).

To address these issues, management strategies allied to differing culturally-bounded property rights need to be developed accordingly; and Ponting and O’Brien (2013) suggest that regulatory philosophies and frameworks should consider indigenous resource custodians to be compensated for the use of their reefs and fishing areas. Research in PNG (O’Brien & Ponting, 2013) and Fiji (Ponting & O’Brien, 2013) highlights the integral juxtaposition of sustainability and surf tourism; it may also exemplify how the development of surfing activities at the village level can foster the entitlement of surf sites among indigenous communities through insightful planning for sustainability and increase opportunities for local communities to share in the benefits derived from surf tourism.

Interdependence of Stakeholders

Two paradigms coexist when looking at the contemporary understanding of surfing sites in the social sciences – the global value perspective of the surfing industry alongside the value attributed to specific surfing locations by individuals and local communities. Given the enormous reach of the global corporate surfwear and equipment sales industries and the increase in the number of individual surfers and surfing communities in the world who contribute to the visitation of sites, collectively these factors encompass countless facets of tourism, direct and indirect values, and stakeholder linkages and engagement. While relevant market values are reasonably easy to measure through, for example, domestic and international tourism receipts from surfing schools, camps and events, the nonmarket values such as the economic

benefits of regional and national image, socio-cultural aspects, physical fitness and psychological wellbeing are more difficult to measure. Nevertheless, nonmarket values touch the lives of millions of surf resource stakeholders in coastal areas across the world.

As mentioned above, there has been relatively little research which investigates surfing sites in a whole system context, whether in terms of the individual, society, the economy, or the conservation of the natural environment. As a result, the study of surf sites as a whole system is theoretically very significant for three reasons. First, it revolutionizes the understanding of coastal systems, community and sustainability by introducing surfers and other groups as intrinsic and extrinsic surf site stakeholders. Secondly, it augments the role of the environmental and social sciences in the management of coastal surfing resources. Thirdly, it sets the stage for employing new and multidisciplinary mixed-methods approaches in surf tourism research which account for interrelated and intersecting social, economic, environmental and managerial sustainability indicators.

2. OBJECTIVES

- (i) To establish a corpus of surf tourism research literature for systematic review and to determine foundational scholars and emergent topics and themes in the research area.
- (ii) To develop and frame surf resource sustainability indicators and indices aimed at the conservation aptitude of surf sites.
- (iii) To investigate surf resource indicator importance, particularly in terms of measurability and conservation aptitude.
- (iv) To apply the surf resource sustainability index to surf sites in Phuket, Thailand and to identify and prioritize their conservation aptitude.

3. RESEARCH DESIGN

The content presented in this dissertation is the compilation of, and synergies between, three international journal papers and one conference paper, forming an inclusive research design constructed in consecutive yet separate layers of investigation. Binding the research is the innovation of the Surf Resource Sustainability Index (SRSI), a methodology designed as a conceptual and global model for assessing the complexities of surf tourism sites in a social science context. While each article stands as an independent study, together they encompass the development of the SRSI. The individual studies are: (i) a systematic review of surf tourism research; (ii) the primary approach and design of the SRSI, including a case trial of the methodology in Phuket, Thailand; (iii) a study on indicator importance among scholars and expert surfers from diverse backgrounds; and (iv) an in-depth application of the SRSI in Phuket, including a cross-sectional analysis of nine surf sites and review of sustainability issues and implications.

3.1 SRSI Indicator Development

The design and development of the Surf Resource Sustainability Index (SRSI) is available in Martin and Assenov (2013a) including the review of relevant literature on tourism and beach quality indices, and this work has not been repeated here. The following detail provides supplementary background on environmental indices and indicators, a rationale for the SRSI concept of conservation aptitude and indicator development. A summary of SRSI indicator importance based on stakeholder interviews and a critical analysis of limitations, biases and reliability of the research is provided in the discussion.

Environmental Sustainability Indices

According to Emerson et al. (2010), environmental sustainability has emerged as a critical policy focus across the world, and organizations are increasingly required to explain their performance on a range of pollution control and natural resource management challenges with reference to quantitative metrics:

A more data-driven and empirical approach to environmental protection promises to make it easier to spot problems, track trends, highlight policy successes and failures, identify best practices, and optimize the gains from investments in environmental protection. (p. 6)

Index design is a comprehensive process requiring the development of indicators which serve to measure and calibrate, and their interpretation can require statistical analysis in terms of conceptual and analytical processing, and the calculation of scores and ratings. Accordingly, defining theory and practice in environmental protection requires an empirical approach and the development of indices and indicators serving to track and measure trends. While environmental indices can be highly interdisciplinary and take many forms, such as those focused toward ecology or environmental sciences, Esty et al. (2008) suggests that their innovation is more often than not aimed at improving policy design and implementation by providing accurate, up-to-date, data-driven recommendations and prioritizations to policy-makers and other stakeholders.

Environmental managers require data to make informed decisions and create strategies to serve environmental conservation in the field. Any multi-issue environmental performance measurement system can be characterized largely in terms of how it achieves two core functions: specifying an architecture that identifies high-priority issues; and calculating metrics on a common scale (Emerson et al., 2010).

Esty et al. (2008) identify that the real value of an environmental index lies not in the numerical rankings, but rather in careful analysis of the underlying data and performance metrics. They note that when applied in a socioeconomic context, environmental indices are a powerful tool for refining policy choices, optimizing the impact of limited financial resources, and understanding the determinants of policy results.

Indicators

Miller (2006) suggests that as the knowledge of environmental concerns expands, researchers seek the development and adoption of new indicators to help monitor environmental quality and human well-being. Ahlheim and Fror (2001) outline that

the strength of environmental indices lies in the *indicators* which form the basis of measurement in the index. A base component of an index is an indicator, a sub-set or pointer which serves as an instrument of measurement. An indicator is a standardized and useful method for measuring and comparing complex data sets (Miller, 2006). A good indicator meets the criteria of being: measurable, precise, consistent, and sensitive – and measurable entities relate to a specific information need, such as the status of a key ecological attribute, change in a threat, or progress towards an objective (TNC, 2007). Thus, indicators are developed in order to measure changes in the environment, similar to the pointer on a pressure gauge, and may also describe effects that either enhance environmental quality and human well-being or deplete natural resources and lead to a lower quality of life.

Triple Bottom Line and Surf Sites

The interwoven social, economic and environmental dimensions among humans and the environment have been expressed as *the triple bottom line* by a number of researchers in recent years. In terms of the sustainability of surf sites, references include Buckley (2002a, 2002b), AECOM (2010), Gold Coast City Council (2013), Lazarow et al. (2007, 2008), Lazarow (2010), O'Brien (2007b), and Scarfe (2009). Accordingly, the SRSI was designed in the triple bottom line context and includes an additional index specifically for surf site governance.

In the context of economics, the term *triple bottom line* was introduced by Elkington (1997), and Esty et al. (2008) employ the concept as foundational to environmental index design. Miller (2006) suggests that social, economic and environmental indicators and indices are baseline to our understanding of the sustainable management of resources, and this concept can be broadened to include surf sites. For example, a management strategy introduced by Gold Coast City Council (2013) (which includes a *Surf Management Plan*) reports that surf sites are integral components of the coastal resources where environmental significance includes nature, plants and wildlife; social significance includes space for people to undertake beach and ocean activities; and economic significance includes the income generation aspects for businesses. PhD dissertations by Lazarow (2010) and Scarfe (2009) target the social, economic, and environmental benefits of surfing breaks,

particularly in the context of coastal management, and these studies further identify the significance of local knowledge available from surfers and other surf resource stakeholders. Similarly, Lazarow et al. (2007, 2008)'s innovation of *Surfing Capital* was instrumental in this area. In the context of surf events, O'Brien (2007) employed the triple bottom line concept to explore best practices and sustainability for host community benefit.

Considerations in Index Design

There are many options to index design, and this study utilizes an approach which is appropriate and manageable. Several frameworks were considered, such as a threat-based framework employed by the Nature Conservancy (TNC, 2007), and the research took account of the social, economic, environmental and governance themes in the literature and among surf resource stakeholders.

Pijoan (2008) was the first to develop surf resource indicators under the concept of an *Integrated Aptitude Index* (IAI). Her study followed an approach similar to that employed by The Nature Conservancy (2007)'s action planning guide. While the Nature Conservancy approach aimed specifically at biodiversity issues, Pijoan (2008)'s approach to surf site indicators integrated *Quality* (Q) [water and beach quality], *Break Singularity* (BS) [seasonality and type of wave], *Surfer Contribution* (C) [total users], and *Infrastructure* (I) [access, facilities, parking] to generate an overall threat rating. However, this system only reflects the sum of indicators and is not a comprehensive index methodology. Table 4 outlines Pijoan (2008)'s IAI:

Table 4 Integrated Aptitude Index (IAI) for Surfing

IAI = Σ (Q, BS, C, I)	$Q = \Sigma (WQ, BQ)$	(WQ=Water Quality, BQ=Beach Quality)
	$BS = \Sigma (S, TB, TW, QW)$	(S=Seasonality, TB=Type of break, TW=Type of wave, QW=Quality of the wave)
	$C = \Sigma (LU, IU)$	(LU=Local Users, IU=International Users)
	$I = \Sigma (A, F, P)$	(Access, Facilities, Parking)

Source: Adapted from Pijoan (2008)

When placed in the context of sustainability, indicators can have both positive and negative attributes. As suggested by The Center for Surf Research (2013a), we must consider that the impacts of surf tourism can be positive as well as negative and the goal of sustainability is to maximize the positive impacts and minimize the negative impacts. Surfing events are a prime example as they arguably have positive economic implications offset by negative environmental impacts and other implications in sustainability. Surf tournaments offer social and economic conservation aptitude in that they spark awareness of these values at sites which may not have otherwise been recognized. Conversely, as Ahmed et al. (2008) note, the volume and spending patterns of tourists drawn to surfing events inevitably create different types and amounts of waste and environmental impacts. Thus, while positive and negative implications can be assumed and accounted for, conservation aptitude focuses the discussion on conservation issues at surf sites by drawing attention to specific indicators which are locally relevant.

Conservation Aptitude

Conservation aptitude is a theoretical compass which points toward sustainability. It represents the summation of assessable qualities or attributes a site possesses which can make a positive contribution to sustainability. Conservation aptitude is employed as a relative and qualitative assessment measure of the extent to which a site has in place those attributes considered favorable to its sustainability (as a site and as a natural resource) over both the short and long term. These favorable, or desirable, attributes can be grouped into four categories: social, economic, environmental and administrative. While no real metric can be guaranteed to accurately predict the future sustainability of a specific site (given the fundamental interconnectedness and unpredictability of all things), the research develops the concept of conservation aptitude to describe a hypothetical, ideal metric which would be optimally suited to that purpose. Subsequently, the research develops a set of practical, relatively easily-measurable surf resource sustainability indicators, called SRSI, which represent an ongoing attempt to approximate as closely as possible in practice this theoretical metric. Conservation aptitude, then, is to be conceived as an ideal, while surf resource

sustainability indicators are the practical tools we can use to help us navigate towards it.

SRSI Indicator Selection

Emerson et al. (2010) suggest that environmental indicators can be identified through a careful analytical process which includes a broad review of the environmental science literature, in-depth consultation with experts, evaluation of candidate data sets, incorporation of criteria from other policy assessments, and good judgment. The following discussion of surf resource sustainability indicators addresses the context and sources of indicator selection and development, and a combination of sources was consulted. Potential indicators and key scholars were identified through the systematic review of surf tourism research literature conducted by Martin and Assenov (2012a). A total of 156 pieces of literature were content analyzed and a preliminary list of surf site indicators were identified as key markers for surf resource sustainability. Six key surf tourism scholars were subsequently consulted. Networking with surf tourism scholars opened lines of communication and collaboration and afforded the researcher opportunities to carry out interviews via email and *Skype* and to attend international academic conferences for face-to-face meetings. Subsequently, two of these scholars traveled to Thailand and visited field sites in Phuket with the author.

A selection process was undertaken whereby the researchers organized themes and areas of concern into categories, and these topics were narrowed through the logical subordination of criteria in order to keep the indicators and indices manageable. Indicator development was a process of criteria selection whereby the researcher entered a method of trial and error through field applications to gauge which criteria best framed a given indicator, or if in turn an indicator under development was to be repositioned as a sub-indicator or criterion. The research design process included a series of field tests wherein the experience of gathering qualitative data on surf sites was used to detail and document issues and attributes.

Additionally, 89 structured and semi-structured interviews with surfer-stakeholders were conducted, including 21 comprehensive interviews on indicator importance, eleven of which appeared in Martin and Assenov (2012b) (data from the

21 interviews on importance are provided in the results and discussion of the dissertation). These interviews led to the replacement of several indicators and the restructuring and subordination of various criteria sets. Interviewees were of diverse backgrounds and experience and included surf tourism scholars, surf industry professionals, veteran lifeguards, and professional and international surfers and surf tourists from Asia, Africa, Australia, Europe, and the Americas. Interviews were conducted via Skype or face to face at international surfing competitions in Phuket, Thailand.

3.2 Indicator Importance and Weight

Scholars and international surfers from diverse backgrounds were chosen for the investigation of indicator importance given their inherent experience as key stakeholders in the resource and to provide globally-representative data. The study is based on earlier research (Martin & Assenov, 2012c) and is placed into three contexts: (i) to generate quantitative data on indicator importance for immediate analysis and for use in the SRSI design and weighting schema; (ii) to develop a discussion on existing SRSI indicators in order to better understand the holistic nature of indicator importance and offer a global-scale assessment of SRSI indicator significance; and (iii) to introduce a surf site conservation action matrix.

Twenty-one personal interviews were conducted from September to November 2012 during the 2012 Annual Phuket Surfing Contest at Patong Beach, Thailand, or via *Skype*. Respondents were chosen based on their position as stakeholders and for their practical experience and knowledge of the resource. They were of diverse backgrounds and experience and included surf tourism scholars, surf industry professionals, veteran lifeguards, and professional and international surfers and surf tourists from six continents. Their combined years of surfing experience were 655 (an average of 31 years each) and they had surfed an average of eight countries each. The interview time was between 90 and 120 minutes for each respondent.

Informants were given a survey sheet to review during the interview and the researchers made all markings and notes on an original survey sheet for each participant. For interviews conducted via *Skype*, documents (survey sheet and a copy of the SRSI) were emailed prior to the appointment. Individual indicators were

discussed with each informant to ensure the clarity and context of their assessment (i.e., the importance of the indicator in terms of conservation aptitude). Subsequently, interviewees were asked to rate the level of importance for conservation aptitude of each indicator. The interviewer managed the context of discussion for each indicator relative to the corresponding index to which it belongs (e.g., surfing events in terms of their economic importance or surfing events in terms of their social importance). Discussion was required in all cases to ensure that informants gave objective answers (rather than merely offering their subjective opinion on the indicator). Detailed notes were taken during the discussion regarding each indicator and a critical summary of stakeholder viewpoints is provided for each indicator group.

The measurement scale is based on a 1-5 *Likert Scale* such that high values reflect high importance for conservation planning and development. Interviewees were asked to select one of five importance values (i.e., 1 = very low; 2 = low; 3 = moderate; 4 = high; and 5 = very high). Thus, the mean indicator values fall into the following five categories: very low (1.00-1.80); low (1.81-2.60); moderate (2.61-3.40); high (3.41-4.20); very high (4.21-5.00). Respondents were also asked to provide qualitative comments.

Indicator Weighting

The currently-published SRSI design employs equal weights among indicators (Martin & Assenov, 2013a). However, a weighting system for future application was designed and is presented in the discussion (see section 4.2) based on the data gathered through the abovementioned methodology on indicator importance. The discussion offers equally-weighted and geometrically-weighted scores side-by-side. The outcome of raw and weighted indicator scores are compared and analyzed based on *paired t-tests* and *Bias Ratio* tests (as discussed by Kish, 1992).

3.3 Case Application

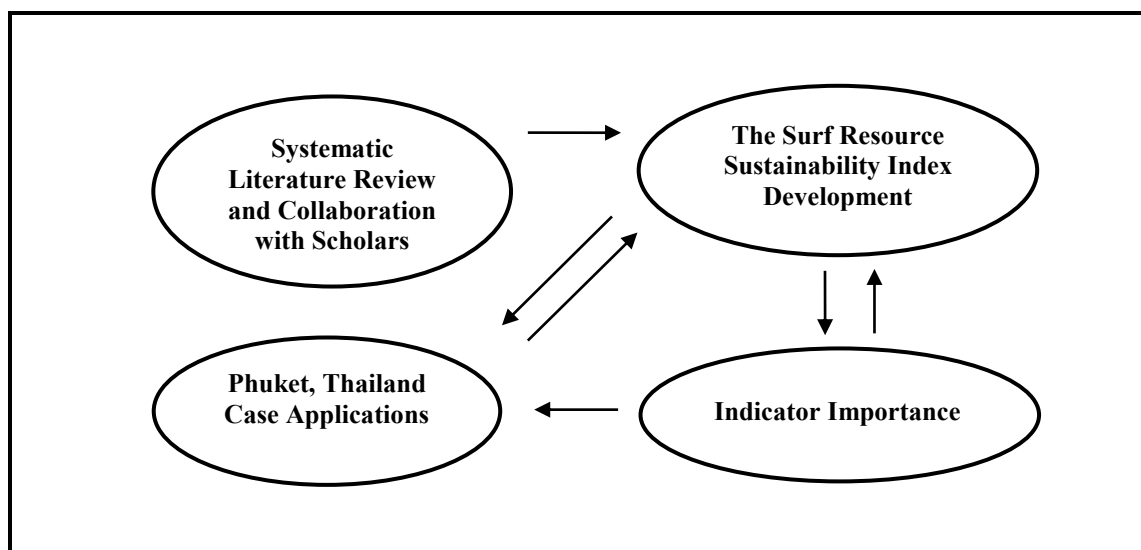
A case study included in the research design was an application of the SRSI on the resort island of Phuket, Thailand. This approach was intended as a comprehensive case trial and included the cross-sectional analysis of nine key surf beaches (Martin &

Assenov, 2013b). This was done as a practical application of the index and to gather and test a comprehensive data set useful in examining the function and applicability of the index metrics. Included in the methodology was an analysis of mean index values and mean indicator values. Mean index values for individual beaches were sought in order to conduct a cross-sectional analysis of sites and to pinpoint relative strengths and weaknesses in conservation aptitude. Mean indicator values were sought in order to look holistically at conservation aptitude in Phuket and to signal key areas for index improvement.

3.4 Conceptual Framework

Collectively, the four studies included in the research design served to define, design and refine the SRSI methodology (see Figure 18). The theoretical framework illustrates how field data were mutually beneficial to the index design and to the understanding of surf site conservation in Phuket. For example, as an outgrowth from the systematic study of surf tourism research literature, the SRSI development and indicator importance research were designed as reciprocal studies whereby the results of one study served to develop the other. The investigation into indicator importance also served in developing the Thailand case trials. Ultimately, the Thailand case application served to improve the SRSI framework.

Figure 18 Research Design



Source: Author

4. RESULTS AND DISCUSSION

The results and discussion provided in the three journal papers and one conference paper comprise the dissertation and correspond to the four key objectives of the study and are not repeated here. The following discussion is focused on two key areas: indicator importance and weights; and the limitations, biases and reliability of the study. The latter provides a critical summary of the research. Recommendations and suggestions for future research conclude the discussion and lead to the concluding remarks.

4.1 Indicator Assessment

The indicator assessment data and discussion identify opinions regarding the significance or weight of the Surf Resource Sustainability Index (SRSI) indicators among surfer resource experts and stakeholders and is built upon an earlier research by Martin and Assenov (2012c). Data are based on expert surveys with respondents from diverse backgrounds with international experience and provide a normalized and globally-representative account. The methodology is provided in the research design section and the measurement scale is based on the 1-5 *Likert Scale* (as per section 3).

Indicator Importance and Weight

Although all four indices received „high“ importance ratings, the average importance ratings of environmental (4.04) and governance (3.90) indicators were slightly higher than those of social (3.81) and economic (3.45) ones.

Three of the top four indicators (of „very high“ importance) were environmental: water quality (4.71), beach quality (4.48) and biodiversity (4.29); followed by the social indicator for history (4.29). Looking across all four indices, 19 of the 27 indicators received „high“ importance ratings, and the leading five are coastal engineering (4.19); education and interpretation (4.05); surf community (4.14); socio-psychological carrying capacity (4.0); and surf tourism (4.0). Although no indicators received low or very low mean values, four indicators were only of moderate significance: marine life hazards and physical hazards (both at 3.38), and surf amenity

and infrastructure and surf-related nonmarket value (both at 3.05). The importance rating (weighting) of each indicator has been calculated and provided in Table 5.

Table 5 SRSI Indicator Importance Rating*

SOCIAL	
1. Clubs – Boardriders	3.38
2. Clubs – Lifesaving	3.43
3. History	4.29
4. Public safety	3.86
5. Social experience	3.86
6. Socio-psychological carrying capacity	4.00
7. Surf community	4.14
8. Surf events	3.52
<i>Mean</i>	<i>3.81</i>
ECONOMIC	
9. Surf amenity & infrastructure	3.05
10. Surf events	3.62
11. Surf industry & commercial activity	3.52
12. Surf-related nonmarket values	3.05
13. Surf tourism	4.00
<i>Mean</i>	<i>3.45</i>
ENVIRONMENTAL	
14. Biodiversity	4.29
15. Coastal engineering	4.19
16. Eco-physical carrying capacity	3.90
17. Hazards – Marine life	3.38
18. Hazards – Physical	3.38
19. Quality – Beach	4.48
20. Quality – Water	4.71
21. Surf type & quality	4.00
<i>Mean</i>	<i>4.04</i>
GOVERNANCE	
22. Beach & water safety	3.67
23. Education & interpretation	4.05
24. Legislative status	4.10
25. Management	3.95
26. Not-for-profit organizations	3.81
27. Public access	3.81
<i>Mean</i>	<i>3.90</i>

*Likert scale: very low (1.00-1.80); low (1.81-2.60); moderate (2.61-3.40); high (3.41-4.20); very high (4.21-5.00).

Social Indicators

Interviewee comments on social indicators identify the significance and potential to generate much needed communication and collaboration between stakeholders – among surfers as well as with other stakeholders. In addition, high social aptitude for site protection is viewed as an essential component for policy development. Respondents mostly agree that *boardriders clubs*, which may include social networks and entire families, are significant in encouraging the management and protection of the resource, particularly at the specific sites where they are based. *Lifesaving clubs* were slightly more controversial, yet there is general agreement that they offer much needed education and safety services not provided by other institutions or local government. *Surf site history* as an attribute of conservation aptitude was the highest-ranking social indicator and is viewed as foundational to the contemporary relevance of site protection in areas where surfing activities have matured, such as in Australia and California and Hawaii, USA.

Interviewees expressed that negative issues surrounding *public safety* at sites are increasing and this may have implications in terms of planning and development, such as decreased support for new infrastructure. Similarly, an uninviting or unsafe social atmosphere (*social experience*) has a psychological effect on conservation aptitude as it may inhibit stakeholder engagement if individuals do not feel welcome at a particular break or stop visiting a beach altogether. Whereas the respondents in their capacity as surfers strongly dislike crowded areas, many of them agreed that in the context of conservation aptitude crowdedness is good as it indicates higher participation and interest in the site.

The *surfing community*, ranked as the second most-important social indicator, was seen as a significant stakeholder at sites in many countries, providing the core impetus to site awareness, custodianship and unity to conserve surf breaks in the wake of environmental degradation and coastal development. Interviewees suggest that the social implications of *surf events* include providing awareness of the site to the wider non-surfing public and opening a bridge to local government and other stakeholders was important. However, there is widespread distrust of corporate sponsors due to the

general perception that their primary motivation is profit, rather than long-term sustainability or community support.

Economic Indicators

Economic indicators were viewed in many cases as a trade-off and an inevitability of contemporary times. For example, *surf amenity and infrastructure* was generally perceived as positive to the conservation aptitude and site integrity by surfer-stakeholders who pinpointed convenience, community use (including families), and added value; however, issues of crime and crowding were acknowledged as going hand-in-hand with development. In an economic context, respondents agree that *surf events* invite a wide-reaching (regional, national, international) economic element which is of increasing importance in today's economy, but dislike the corporate leveraging of events and are sometimes doubtful of the direct benefits to the local community. They recognized the economic linkages of surf contests with other tourism businesses, such as transportation, accommodations and restaurants. In developing countries, competitions were viewed as a direct way to increase site awareness as an economic attribute, particularly with non-surfer stakeholder groups. Although interviewees expressed reservations regarding the presence of the *surf industry and commercial activity* at sites, it was considered a positive attribute in raising support for protecting the site. Similarly, stakeholders see non-market values as important but note that such attributes may be difficult to connect directly to site conservation and are viewed as subordinate to the wider value of the coastal zone.

Surf tourism was the highest-ranked economic indicator, but stands out as particularly controversial. While surf tourism provides awareness and directly-attributed economic support to a site, respondents note concerns over environmental impacts and social tensions due to overcrowding. Furthermore, although surfers may be involved in surf tourism-related businesses and profit from them, they mainly stand against commercialism, noting that while visitors may bring money to the community, surf tourism may also bring crowding, crime and corruption. Overall, surf tourism is viewed as an inevitable trend of the times and should in any case be leveraged for surf site sustainability.

Environmental Indicators

Environmental indicators were ranked on average as the most important indicators in the SRSI in a conservation context, although many respondents admitted that these indicators were not always crucial for their selection of surfing sites. The significance of *biodiversity* was well-understood by respondents who realize that it is an important aim in conservation, recognizing it as a signal of site integrity and an indicator of the wider ecological system. While rated of similar importance, the implications of *coastal engineering* were more ambiguous as stakeholders acknowledged that these works can create as well as destroy sites. However, emphasis was placed on avoiding these projects and protecting the natural integrity of existing sites. In contrast, *hazards* were ranked of moderate importance, and this may be unique to the surfer-stakeholder group as surfing has inherent risks and surfers are noted risk-takers. However, policy implications were noted, as it may be more difficult to argue for conservation strategies if sites are known for particularly dangerous rip currents, rocks or shark attacks.

Beach quality rated very high as this indicator was viewed as crucial to site aesthetics, integrity, and in catching the attention of stakeholders. Similarly, *water quality* is singled out as the most important of all indicators in the research, although surfers admit that if the wave is very good they may still go surfing even at the risk of getting sick. Poor water quality has spawned activism in the not-for-profit sector with the growth of surfer-based organizations such as The Surfrider Foundation and Surfers Against Sewage (Ryan, 2007). *Wave quality* was ranked as important, but attracted mixed comments. While experienced surfers prefer sites with high wave quality, this indicator is less significant for novice surfers and the accompanying families and friends. Versatile sites serving all levels of surfing may be more attractive for conservation due to the fact that they draw a larger range of visitors interested in their preservation.

Governance Indicators

Governance indicators were found to be second highest in importance and provoked a wide range of opinions, with respondents admitting the importance of good

governance and education but noting the negatives of over-regulation of a site. *Beach and water safety* was cited as most relevant to urban settings where the presence of lifeguards is seen as key to site integrity, providing a professional and managerial component relevant to conservation aptitude. In contrast, the lack of safety services in rural areas was viewed as a liability in some cases, given that newly developed surf beaches may experience increasing drowning rates among visitors, which may weaken the argument for conservation.

Education was ranked as the most important governance indicator, and was identified as vital in fostering stakeholder engagement. Respondents believed that knowledge empowers the public with a sense of understanding of relevant issues and its proactive use helps in reducing impacts at sites. Grassroots *not-for-profit organizations* were described as sometimes ineffective but generally useful when visible and active; they may fill the void in government activity in building conservation policy and developing best practices. *Public access* was found to be essential as support for conservation is related to first-hand experience with sites. At rural surf sites, the role of traditional resource custodians in the context of public access and sustainability is increasingly relevant. *Legislation* was noted as important in theory but ambivalent in practice, and less crucial for site sustainability than apposite management. Legislation development may be time-consuming and without immediate impacts on the concerned sites. Stakeholders identify *management* as a complex issue given the infancy of management at surf sites as an institutional practice. Knowledge and best practices for surf site conservation are a recent construct and engagement with surfers in the management process was considered as challenging given the individualistic nature of the sport.

Surfer Stakeholders

It is not surprising that nearly all indicators were identified as highly important by the respondents given that the indicators were selected in the first place based on their significance as essential conservation markers.

The interview process revealed a difficulty in the discernment of the subjective and objective nature of measuring indicators by informants. Interviewees preferred to give answers based on personal preference rather than judging the implications and

importance of each indicator in terms of conservation aptitude. For example, the social indicator „history“ was often perceived as being of very low personal importance but of very high conservation importance when participants were more objective and considered the implications of surf site history in the context of creating surfing reserves (as suggested by Farmer & Short, 2007; and Short & Farmer, 2012). Similarly, some of the more controversial indicators receiving wide-ranging scores, such as the economic indicators for surf tourism and surf events, drew more extensive comments than others, reflecting strong and varied opinions.

Stakeholder Diversity and Interests

In terms of SRSI indicators, the current research found that within a particular group of surfers with extensive international experience, individuals from diverse backgrounds placed different levels of importance on SRSI indicators. For example, lifesaving club members placed higher significance on lifesaving clubs relative to other interviewees, lifeguards placed higher significance on water safety, professional and contest-affiliated surfers placed higher significance on the social and economic implications of surf contests, and so forth. Such differences in the respondents' attitudes would be further amplified if stakeholders with more diverse backgrounds were surveyed. Phillips and House (2009) recognize that different stakeholders attribute different importance to the beach quality indicators they investigate, and three distinct groups of stakeholders – surfers, mothers and conservation workers – assign weightings that vary significantly in line with their priorities, which respectively tend to emphasize different physical, human and biological factors. Thus indicator importance can serve as a practical guide, offering a window to the way in which different people with different interests in surf tourism locations will focus on different attributes. For example, families with children might be reasonably expected to prefer beaches with higher safety standards and amenities, surfers might tend to care more about the quality or frequency of waves, local landowners might be concerned primarily about impacts related to access, and local governments might assign the greatest priority to economic effects (see section 4.2, Weight Development).

Conservation Action Matrix

When applying the SRSI to conservation action planning and development of surf tourism sites, an area of concern is that sites with low conservation aptitude may be problematic to protect although they may have high conservation value (i.e. areas of high environmental, socio-economic or biodiversity values) (WWF, 2013). The interpretation of indicators and respective indices should consider a number of attributes, including the significance of low aptitude indicators in context.

To address this issue, a conservation action matrix was developed (see Figure 19), whereby assessments can be weighed against the perceived importance by stakeholders and appropriate actions can be better articulated and addressed. The matrix is divided into quadrants corresponding to the level of indicator importance relative to site assessment score:

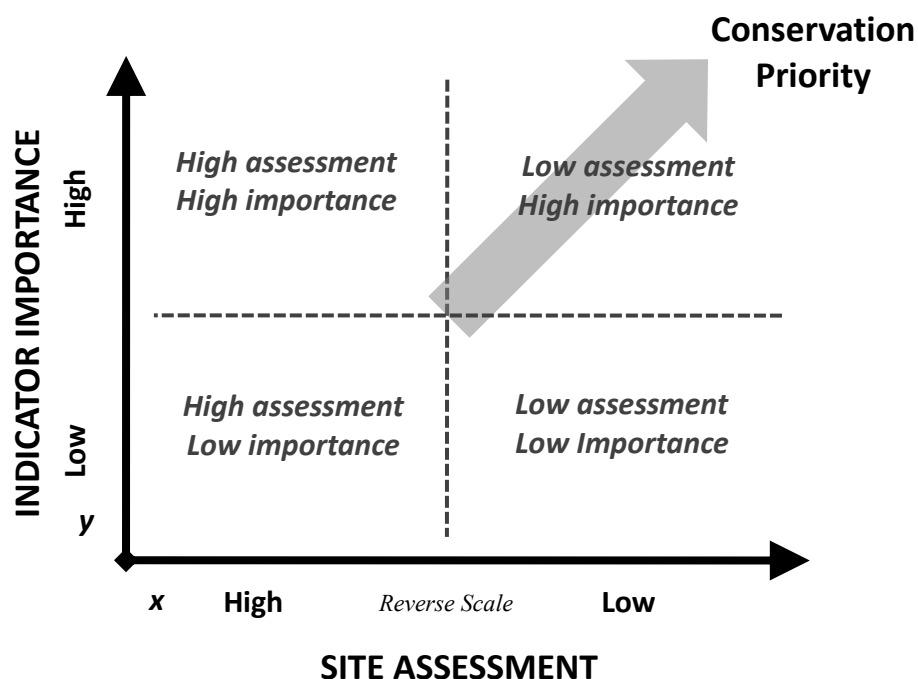
Low rating - high importance: urgent action needed

Low rating - low importance: action needed but not critical

High rating - low importance: preserve the site attributes

High rating - high importance: sustain and closely monitor the site attributes

Figure 19 The SRSI Conservation Matrix*



* A reverse scale is applied to the x axis to better illustrate the conservation priority

4.2 Weight Development

The currently published SRSI design employs equal weights among indicators (Martin & Assenov, 2013a). However, the following discussion serves as an introduction of a weighting system for future applications and is based primarily on field data collected at Phuket surf sites by Martin and Assenov (2013b). The required primary indicator value for geometric weighting was generated as the average of expert survey results based on a diverse group of twenty-one internationally experienced surfers and scholars and offers a global scale estimate of the criteria for SRSI indicator importance (as for section 4.1). Data are represented in Tables 6a and 6b and include the indicator importance ratings, field assessment scores, the outcome of weighted indicator score (*score^w*), equally- and geometrically-weighted scores for each index, and the *Bias Ratio* (B/S) (Kish, 1992) and *paired t-tests* results for each beach. The following discussion addresses the choice, application and limitation of the metrics employed.

Equally-weighted and Geometrically-weighted Scores

Weight structure can reflect the intrinsic value of indicators and be justified procedurally. Consequently, setting indicator weights is a decisive component of measurement design with potential to impact index values and rankings, and weight systems normally involve a complex theoretical process aimed at assessing relative importance.

Two approaches to the weighting were employed. First, equal weights were calculated. Equal weights are commonly used when indicators or dimensions are judged to be approximate in value and are placed on the same scale. Due to the absence of comprehensive data to the contrary, an equal weighting was a logical point of departure given the comparative similarity in weight and site assessment scores. Secondly, geometric weights were calculated by combining indicator importance with surf site assessment data, thus placing a weight based on the judgment of the expert surveys. The original weighting and field site assessment data are on the same scale (1-5 *Likert*).

Table 6a SRSI Weight Schema (Social and Economic)

Indicator		weight	Nai Yang 1		Nai Yang 2		Surin		Kamala		Kalim		Karon		Kata Yai		Kata Noi		NaiHarn	
			score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w
Social	Clubs – Boardriders	3.38	1.50	2.25	1.50	2.25	1.50	2.25	2.50	2.91	1.00	1.84	2.50	2.91	3.00	3.18	1.00	1.84	1.00	1.84
	Clubs – Lifesaving	3.43	1.00	1.85	1.00	1.85	2.00	2.62	1.50	2.27	1.00	1.85	1.00	1.85	1.00	1.85	1.00	1.85	1.00	1.85
	History	4.29	2.00	2.93	2.00	2.93	3.00	3.59	3.00	3.59	3.00	3.59	2.00	2.93	4.50	4.39	3.00	3.59	3.00	3.59
	Public safety	3.86	4.00	3.93	4.00	3.93	3.50	3.68	3.00	3.40	4.00	3.93	4.00	3.93	4.00	3.93	2.00	2.78	4.00	3.93
	Social experience	3.86	5.00	4.39	4.50	4.17	4.00	3.93	3.00	3.40	3.50	3.68	4.00	3.93	4.00	3.93	3.00	3.40	3.50	3.68
	Socio-psychological capacity	4.00	2.00	2.83	4.00	4.00	3.50	3.74	4.00	4.00	4.00	4.00	4.00	4.00	4.50	4.24	3.00	3.46	3.00	3.46
	Surf community	4.14	2.00	2.88	2.00	2.88	4.00	4.07	3.00	3.52	3.00	3.52	3.00	3.52	4.50	4.32	3.00	3.52	3.00	3.52
	Surf events	3.52	1.00	1.88	1.00	1.88	2.00	2.65	2.50	2.97	3.00	3.25	2.00	2.65	4.00	3.75	1.00	1.88	2.50	2.97
	<i>SocSRSI equally weighted</i>	<i>3.81</i>	<i>2.31</i>		<i>2.50</i>		<i>2.94</i>		<i>2.81</i>		<i>2.81</i>		<i>2.81</i>		<i>3.69</i>		<i>2.13</i>		<i>2.63</i>	
	<i>SocSRSI weighted</i>		<i>2.87</i>		<i>2.99</i>		<i>3.32</i>		<i>3.26</i>		<i>3.21</i>		<i>3.22</i>		<i>3.70</i>		<i>2.79</i>		<i>3.10</i>	
	<i>Bias Ratio (prob. p, significance)</i>		<i>0.0177, *</i>		<i>0.0307, *</i>		<i>0.0176, *</i>		<i>0.0015, **</i>		<i>0.0332, *</i>		<i>0.0247, *</i>		<i>0.9355, ns</i>		<i>0.00104, **</i>		<i>0.010, **</i>	
	<i>Paired t-test</i>		<i>0.0288, *</i>		<i>0.0344, *</i>		<i>0.0107, *</i>		<i>0.0007, ***</i>		<i>0.0171, *</i>		<i>0.0268, *</i>		<i>0.9258, ns</i>		<i>0.00002, ***</i>		<i>0.0033, **</i>	
Economic	Surf amenity & infrastructure	3.05	3.00	3.02	2.00	2.47	3.50	3.27	2.50	2.76	2.50	2.76	3.00	3.02	4.00	3.49	2.00	2.47	2.00	2.47
	Surf events	3.62	1.00	1.90	1.00	1.90	2.00	2.69	2.50	3.01	3.00	3.30	2.00	2.69	4.00	3.81	1.00	1.90	1.00	1.90
	Surf industry & commercial activity	3.52	2.00	2.65	2.00	2.65	3.50	3.51	2.50	2.97	2.00	2.65	2.00	2.65	4.00	3.75	1.50	2.30	2.00	2.65
	Surf-related nonmarket impacts	3.05	3.00	3.02	3.00	3.02	4.00	3.49	3.50	3.27	3.50	3.27	3.50	3.27	4.50	3.70	2.50	2.76	4.00	3.49
	Surf tourism	4.00	1.00	2.00	2.00	2.83	4.00	4.00	3.00	3.46	2.50	3.16	3.50	3.74	5.00	4.47	3.00	3.46	3.00	3.46
	<i>EconSRSI equally weighted</i>	<i>3.45</i>	<i>2.00</i>		<i>2.00</i>		<i>3.40</i>		<i>2.80</i>		<i>2.70</i>		<i>2.80</i>		<i>4.30</i>		<i>2.00</i>		<i>2.40</i>	
	<i>EconSRSI weighted</i>		<i>2.52</i>		<i>2.58</i>		<i>3.39</i>		<i>3.09</i>		<i>3.03</i>		<i>3.08</i>		<i>3.85</i>		<i>2.58</i>		<i>2.80</i>	
	<i>Bias Ratio (prob. p, significance)</i>		<i>0.0597, ns</i>		<i>0.0152, *</i>		<i>0.964, ns</i>		<i>0.0305, *</i>		<i>0.0452, *</i>		<i>0.143, ns</i>		<i>0.0071, **</i>		<i>0.0215, *</i>		<i>0.157, ns</i>	
	<i>Paired t-test</i>		<i>0.0684, ns</i>		<i>0.0213, *</i>		<i>0.970, ns</i>		<i>0.101, ns</i>		<i>0.116, ns</i>		<i>0.198, ns</i>		<i>0.137, *</i>		<i>0.0080, **</i>		<i>0.1733, ns</i>	

score^w is a weighted score (see equation 1),

Levels of Significance: ns = not significant at p > 0.05 level, * significant at 0.05 ≥ p > 0.01, ** significant at 0.01 ≥ p > 0.001, *** very significant p ≤ 0.001

Table 6b SRSI Weight Schema (Environment and Governance)

Indicator		weight	Nai Yang 1		Nai Yang 2		Surin		Kamala		Kalim		Karon		Kata Yai		Kata Noi		NaiHarn	
			score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w	score	score ^w
Environment	Biodiversity	4.29	4.00	4.14	3.50	3.87	2.00	2.93	2.00	2.93	1.00	2.07	2.00	2.93	2.00	2.93	2.00	2.93	2.50	3.27
	Coastal engineering	4.19	4.00	4.09	4.00	4.09	3.00	3.55	3.00	3.55	2.00	2.89	3.00	3.55	3.00	3.55	2.00	2.89	3.00	3.55
	Eco-physical carrying capacity	3.90	2.00	2.79	4.00	3.95	4.00	3.95	4.00	3.95	3.00	3.42	4.00	3.95	4.00	3.95	4.00	3.95	4.00	3.95
	Hazards – Marine life	3.38	3.50	3.44	3.50	3.44	4.00	3.68	4.00	3.68	4.00	3.68	4.00	3.68	4.00	3.68	4.00	3.68	4.00	3.68
	Hazards – Physical	3.38	3.00	3.18	3.00	3.18	2.50	2.91	3.00	3.18	3.00	3.18	3.00	3.18	3.00	3.18	3.00	3.18	2.50	2.91
	Quality – Beach	4.48	3.50	3.96	3.00	3.67	3.00	3.67	3.00	3.67	2.50	3.35	3.50	3.96	3.00	3.67	3.50	3.96	4.00	4.23
	Quality – Water	4.71	4.50	4.60	3.50	4.06	3.50	4.06	3.00	3.76	2.00	3.07	3.00	3.76	2.50	3.43	4.00	4.34	4.00	4.34
	Surf type & quality	4.00	4.00	4.00	4.00	4.00	3.50	3.74	3.00	3.46	4.00	4.00	3.00	3.46	4.00	4.00	4.00	4.00	4.00	4.00
	<i>EnvSRSI equally weighted</i>	<i>4.04</i>	<i>3.56</i>		<i>3.56</i>		<i>3.19</i>		<i>3.13</i>		<i>2.69</i>		<i>3.19</i>		<i>3.19</i>		<i>3.31</i>		<i>3.50</i>	
	<i>EnvSRSI weighted</i>		<i>3.78</i>		<i>3.78</i>		<i>3.56</i>		<i>3.52</i>		<i>3.21</i>		<i>3.56</i>		<i>3.55</i>		<i>3.62</i>		<i>3.74</i>	
	<i>Bias Ratio(prob. p, significance)</i>		<i>0.0627, ns</i>		<i>0.0333, *</i>		<i>0.0138, *</i>		<i>0.0030, **</i>		<i>0.0227, *</i>		<i>0.0043, **</i>		<i>0.0313, *</i>		<i>0.0114, *</i>		<i>0.1156, ns</i>	
	<i>Paired t-test</i>		<i>0.0669, ns</i>		<i>0.0620, ns</i>		<i>0.0352, *</i>		<i>0.0340, *</i>		<i>0.0271, *</i>		<i>0.0391, *</i>		<i>0.0686, ns</i>		<i>0.0947, ns</i>		<i>0.0955, ns</i>	
Governance	Beach & water safety	3.67	2.50	3.03	1.00	1.92	2.50	3.03	2.00	2.71	1.50	2.35	2.50	3.03	2.50	3.03	2.00	2.71	2.00	2.71
	Education & interpretation	4.05	2.50	3.18	1.00	2.01	2.00	2.85	2.00	2.85	1.00	2.01	2.00	2.85	2.00	2.85	1.50	2.46	2.00	2.85
	Legislative status	4.10	4.00	4.05	4.00	4.05	1.00	2.02	1.00	2.02	1.00	2.02	1.00	2.02	1.00	2.02	1.00	2.02	1.00	2.02
	Management	3.95	2.50	3.14	2.00	2.81	1.00	1.99	1.00	1.99	1.00	1.99	1.00	1.99	1.00	1.99	1.00	1.99	1.00	1.99
	Not-for-profit organizations	3.81	3.50	3.65	1.50	2.39	1.50	2.39	2.50	3.09	1.00	1.95	1.00	1.95	1.00	1.95	1.00	1.95	1.00	1.95
	Public access	3.81	4.00	3.90	3.00	3.38	3.50	3.65	2.50	3.09	3.00	3.38	3.00	3.38	3.00	3.38	2.00	2.76	3.50	3.65
	<i>GovSRSI equally weighted</i>	<i>3.90</i>	<i>3.17</i>		<i>2.08</i>		<i>1.92</i>		<i>1.83</i>		<i>1.42</i>		<i>1.75</i>		<i>1.75</i>		<i>1.42</i>		<i>1.75</i>	
	<i>GovSRSI weighted</i>		<i>3.49</i>		<i>2.76</i>		<i>2.65</i>		<i>2.62</i>		<i>2.28</i>		<i>2.54</i>		<i>2.54</i>		<i>2.32</i>		<i>2.53</i>	
	<i>Bias Ratio (prob. p, significance)</i>		<i>0.0481, *</i>		<i>0.0196, *</i>		<i>0.006, **</i>		<i>0.001, ***</i>		<i>0.0013, **</i>		<i>0.003, **</i>		<i>0.003, **</i>		<i>0.0001, ***</i>		<i>0.0052, **</i>	
	<i>Paired t-test</i>		<i>0.0613, ns</i>		<i>0.0071, **</i>		<i>0.003, **</i>		<i>0.0002, ***</i>		<i>0.0003, ***</i>		<i>0.0008, ***</i>		<i>0.0008, ***</i>		<i>0.00001, ***</i>		<i>0.0021, **</i>	
<i>SRSI equally weighted mean ± SE</i>			<i>2.81±0.231</i>		<i>2.63±0.230</i>		<i>2.87±0.193</i>		<i>2.69±0.152</i>		<i>2.44±0.211</i>		<i>2.69±0.195</i>		<i>3.22±0.241</i>		<i>2.30±0.209</i>		<i>2.65±0.221</i>	
<i>SRSI weighted mean ± SE</i>			<i>3.21±0.158</i>		<i>3.10±0.160</i>		<i>3.26±0.126</i>		<i>3.16±0.103</i>		<i>2.97±0.140</i>		<i>3.14±0.130</i>		<i>3.42±0.148</i>		<i>2.89±0.152</i>		<i>3.11±0.156</i>	

score^w is a weighted score (see equation 1); Levels of Significance as for Table 6a

Geometric weighting is achieved by multiplying indicator importance data with site assessment data for each indicator, and subsequently taking the square root of the combined data as follows in equation 1:

$$X_w = \sqrt{X \times w} \quad (1)$$

where:

X = value of site assessment (score^w)

w = indicator importance used as a weight

Paired t-tests and Bias Ratio

The effects of weighting were analyzed using two approaches: the paired t-test and the Bias Ratio (B/S) test as described by Kish (1992) which was applied using the t-distribution. These two statistics ask different statistical questions. The paired t-test on scores and weighted scores within each category, that is social, economic, environmental or governance, is testing the null hypothesis (H_0) that weighting has no significant effect upon the rating of the indicator scores (i.e., the weighted $score^w$ is not significantly different from the raw score). The B/S test is testing if the weighting has a significant effect upon the means of the overall scores within each broad category. Thus, the null hypothesis in the case of the B/S ratio test is that the mean score and the mean weighted $score^w$ are not significantly different.

In general, the equally-weighted and geometrically-weighted SRSI values are not greatly different in Phuket and this is evident in that importance ratings assigned by experts and site evaluations are similar, such as the rankings at Phuket beaches for environment issues. However, this is not the case in governance issues where equally-weighted sums are often lower than the geometrically-weighted sums, indicating that there is a general lack of adequate governance of surf-related resources. Paired t-tests on the governance issues showed that geometrically-weighted and equally-weighted scores were consistently different at high levels of significance ($p \leq 0.01$).

Broadly, Tables 6a and 6b show that the two Nai Yang beaches stand out as different to the other seven, and this is likely attributed to the fact that these beaches are located in a Marine Protected Area (MPA). The Kish (1992) statistic shows that in

general the overall differences between the means of equally-weighted and geometrically-weighted scores for most categories on most beaches are either not significant ($p > 0.05$) or only significant at the $p \leq 0.05$ level (but not at $p \leq 0.01$). The exception is governance where scores and geometrically-weighted scores are significantly different for all beaches except Nai Yang Beach 1 („National Park Reef“) which is near the ranger station of the national park.

The paired t-tests offer a much more focused analysis of each survey indicator, showing clearly that there are governance problems on most of the beaches, and this is consistent with the conclusions drawn from the B/S analysis. For example, paired t-tests indicate that social issues and governance results overlap, and this is evident at the Kamala and Kata Noi beaches where scores are similarly low for both social quality and governance. Future research can address if there are correlations between results and assessment criteria among indicators in different indices given the intrinsic linkages between social, economic and environmental issues and governance.

In most cases, the equally-weighted scores were lower than the geometrically-weighted scores. In contrast, Kata Yai had a very high economic score, considerably higher than the weighted score, indicating that facilities there were better than the global expectations as indicated by the priority weightings. The nearby Kata Noi shared the lowest raw score relative to the weighted score found in the present study and as a result the differences were statistically significant ($p \leq 0.01$).

Perhaps the most important category for encouraging or discouraging surfing activities and tourism is the environmental conditions category. Surfers and surf tourists are not interested in surfing in dirty water (given that this is the highest ranked indicator in the index) and such issues will tend to override other considerations. Weights of all the environmental parameters are uniformly high or very high and so equally-weighted and geometrically-weighted scores are very sensitive to small differences and appear in the case of the overall assessment of the Phuket beaches. For example, the B/S index indicates problems with the perception of the quality of environment at Karon and Kamala beaches ($p \leq 0.01$) even though such discrepancies are less apparent based on the paired t-tests for each separate environmental issue ($p \leq 0.05$). The environmental scores for the two beaches in the national park (Nai Yang 1 and 2) are the highest on environmental criteria of any beach in Phuket and weighting

of the scores has no significant effect because all the weights are high and the scores are similarly high.

Limitation of the Quantitative Data

Given that the currently-applied weights were similar in value to site assessment scores, the results are not principally dissimilar and a greater variance in weights could provide more room for evaluation and discussion. While the current presentation of data uses the case in hand (as for section 4.1), it provides documentation and represents a conceptual framework for the use of weights in developing the SRSI process. Inevitably, any judgment of preferability is a subjective judgment regarding the relative importance of one impact category over another, and value judgments may change with location or time; thus the underlying standard is that the weighting procedure is clearly documented, and the equally-weighted data should be shown together with the geometrically-weighted results to ensure a clear understanding of the assigned weights (SAIC, 2006). It is assumed that if other experts were surveyed where emphases are in different disciplines, results would likely vary. For example, there may be critical emphasis on environmental indicators from environmentalists, or on social or economic indicators by social scientists. As the current study is the first to address conservation indicators specifically of surf sites, challenges include the fact that research and scholarly work in the field is limited, although increasing as identified by Martin and Assenov (2012a).

When applying weights to indicators and indices, research designs fundamentally employ some weighting algorithm chosen by the researchers, such as the usage of equal and geometric weights and means applied in this study. Similarly, the study employed a 1-5 *Likert Scale* for indicator importance data and field assessment data alike, and this original choice in metrics was not altered or normalized given that the raw data are on the same scale. However, other choices of metrics are available and future research design can consider other approaches to making data representative.

SRSI weights may also be justified or influenced by the urgency or apparent priority of political intercession in a given indicator, such as a site where an imminent coastal engineering project is planned. In terms of the generation of data, if weights are updated with each analysis, this creates complications when comparing the SRSI

values across time, considering that weights are subject to change over time and that experts and stakeholders may subsequently change their assessments. Conversely, if the weights are not updated, then challenges emerge in indicator reliability and applicability over time.

4.3 Limitations, Biases and Reliability

The Surf Resource Sustainability Index (SRSI) is a perceptive index built primarily on the elicitation of expert opinion. Throughout the development and trial applications the research design was observantly aimed at limiting bias, increasing reliability, and ensuring validity; and a framework of indicators and assessment criteria serve to address these complex issues. Grey et al. (2007) identify that limitations, biases and reliability are significant concerns of any research design and have been investigated comprehensively by qualitative and quantitative researchers in the physical, natural and social sciences. They are of particular concern in the case of a perceptive index methodology which is experimental, progressive, and contingent on interviews and judgments by respondents and researchers alike. Thus, if biases or limitations of an index design are not carefully considered, the results could be unreliable and invalid.

Reliability is the measure of how consistent something is. Ruane (2005) defines reliability in terms of assessing measures as the “empirical evidence of correlation coefficient between two results,” such as testing the air pressure of a tire more than once to be sure that the measurement is correct. In a social science context, Hektner (2007) suggests that questions of reliability and validity speak directly to issues of accuracy and usefulness, such as how consistent is the measurement and how closely the measurement reflects what it was intended to measure. Thus, reliability testing and retesting can identify if assessments provide similar, objective and useful information over time. However, in the case of conducting interviews, reliability can be somewhat ambiguous and unreliability can arise from a respondent’s bias or by simply misunderstanding interview questions (Williams, 2003).

Validity refers to a particular use and the consequences of employing the tools for assessment. Thus validity can be inferred from many different types of evidence and is not necessarily measured. Grey et al. (2007) likens the issue of validity to employing a single instrument or scale which is correctly calibrated. An incorrect

scale or instrument may provide results which are reliable yet consistently invalid. Therefore, if the same instrument or scale is consistently applied to measure an indicator it may offer „reliable“ results when re-tested; however, the results would be invalid if the measuring tool or scale were incorrect to begin with.

The concept of validity can be subdivided into content, concurrent and predictive facets. Content validity is perhaps the most relevant to SRSI metrics because assessments are meant to effectively and accurately represent the empirical nature of the site. Ruane (2005) puts forward the essential question of content validity: “Is the measure really measuring what it claims to measure?” Williams (2003) suggests that content validity can refer to the appropriateness of an item for measuring a concept, and in the case of the SRSI this is treated as a technical issue which is inevitably subjective and relies on asking various relevant people to assess a measure.

Concurrent validity refers to high correlation between the scores of two measures (Ruane, 2005). In the example of SRSI, concurrent validity could be sought by employing a previously established method of assessment on a particular indicator (an old method) and concurrently assessing the same indicator with the SRSI method (a new method). A high correlation between the scores of the old and new methods is concurrent validity.

Predictive validity may imply that the particular state of a beach in the future can be deduced based on the current assessment results (i.e., a valid prediction). However, objective or empirical evidence, such as trend analysis, would be required in order to explicitly demonstrate the predictive validity of measures.

Communication and collaboration with individual surfers from the academic community, surf industry professionals, professional surfers and competitors, surf tourists, lifeguards, lifesaving club members and environmentalists was undertaken in order to improve validity during the index development process. While bias may be assumed for each group, their diverse backgrounds and perspectives provide a synthesized understanding of the resource when placed in social, economic, environmental and institutional contexts. The validation of indicators was also sought through expert consultations with surf tourism and surf resource specialists. Eighty-nine in-depth interviews were conducted and six of these were with key scholars who were presented with the draft SRSI indicators. A scoping study indicated that

interviews with tangential stakeholders without direct experience or understanding of the indicators were unproductive and therefore surfers were targeted as the key source of information.

The complexities of experimental research in the SRSI design and application posed a range of implications, such as sustainability testing, measurement error, the ability to reduce bias, and the accuracy of interpretation of results. To address these issues, the following discussion has been provided in two methodological contexts, the SRSI design process and the field applications.

SRSI Design

Grey et al. (2007) note that there are inevitably reciprocal „give and take“ scenarios underlying bias, reliability and validity in the social sciences. In the case of the SRSI, applicability was by design prioritized if needed at the expense of objectivity and reliability, particularly in terms of the evaluation of complex environmental systems which may require independent methodologies. However, the qualitative/descriptive layers of the index serve to increase the reliability and validity of assessments while the numerical values attached to them draw on the inferences of the criteria to create an accountable record. Similarly the cross-sectional analysis allows improved concurrent validity, providing researchers are consistent in applying the same rating criteria at each site across a given region or city.

The research had to account for the manageability and applicability of the index and consider that design decisions may pose limitations for the reliability and validity of the methods. First, index design understandably comes with the need to limit the total number of indicators. Secondly, assessment criteria may not cover some environmental aspects in order to keep the index manageable, such as not entirely accounting for the interplay among indicators. For example, the indicator for water quality may be intrinsic to the indicator for biodiversity, and while such linkages can be assumed, they are not necessarily held implicit to the model, and this is a limitation of the research design. This may be particularly the case if comparing studies across dissimilar regions where indicator interdependence varies. Therefore, the definition of indicators, units of measurement, and limitations of indicators should be considered in a holistic multidimensional context whereby assessment criteria and results account

for the intersecting or interrelated properties of indicators to bring about sustainability. However, such metrics are by design beyond the scope of the SRSI.

As indicator assessment criteria were purposefully kept manageable, there are notable limitations to the approach, particularly in the principles and standards applied. For example, the current criteria for assessing water quality do not require water testing, although it is preferable but expensive and time consuming. We must consider that while the water may appear clean or clear, there may be high levels of bacteria or heavy metals present. At the same time, this is an issue of validity as the criteria must be appropriate, standardized and applied universally.

Similarly, subordination criteria (the criteria which delineate an indicator) could be reinterpreted. For example, the beach quality indicator currently includes an assessment of coastal erosion and marine debris. Researchers should ensure they don't overlook or overshadow one set of criteria when measuring the sum of combined criteria which comprise the indicator. For example, coastal erosion and marine debris vary considerably in terms of their causes, implications and impacts on beach quality. Such limitations must be recorded in the descriptive layer of the index and account for the process behind measuring each sub-indicator.

Indicator Temporal Variance

The importance of indicators can be anchored to their relative temporal variance (i.e., reversibility or permanence). For example, beach quality or public safety are potentially reversible in the short term (i.e., beaches can be cleaned up and beach parks can be policed) and were therefore determined to be of potentially lower importance when compared with the loss of biodiversity or coastal engineering projects which have long-term implications and may be irreversible. For example, interviewee J. Middleton (personal communication, November 7, 2012) notes that he only gave mid-ratings to indicators when consequences were „changeable“, such as social indicators like those for clubs or events. In contrast he gave higher ratings to indicators which were more permanent, such as those in the environmental index like biodiversity, eco-physical carrying capacity and coastal engineering. Ultimately, accounting for the short and long-term dynamics of indicators is problematic and is inevitably a limitation in terms of the reach and scope of the study. Future research

can consider the extent to which reversible indicators should carry less weight in the planning process.

Developing a Global Model

Martin and Assenov (2012b, 2013a) tested the index at rural and urban sites and found considerable variance at the indicator and sub-index levels. While urban sites had high values in the social and economic indicator groups, rural sites exhibited high values in the environmental and governance groups. Therefore, when the score of indicators and sub-indices were totaled, rural and urban sites were of nearly equal conservation aptitude although for very different reasons. While these findings are not surprising, there are implications for the replicability of the method as a global model given that data collected in regions which are in or near cities and are highly urbanized may contrast considerably with regions which are remote and rural. Thus different regions or countries may be particularly dissimilar in terms of amenity or accessibility, such as surf tourism sites accessible only by charter boats in contrast to public beaches in cities. To address this limitation and the applicability of the index, the SRSI could be adapted to include different criteria for rural or urban settings, and this could increase the reliability and validity of the research. However, this may come at the cost of the comparability among sites, particularly from one region or country to another. Effectively, rural and urban sites could not be scaled against each other unless indicators and criteria dynamics are universally standardized or compatible and this becomes an issue of validity (as discussed in Esty et al., 2005).

Vulnerability of Surf Sites

While the SRSI field application can provide a static snapshot of a given surfing area, the vulnerability of surf sites has not been distinctly accounted for in this research. Social, economic, environmental and governance indicators are all susceptible to external changes which can have adverse and unexpected effects on the resources. Vulnerability issues of surf sites and the surf tourism industry include policy makers and beneficiaries who may not fully appreciate the fragility of the socioeconomic, environmental and managerial linkages which comprise the broad surf system. For

example, denied access, chemical pollution and sewage, construction of solid structures, dredging of river mouths and canals, litter and marine debris, nuclear waste, and oil spills can all contribute to surf site vulnerability (Butt, 2010; Lazarow et al., 2007, 2008). Surf sites are also vulnerable to very small and rapid changes in conditions, such as industrial development, policy changes (or the lack of policy changes), crowding at surf sites (Buckley 2002a, 2002b), or degradation as a result of coastal engineering projects (Corne, 2009; Lazarow et al., 2007, 2008; Murphy & Bernal, 2008; Nelsen et al., 2007).

Vulnerability may affect reliability if the inferences drawn from assessments don't account for vulnerability as a variable (i.e., not accounting for the vulnerability of sites is a limitation). While trend analysis can help in addressing these issues and increases the validity of the assessment (Grey et al., 2007), considerable time is required for follow-up studies. In cases where immediate action is essential, such an approach could prove ineffective in terms of conservation action planning and attaining results (TNC, 2007).

SRSI Application

Perceptive field surveys based primarily on any stakeholder group carry a potential for bias. However, surfers are a pivotal group because of their familiarity with surf resources and the context of indicators and this is inevitably highly significant (ASBPA, 2011). In contrast, interviews with fishers and beachfront hotel employees showed that although they are a group close to the resource, they did not identify themselves as stakeholders or grasp the implication of surf resource sustainability indicators. The research identifies that it is difficult to generate data based on stakeholder perception if their knowledge or understanding of indicators is limited. Case in point, stakeholders may not recognize or acknowledge that they indeed have a stake in the resource (Butt, 2010).

Additionally, we must consider that assuming observer bias must affect either reliability, validity or both would in itself be a bias as it might affect neither (Williams, 2003). Thus, even if respondents are biased in some aspect, it doesn't mean their observations are invalidated by that bias. To address these issues, the research design was cognizant of characteristics associated with field observations that might

offend or unfairly affect the rating or assessment or distort a given score. Therefore, the research encompassed a wide range of individuals from diverse backgrounds which reached beyond the reference to their acknowledgement of having experience with surfing or interaction with the surf zone. Thus, surfers may not be stereotyped as a single stakeholder group as they come from all walks of life, backgrounds, skill levels and associations with the resource.

Issues of bias include the subjective nature of measuring various attributes for both researchers and respondents during field assessments. In order to reduce bias and increase reliability and validity of the method, interviews were structured to adhere to the indicator criteria and the context of conservation aptitude. Although this was done to reduce the subjectivity of respondents, issues of consistency remain and are difficult to clarify as re-testing was not possible in most cases. Similarly, the potential for bias and questions of reliability of the assessment process must be acknowledged given that judgments were ultimately based on the researchers' own observations. While qualitative and quantitative assessments incorporated the knowledge gained from interviews and site visits, individual researcher evaluations inevitably imply a potential for bias and invite error. Thus, the consistency of assessments should be based on an identifiable level of control and avoid unilateral decision-making, and reliability can be improved through consensus-based assessment based on focus groups. However, such an approach may face challenges in locating and organizing qualified participants, the exhaustive time required to visit field sites, and the need for knowledge of the complex criteria and implications of each indicator.

Case trials were conducted on an island and have not been tested in other locations, such as large coastal areas, and thus adjustments and adaptations may be needed to improve the global applicability and reliability of the model. As islands have fragile ecosystems of their own, this may be a limitation of the index design and the exact approach adopted in this study may not be ideal in all cases.

The case trials raised concerns over the limitations attributed to the application and repeatability of the index given the high level of researcher experience and familiarity with sites required to conduct assessments at specific locations. The need for in-depth local knowledge of the resource and previous experience to conduct field research is a limitation and may affect the reliable comparability among sites across regions or

nations. For example, issues include consistency in testing and re-testing at specific sites as well as comparability between sites, regions or countries where local knowledge and experience may vary among researchers. Thus, further standardization of the assessment criteria and methodology is needed in order to decrease limitation and increase reliability for international comparability. Nonetheless, the reliability of the framework is increased through the systematic documentation of sites in a comparative regional context. This is because sites are placed in a cross-sectional context whereby small levels of difference can be identified, and the accuracy and appropriateness of the interpretations and inferences made during evaluations can be better drawn from the measurement.

In cases where judgments are ultimately based on the researchers' own observations, an acknowledgement of potential bias should be made and alternative methods considered when possible, such as a larger sample size or focus group consensus.

4.4 Recommendations

The surf tourism research community indicates that the sustainability of coastal surfing resources is in dire need of proactive legislation and management (Martin & Assenov, 2012a). Nevertheless, there is a knowledge gap in the current standards and policies for surf site sustainability in many countries around the world, including Thailand. To address this gap, the SRSI is particularly applicable and recommended in assisting policy makers and non-governmental organizations to rank and prioritize surf sites for tourism management and conservation, including the legislation of surfing reserves. For example, the index can be employed to design site-specific frameworks to study and gauge surf tourism sustainability in social, economic, environmental and institutional contexts, and this can be useful in order to pinpoint strengths and weaknesses in coastal resource policy and management. It can be adapted to include new ideas and criticisms and to better include local people, government officers, local entrepreneurs and others who have no interest in surfing activity so that researchers can gain a wide range of feedback on SRSI development. Thus, future SRSI development and application can incorporate public participation as an essential part of sustainable tourism.

The application of SRSI for the conservation of coastal surfing resources and tourism management is recommended in five contexts: (i) to compare the quality of different surf beaches in the same area or region (through cross-sectional analysis); (ii) to identify changes over time at a given surf beach (trend analysis); (iii) to conduct beach and water safety assessments; (iv) to provide a framework for a consultative process whereby different stakeholder groups can offer their own weights to the clusters of factors; and (v) to prioritize surf sites in the legislative aspect, particularly as regional or national surfing reserves.

Developing Standard Lexicon

Although the SRSI research provides a basis for outlining and defining surf resource sustainability indicators, a standard lexicon should be developed for social, economic, environmental and governance surf site indicators. A standardization of terminology for surf site evaluation and conservation can allow researchers from different field locations around the world to better communicate and exchange information and data. Standardizing lexicon in the field of conservation has been developed and employed for some time in the context of biodiversity (Salafsky et al., 2008), and this type of approach stems from the problems associated with the contradicting definitions in conservation studies and the need to clarify terminology for researchers and policy-makers alike.

Field Experience and Site Familiarity

Lazarow (2010) suggests that local knowledge is vital to the sustainable management of surf sites. Accordingly, if assessments are undertaken by researchers with limited experience at study sites, it is recommended that extensive and in-depth local knowledge be sought. The process of rating beaches relative to each other led the researchers to identify the need for a high level of familiarity with the physical and human attributes of each site which could take several surfing seasons or years to gain. Thus, interviews with members of the surfing community and relevant stakeholders at individual beaches are essential to the research process.

Social and Environmental Footprints

Save for Buckley (2002a, 2002b, 2006), very few research articles to date attempt to quantify or describe the impacts of surfers on the physical environment and hence environmental management prescriptions to reduce environmental impacts have yet to be drawn regarding water, waste, energy, transport, etc. The concerns of surfers regarding the environment are most apparent in literature produced by the not-for-profit sector. Relevant works reviewed in this dissertation include those linked with *The Surfrider Foundation* (Nelsen et al. 2007, 2008; Pendleton, 2002; Pijoan, 2008; Wagner et al., 2011), *Surfers Against Sewage* (Butt, 2010, 2011; Ryan, 2007; Surfers Against Sewage, 2009), and *Save the Waves Coalition* (Coffman & Burnett, 2009; Murphy & Burnal, 2008; Save the Waves Coalition, 2010). Thus, in the wake of global „surf environmentalism“, the SRSI can be tailored to the development of best practices for surfers, surf tourism operators, and surf tourists alike. Site-specific attributes and sensitivities can be outlined in order to identify issues, impacts and thresholds of sustainability and raise the level of awareness among stakeholders. Thus, the index can serve not only as an early warning system for threats; it can provide a methodology for surfers to participate in the conservation process. Conversely, it can be employed as a tool to benefit surfer and non-surfer communities and local environments if it can mirror the threats from surfing culture and activities to indigenous communities and traditional resource custodians from unintended consequences and impacts which could arise from surfing reserve development in new surf destinations.

4.5 Suggestions for Future Research

This research has indicated that surf site sustainability indicators are inextricably linked and should not be treated in isolation. New and interdisciplinary approaches to surf site conservation could serve to broaden the SRSI and to invite students and scholars alike from diverse research fields and positions. For these reasons, the SRSI was purposefully designed for use in a variety of contexts with the prospect of adaptation, and invites researchers from around the world to study surf site conservation and tourism management.

For example, a threat-based approach could be adopted, whereby low aptitude identifies a higher need for immediate action (TNC, 2007), or the methodology could be adapted to include conservation values (WWF, 2013) or management priorities as suggested by surf tourism researcher J. Ponting (personal communication, November 9, 2012):

In terms of index development, we must consider the context of the indicators, for example conservation aptitude versus conservation value or management priority. Although conservation indicators and ratings are a very good idea, we must be cautious that they don't simply lead us to consider the sites that are the easiest or most manageable to protect.

As surfing activities and the value and preservation of surfing resources are not distinctly integrated into the field of environmental management, opportunities exist for future research. For example, new index-based conservation methodologies such as the Surf Resource Sustainability Index can be expanded to involve a more holistic and comprehensive definition of sustainability, including issues of climate change. Surf resource indicator design workshops should be held whereby focus groups can better define indicator criteria which account for the „surf system dynamics“ discussed in this research. Conservation action principles and standards for biodiversity, such as those employed by *The Nature Conservancy* (TNC, 2007), can be incorporated with the current SRSI design to form new and integrated levels of understanding. In such a paradigm, the physical and social attributes of coastal surfing resources can be studied as fragile and interrelated features wherein new perspectives can be developed for understanding the sustainability of the natural capital of surf sites. Accordingly, the SRSI design could be adapted to address any number of concerns, including climate change, surf city economics, the carbon footprint of surfers, coastal protection strategy, Environmental Impact Assessment (EIAs), Life-cycle Assessment (LCA), wave energy converters (WECs), or the wider surf tourism industry in developing countries. Similarly, the use of new technologies, such as Geographic Information Systems (GIS) could prove to be useful in future SRSI research.

In-depth research on surf resource stakeholders should be conducted which explores linkages among groups, including the non-surfing community. The knowledge of stakeholder predispositions and values could prove useful in policy

development to protect surfing habitat. For example, one could compare the preferences and concerns of dissimilar stakeholder groups in order to determine the broad conservation value of sites, identify threats to the natural resource base, or address particular management concerns.

As yet, surf tourism research has for the most part focused on prolific surf destinations, particularly those in Australia, Indonesia, and the USA. This research gap can be addressed through studies which broaden the field to include countries where surf quality may be marginal or seasonal, yet other tourism experiences (e.g., cultural or adventure tourism) are already available in parallel with surfing, such as in Thailand and other South East Asian countries. Given the increased petition for empirical research and publication among not-for-profit organizations, governments and academic institutions, innovations in SRSI methodology can expand to include a mixture of physical and social sciences which address the complex issues and interrelationships among stakeholders now emerging at surf sites around the world.

5. CONCLUDING REMARKS

Surfing is a multi-billion dollar industry which relies heavily on the existence of environmental resources and surfing areas embody particularly valuable and diverse marine and coastal areas. As surfing activities and the surf tourism industry expand in scope and intensity in urban and rural destinations, concerns over the sustainability and conservation of sites are increasingly acute. Surf sites are often iconic and aesthetic locations of unique biodiversity requiring sensitive use and management, and impacts are well documented in the literature and in this research.

Prior to this dissertation, a data-driven index methodology for employing comprehensive metrics to rate surf site sustainability had not been developed. The surf resource sustainability index (SRSI) highlights significant issues surrounding surf site integrity and serves as a comprehensive information base for surfers and other stakeholders, providing a platform for structured dialogue on surf resource sustainability. The study has developed *conservation aptitude* as a theoretical compass aimed at the summation of assessable qualities and attributes a site possesses which contribute toward sustainability. As a research instrument, it offers a standardized and systematic approach to setting benchmarks for surf site sustainability and conservation – a framework to study surf tourism sites in a social science context, particularly in identifying and promoting best practices. The study has established the index system as a method for surf site assessment and put forward a set of twenty-seven specific indicators based on well-defined criteria. As a result of quantifying the qualitative data generated during field work, the modular SRSI approach provides an innovative set of descriptive assessments and metrics for measuring and appreciating the value and context of coastal surfing resources. Ultimately, the SRSI metrics presented in this dissertation provide a global model for surf site conservation – a toolkit of qualitative and quantitative methods applicable in future studies aimed at the sustainable use and management of these resources.

The conservation of coastal surfing resources holds the long-term potential of protecting valuable habitats, improving coastal resource management, and nurturing cultural heritage; it also offers long- and short-term benefits to the physiological and psychological wellbeing of individuals and communities. In this way, the society at

large and especially the tourism industry stand to benefit greatly from recognizing and appreciating the need to conserve surfing resources. Conversely, increased use, crowding, pollution, and coastal development all pose significant risks which if not proactively addressed will degrade these resources.

The attributes and risks to surf sites have been highlighted in this research alongside opportunities to maintain and enhance surfing resources through innovative research design in environmental management, such as the SRSI. By working cooperatively with various stakeholders to identify, document and assess coastal surfing resources – and to recognize and seize conservation opportunities – surf management planning can help Phuket and other surfing destinations to maintain and enhance surf site integrity. In Thailand, H.M. King Bhumibol Adulyadej’s philosophy of sufficiency economy encourages the responsible conservation of the environment (TICA, 2013), and I hope that this dissertation can make some small contribution to that effort.

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PAPER I

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**The Genesis of a New Body of Sport Tourism Literature: A Systematic Review of
Surf Tourism Research (1997–2011)**

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The genesis of a new body of sport tourism literature: a systematic review of surf tourism research (1997–2011)

Steven Andrew Martin* & Ilian Assenov

Surf tourism is a rapidly expanding market segment of the wider sport tourism industry and the purpose of this study is to provide an analytical interpretation of surf tourism research. Published and unpublished literature from 1997 through to 2011 was collected through searching a variety of academic databases and communicating directly with the authors themselves. A systematic review was employed to identify and analyze the types of research emerging from international journals, universities, governments, and the not-for-profit sector. The study indicates a genesis in sport tourism literature, representing a new and available body of surf tourism research. We find that this new area of research has arisen mainly from the grey literature through the works of graduate students and consultants. Surfing events, artificial surfing reefs, and the sustainability of surf sites and host communities are among the most prolific areas under discussion and key arguments include socioeconomics, coastal management, and sustainable tourism. Approximately 10% of countries in the world with coastal surfing resources have been studied, and this and other findings indicate the potential for new areas of research in domestic and international tourism. A bibliography provides 156 documentary materials compiled for the systematic review.

Keywords: surfing; surf tourism; literature review; sustainability; coastal management

Introduction and Rationale

Surfing is generally defined as the act of riding an ocean wave while standing on a surfboard and broadly includes other aspects of wave riding, such as riding prone on a 'bodyboard' or simply 'bodysurfing' (using only one's body surface to plane across

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the wave). Consequently, surf tourism research is an outgrowth of the research literature related to the activity of surfing framed in the discipline of tourism. For the purposes of this study, the broad definition of 'surf tourism' has been adopted from Tourism New South Wales (2009):

An activity which takes place 40 km or more from the person's place of residence, where surfing or attending a surfing event are the primary purpose for travel. Surf tourists stay at their destinations for at least one night or can undertake their visit as a day trip. (p. 3)

The growth of surfing in sport and tourism has gained marked attention in academia during the past decade, and this paper establishes a corpus of surf tourism research for academic review. Built upon the foundational studies by Assenov and Martin (2010) and Martin and Assenov (2011), a comprehensive inventory of 156 pieces of research spanning 15 years (1997–2011) was compiled for review, including the gray literature. The study outlines the development of surf tourism literature in terms of the types and quantities of research emerging from international journals, universities, governments, and the not-for-profit sector; it offers an evidence-based informetric approach to the development, content, and current status of surf tourism research in the academe. This type of investigation serves to identify intellectual linkages which can be systematically counted, such as the growth and productivity of studies (Eom, 2008). The reference list provides a seminal body of documentary research materials on surf tourism.

Systematic Approach to the Study

A systematic literature review is a straightforward methodology often applied in the social sciences and this study investigates and presents surf tourism research normatively and quantitatively. While this type of documentary analysis may satisfy the natural curiosity of those in the discipline, it is particularly useful to future research, graduate students, and faculty whereby the knowledge of research productivity facilitates an understanding of scholarly output (Jogaratham et al., 2005). Weed (2006a) suggests that although a key feature of the systematic review is the aim for comprehensive coverage of a field of study, it is a primary research activity in its own right. Fundamentally, a systematic review covers a wide-ranging search for relevant studies on a specific topic, and those identified are then evaluated according to a 'pre-determined explicit method' (Klassen et al., 1998, p. 701). In contrast to single studies taken in isolation, the systematic and statistical summary of a determined body of research results in a 'research synthesis', a methodology which is highly progressive (Petticrew & Roberts, 2006). In the context of sport tourism, Weed (2006b) identifies how the boundaries of such studies are determined:

The key to systematic review is that the criteria for the inclusion or exclusion of studies in the review is explicit from the outset, and while others may not agree with the inclusions, the criteria for such inclusions, and thus the scope of the review, are clearly delimited. (p. 6)

The collection of the surf tourism literature began in 2007 and encompassed three broad approaches: (1) extensive and ongoing internet search using a variety of

advanced search techniques on a wide range of academic databases; (2) tracking references in relevant books, journal articles, conference proceedings, and Master's and PhD theses; and (3) personal communication and collaboration with authors and scholars. Given the nascent character of the field, the latter approach was baseline in locating and authenticating literature. Over 5000 relevant papers were collected and methodically searched for 'surf' and 'tour' along with other base terms and reviewed through reading and interpreting content in order to discern epistemological contribution to the field.

Inclusion and Exclusion of Studies

With the development of the electronic media and the internet, the authentication of literary materials faces new challenges, such as works generally lacking a printable version or other types of gray and transient literature. However, gray literature and to some degree deliberately gray literature (i.e. for intended readership only) are potentially significant in terms of flexibility in approach and content, the speed of dissemination to the private or public domain, the opportunity to go into detail (e.g. not restricted in size or word count), and as a window into a developing field of research where traditional academic materials may be limited or unavailable. For the purpose of this paper, we delineate the gray literature to include theses (Bachelor, Honors, Master's, and Doctoral), paper presentations (without inclusion in conference proceedings), and government and not-for-profit organization reports; we outline published materials to include conference proceedings (with or without editors), journal articles, and book sections or chapters.

As many references found on the internet or quoted in others' written works do not meet accessibility criteria and are therefore of limited value to future research, we have taken account of the need to avoid ephemera (e.g. internet blogs, unpublished posters, PowerPoint files, etc.) and eligibility criteria are as follows: (1) name(s) of author(s), venue, dates, and an accountable record of presentation or proceedings for conference papers (including page numbers); (2) name of author, year of completion, university and its location for Bachelor, Honors, Master's, and PhD theses; (3) name(s) of author(s) or lead organization(s) (accountable for or commissioned by), year, and type of publication for government or not-for-profit publications or reports; (4) name(s) of author(s), year, and volume and page numbers of peer-reviewed journal articles; and (5) name(s) of author(s), year, publisher, chapter and/or title, and pages for books. Upon consideration, some exceptions were permitted (such as being unable to obtain full papers or page numbers for conference papers). Conversely, in cases where we were unable to authenticate research it was regretfully excluded. Taking into account the nature and limitations of locating the gray literature from around the world and despite the best efforts of the authors, it is inevitable that the inventory of literature is less than exhaustive.

The literature has developed over the previous decade and there are cases where a string of research exists by the same author. To ensure inclusiveness, such layers of research have been measured as individual studies, including papers which are in fact

duplicates (with or without title changes). While in the scientific literature, republished materials are called 'double publication', surf tourism literature is a developing area and graduate students may have presented similar work at symposiums or conferences, and these works may have entered into proceedings (with or without editors) and/or received publication in an academic journal at later dates. In some cases, this has led to a somewhat ambiguous record of publication and posed some dispute in the accurate account of references in this paper. We may have erred on the side of inclusion when evaluating whether contributions passed the quality threshold.

Bearing in mind the aforementioned definition of surf tourism by Tourism New South Wales (2009), the focal point of research included for review is not necessarily the traditional definition of 'tourism' *per se*, and given the infancy of the field, a range of papers with discussion on the visitation of surf sites for leisure, recreation, and tourism, be it domestic or international, have been considered. Topic areas include surfing events, surfing space and imagery (as marketing devices or psychodynamic constructs), coastal and environmental management, valuation and socioeconomic studies, sustainability issues at surf sites and for local communities, and the designation of surf tourism locations as surfing reserves.

Excluded from this study were the following: (1) numerous books and travel guides on surfing and the history of surfing; (2) research literature in French, Spanish, and Portuguese (approximately 10 studies identified thus far); (3) surf tourism articles in magazines (e.g. *Surfer's Journal*, *Surfer Magazine*, *Surfer's Path*), web media (e.g. *Surfline.com* and *Surfers Village.com*), and those articles appearing in newspapers; (4) the wide body of social science works related to surfing (the 'surfing literature'); (5) technically based artificial surfing reef literature (the 'ASR literature'); and (6) scientific works related to surfing (the 'surf science literature').

Of special consideration for inclusion were the following examples: (1) the ASR literature where it includes direct discussion on surf tourism; (2) surf event economic impact studies prepared for or commissioned by corporations, contest sponsors, or surfing organizations (however, as these studies are often considered 'commercial in confidence', only those files which could be located for review were included and therefore a considerable number of reports were excluded, such as a long-running series of annual reports prepared for *Surfing Victoria Inc.*); (3) one Spanish language Master's thesis on sustainable surf break management in Mexico by Pijoan (2008) due to co-authorship in an English language conference paper in affiliation with the US-based *Surfrider Foundation* (on the grounds that an English account conveying essentially the same material was available).

At the discretion of the researchers, a distinction has been made regarding whether studies are 'dedicated' or 'non-dedicated' to the field of surf tourism. One-hundred and two dedicated works are acknowledged in the statistics and tables appearing throughout this paper. While dedicated studies which focus directly on surf tourism are generally distinguishable, non-dedicated works involved careful consideration for inclusion based on their contribution to the field. As it is not practical to provide justification for each of the 54 non-dedicated studies in our paper, the following five pieces of research serve as examples and reasoning for inclusion:

(1) Preston-Whyte's (2002) study which targets the concept of surfing space as a social construct and tourist activity intrinsic to the challenges surfers face in mastering the forces of nature; (2) the topic of surf break management described through oceanographic study, particularly those works by Scarfe (2008) and Scarfe et al. (2009a, 2009b) given their unique contribution in terms of literature review and attention to the environmental management of surf sites for recreation (note that the latter reference was redeveloped from a previous work to include surf tourism and subsequently published in *Reef Journal*); (3) Chapman and Hanemann (2000) who argued the environmental costs to commerce, including surfing and tourism, from the *American Trader* oil spill in Huntington Beach, California; (4) the social science PhD thesis of McGloin (2005) which focused on the social dimension of surfing as a distinctly Australian national identity which includes and attracts tourism; and (5) the anthropologic PhD research by Leonard (2006) who looked at the origin of Bali's surf hero culture amidst the rise of Indonesia's surf travel industry.

The Genesis of a New Body of Research

Forerunners of the Field

Despite the fact that the imagery of surf travel has appeared in specialized surf magazines and films since the 1960s, Kelly (1973) conducted one of the earliest known investigations in the research area (an estimate of surfers' expenditures on surfing equipment in Hawaii). Although surfers were traveling from far and wide to surf the big waves of Hawaii and to buy Hawaiian-made surfboards, 'surf tourism' was yet to appear in the literature. In the 1980s, research into the economic significance of the sport of surfing as a superficially appearing low-capital leisure activity at US beaches brought to light the importance of the natural ocean resources (Johnson & Orbach, 1988), and the economic effects of surfing activities in Hawaii showed that the sport was an integral part of the state's economy and tourism industry (Markrich, 1988). In January 1991, the *Hawaii Ocean and Marine Council* published a management plan which acknowledged that 23,000 surfers were using the coastal zone, that surfing events were a major source of ocean recreation revenues, and that the sport was highly significant to tourism (Hawaii Ocean and Marine Council, 1991). As the early surfing industry had important spinoffs to the clothing industry in beachwear and beach-holiday fashions, corporate manufacturers were prolific in promoting international surf competitions at iconic surf destinations. As a result, commissioned studies into the touristic impacts and econometric evaluations of surfing events (contests, competitions, and festivals) led a new area of 'surf event research' in sport tourism in Australia (Breedveld, 1995; Downey, 1991; Ernst & Young, 1995).

Surf Tourism in Academia

Our systematic review begins with Halsall (1997) whose graduate report employed the established *Hallmark Tourist Events* methodology to investigate the impacts of

Australia's annual *Margaret River Masters Professional Surfing Event* on the host community. In the following year, the term 'surfing resort' appears in an international journal (Augustin, 1998), followed by 'surf travel' (Reed, 1999), and 'marine tourist' (Orams, 1999) being similarly employed to indicate a new research area and market segment. Poizat-Newcomb (1999a, 1999b) was among the first to coin 'surfing tourism' in an in-depth study of the sport as an international touristic activity and the second to publish in an international journal (*Journal of Sport Tourism*). However, the term 'surf tourism' first appears in academia in a Master's thesis from San Diego State University (Reed, 1999), a symposium abstract (Buckley, 1999), and subsequently in an unpublished graduate research report (Ponting, 2000) and conference abstract (Buckley, 2000).

Systematic Review of Surf Tourism Research (1997–2011)

Timeline and Development of Research

As a field of academic inquiry, surf tourism research emerged just prior to the dawn of the twenty-first century. Table 1 identifies the development of the research over time, differentiating the types of literature, including 102 papers which we have assigned as dedicated to surf tourism research. Sixty percent of the total works were produced in the recent 5 years, signaling a significant acceleration in publication frequency, and this is an indication of a new and developing field of study. Approximately two-thirds of the 156 studies produced to date are gray literature.

Table 1. Surf tourism research by type of publication, 1997–2011

Year	Journals	Book sections	Conference papers	Graduate studies ^a	Non-refereed studies ^b	Total
1997	0	0	0	1	0	1
1998	1	0	0	0	0	1
1999	3	2	1	2	0	8
2000	0	0	1	1	0	2
2001	2	1	0	2	1	6
2002	4	0	3	1	2	10
2003	3	0	6	0	1	10
2004	2	1	2	2	1	8
2005	4	0	2	2	0	8
2006	0	2	3	2	1	8
2007	7	2	3	3	10	25
2008	3	1	3	4	7	18
2009	10	2	6	3	4	25
2010	1	1	5	2	4	13
2011	2	2	4	3	2	13
Total	42 (23) ^c	14 (6)	39 (35)	28 (19)	33 (19)	156 (102)

^aIncludes Master's and PhD theses and graduate and undergraduate academic projects.

^bPapers prepared for or by local authorities, corporations, and not-for-profit organizations.

^cNumbers in parentheses show the number of papers by publication dedicated to surf tourism.

Table 2. Research articles by journal

Journal	Articles ^a
<i>Journal of Coastal Research</i>	5(2)
<i>Journal of Sport & Tourism</i> ^b	3(3)
<i>Reef Journal</i>	3(0)
<i>Journal of Sustainable Tourism; Shore & Beach</i>	2(2)
<i>Tourism Management</i>	2(0)
<i>Africa Insight; European Sport Management Quarterly; Geografiska Annaler; Geographical Review; International Journal of the History of Sport; Journal of Ecotourism; Journal of Quality Assurance in Hospitality & Tourism; Land Use Policy; Society & Leisure; South African Journal for Research in Sport, Physical Education and Recreation; Tourism Analysis; Tourism Planning and Development; Tourism in Marine Environments; Tourism Review International</i>	1(1)
<i>Annals of Tourism Research; Cultural Values; Event Management; Film & History; Geography Compass; Journal of Travel Research; Managing Service Quality; Qualitative Market Research – An International Journal; Revista de Turismo y Patrimonio Cultural; Sport in History; Tourism Geographies</i>	1(0)
Total journal articles	42(23)

^aArticles which are dedicated to surf tourism are in parenthesis.

^bPreviously (until 2006) known as *Journal of Sport Tourism*.

The Advance of Journal Articles

Academic journals began to publish surf tourism research as early as 1998, and we were able to identify 42 articles (of which 23 are dedicated to surf tourism) appearing in 31 journals (14 of which are devoted to the discipline of tourism). As international journals serve as indicators of disciplines of study, we find surf tourism primary to tourism management, sport tourism, sustainable tourism, ecotourism, marine tourism, tourism geography, and event management (Table 2). Thirteen journal articles were produced as a result of graduate work, indicating the contribution of graduate research to international journals.¹ Journals have been grouped and sub-grouped according to the number of published and dedicated surf tourism articles.

Institutional Contributors to Journal Articles

When segmented by country, institutional contributions to international journal articles indicate that Australian universities have produced just over one-third of all articles (15 articles), followed by the USA and the UK (five articles each) and South Africa (four articles). Griffith University, Australia, is the foremost institution in surf tourism research (seven articles). Although Hawaii is the undisputed origin of surf tourism in the twentieth century, there have been no journal articles attributed to universities in Hawaii (albeit there have been other research works); and while Indonesia is one of the most prolifically researched surfing destinations in the world, to our knowledge at the time of writing an English language surf tourism research project has yet to be attributed to an Indonesian university. Table 3 outlines institutional

Table 3. Institutional contributors to journal articles

Country	Institutional contributors	Pieces of research	Year of first publication
<i>Universities</i>			
Australia	Griffith University	7	2002
	Australian National University	3	2007
	University of Wollongong	2	2003
	Edith Cowan University	1	1999
	University of Technology, Sydney	1	2005
	University of Queensland	1	2006
USA	Pennsylvania State University	1	2009
	San Diego State University	1	2009
	Stetson University	1	2009
	University of California, Berkeley	1	2009
UK	University of California, Los Angeles	1	2007
	Manchester Metropolitan University	2	2005
	Bournemouth University	1	2011
	Swansea Metropolitan University	1	2009
South Africa	University of Exeter	1	2005
	University of Natal	2	2001
	Cape Peninsula University of Technology	1	2008
	University of KwaZulu-Natal	1	2008
New Zealand	University of Waikato	3	2004
Canada	University of Calgary	2	2001
France	Université Michel de Montaigne-Bordeaux III	1	1998
Ireland	Dublin Institute of Technology	1	2011
The Netherlands	University of Leiden	1	2003
Portugal	Instituto Superior Tecnico	1	2009
Spain	Universidad de La Laguna	1	2010
<i>Other organizations</i>			
Australia	National Surfing Reserves	1	2007
New Zealand	ASR Marine Consulting and Research	1	2009

Note: For papers with authors from different institutions, only the first author affiliation has been accounted for. Academic affiliations were not applicable for two authors.

contributors by country and universities and other institutions within each country by contribution. Data were compiled based on primary authorship.

Key Scholars in the Field

Table 4 identifies five Australian authors, Buckley, Dolnicar, Lazarow, O'Brien, and Ponting, as instrumental in defining the research area, accounting for 46 of the total examined studies (including 12 journal articles) and constituting nearly one-third of the extant surf tourism literature to date. As four of these authors are surfers, this indicates that surfers are highly significant in driving the field of study. As of

Table 4. Shortlist of prolific authorship in surf tourism

Authors ^a	Journal papers (primary authorship)			
	Citations (Google Scholar) ^b	Total dedicated articles	Other research ^c	Total pieces of research
Buckley	89	3	5	8
Lazarow	33	4	7	11
Ponting	27	2	14	16
Dolnicar	26	2	2	4
O'Brien	21	1	6	7
Nelsen	15	1	3	4

^aArranged by number of *Google Scholar* citations.

^bAs of 5 September 2012.

^cIncludes non-dedicated surf tourism articles in journals, secondary authorship, graduate work, book sections, conference papers, and non-refereed papers.

September, 2012, Buckley is the most cited scholar in the field based on data retrieved from *Google Scholar*. While Table 4 is short of an exhaustive account, it identifies researchers who have primary authorship of at least one journal article dedicated to surf tourism and served as a common link across multiple studies. The table excludes some authors, such as Fluker (five pieces of research) and Martin (seven pieces of research), who, despite appearing in conference proceedings and publishing research, do not have primary authorship of journal articles.

Degree Conferral in the Research Area

Degree conferral in the research area includes 28 theses at the bachelor, honors, and graduate levels, 19 of which are dedicated to surf tourism (Table 5). Graduate studies dedicated to surf tourism research accentuate the interdisciplinary development of the field of study with degrees conferred in anthropology, ecology and sustainable development, hospitality and tourism management, Latin American studies, leisure and tourism, oceanography and coastal zone management, spatial planning, tourism management, travel industry management, and urban and regional planning. Management, sustainability, and marketing are the key research areas. Australian Jess Ponting was the first to produce a sequence of graduate studies on surf tourism leading to degree conferrals: a graduate report (Ponting, 2000), a Master's thesis (Ponting, 2001), and a PhD thesis (Ponting, 2008). Twenty-eight conference papers were produced as a result of graduate work.²

Commissioned Research

Research produced as a result of commissioned studies forms a developing component to the field, wherein 26 out of 32 total pieces of research were produced in the recent 5 years.³ These works are mainly reports, assessments, and impact studies generated by or

Table 5. Degree conferral in the research area (Bachelor, Honors, Master's, and PhD theses)

Year	Author	Degree conferred	University	Country
1997	Halsall	Graduate Diploma in Urban and Regional Planning (planning report) ^a	Curtin University of Technology	AU
1999	Reed	Master of Arts in Geography (thesis)	San Diego State University	USA
1999	Gough	Honors Degree in Social Sciences (Directed Research Project)	University of Waikato	NZ
2000	Ponting	Master of Mgt (Tourism Mgt) (graduate report) ^a	University of Technology, Sydney	AU
2001	Ponting	Master of Mgt (Tourism Mgt) (thesis) ^a	University of Technology, Sydney	AU
2001	Tilley	Bachelor of Science (Capstone Project) ^a	California State University, Monterey	USA
2002	Williams	Bachelor of Arts in Geography ^a	University of Exeter	UK
2004	Tantamjarik	Master of Science in Travel Industry Mgt (thesis) ^a	University of Hawaii	USA
2004	Hageman	Bachelor of Arts in Tourism Mgt and Consultancy (thesis) ^a	NHTV Breda University of Applied Sciences	NL
2005	McGloin	Doctor of Philosophy (thesis)	University of Wollongong	AU
2005	Sanders	Doctor of Philosophy (thesis)	Murdoch University, Perth	AU
2006	Hageman	Master of Science in Leisure, Tourism and Environment (thesis) ^a	Wageningen University	NL
2006	Leonard	PhD in Anthropology (thesis)	Australian National University	AU
2006	Cochetel	Master of Technology in Marketing	Durban University of Technology	SA
2007	Krause	Master of Arts in Anthropology (thesis) ^a	San Diego State University	USA
2007	Frood	Master of Arts in Ecology and Sustainable Development (thesis) ^a	Murdoch University, Perth	AU
2008	Kelly	Master of Science in Oceanography/Coastal Zone Mgt (thesis) ^a	Florida Institute of Technology	USA
2008	Ponting	PhD in Leisure and Tourism (thesis) ^a	University of Technology, Sydney	AU
2008	Scarfe	PhD in Earth and Ocean Sciences (thesis)	University of Waikato	NZ
2008	Pijoan	Master of Science in Arid Zone Ecosystem Mgt	Autonomous University Ensenada	MX
2009	Hugues-Dit-Ciles	Doctor of Philosophy (thesis) ^a	University of Plymouth	UK
2009	Ingersoll	PhD in Political Sciences (thesis) ^a	University of Hawaii	USA

(Continued)

Table 5 Continued

Year	Author	Degree conferred	University	Country
2009	Mach	Master of Natural Resources and Sustainable Development (substantial research paper) ^a	American University, Washington, DC	USA
2010	Martin	MBA in Hospitality and Tourism Mgt (thesis) ^a	Prince of Songkla University	TH
2010	Lazarow	PhD in Public Policy and Coastal Mgt (thesis)	Australian National University	AU
2011	MacWilliam	Master of Science in Spatial Planning (thesis) ^a	Oxford Brookes University	UK
2011	Iatarola	Master of Arts in Latin American Studies (thesis) ^a	University of California, San Diego	USA
2011	Eberline	Master of Resource Mgt in Coastal and Marine Mgt (thesis) ^a	University of Akureyri	IS

^aResearch dedicated to surf tourism.

for government agencies, councils, tourism planning organizations, and the not-for-profit sector (Table 6). Commissioned research is most evident in Australia (13 studies), the USA (9 studies), and the UK (6 studies). Eastern Australia (New South Wales and Queensland) is the most researched coastline in this category (with 10 studies). Taken as a whole, commissioned research targets tourism management issues, particularly in areas of the economy, environment, coastal resources, and destinations. *Save The Waves* (STW) and *Surfers Against Sewage* (SAS) are the most active not-for-profit organizations with two and three reports, respectively. While most not-for-profit studies target environmental sustainability issues as well as the economic implications of surfing and surf tourism, all 14 government-commissioned studies (i.e. excluding the works for corporate and private organizations) focus on tourism development through impact studies and management reports. As aforementioned, a considerable number of 'commercial in confidence' studies commissioned by *Surfing Victoria, Inc.* (and other organizations) were not available for this study, save for Pulford (2007). Seventeen of the commissioned studies are dedicated to surf tourism.

Research Locations

The most popular surf tourism research sites are in Australia, the USA, and Indonesia. Australia and the USA benefit from the presence of universities near the coast and from students and scholars who surf and have taken up research accordingly. Although surf tourism is clearly a global phenomenon, research has been carried out in relatively few countries to date and this may indicate a knowledge gap. We find that although surfing occurs in as many as 162 countries (Wannasurf, 2013) and is officially and organizationally represented in 72 countries on five continents (International Surfing Association, 2013), peer-reviewed research on surf tourism has been conducted in only 18 countries.

Table 6. Commissioned research

Year	Commissioning organization	Type of research ^a	Field location
<i>Not-for-profit organizations</i>			
2002	Environmental defense; Surfer's Environmental Alliance; The Surfrider Foundation	Valuation study	Rincon, Puerto Rico, USA
2008	STW Coalition	Economic impact study ^b	Mundaka, Spain
2009	STW Coalition	Economic analysis ^b	Mavericks, California, USA
2009	SAS	Environmental impact assessment	UK beaches
2010	SAS	Resource report	Global, UK beaches
2011	SAS	Sustainability report	Global, UK beaches
2011	Surf First; Surfrider Foundation	Socioeconomic report ^b	USA
<i>Government, corporate or private organizations</i>			
2001	Cornwall Enterprise	Socioeconomic assessment	Cornwall, UK
2002	Opunake Artificial Surf Reef Committee and South Taranaki District Council	Economic and social impact report ^b	Opunake, South Taranaki, NZ
2003	Cornwall County Council	Historical report	Newquay, Cornwall, UK
2004	Back Beach Improvement Group	Socioeconomic impact study ^b	Back Beach, Western AU
2004	Tourism Ragland ^c	Case study ^b	Ragland, NZ
2007	Fiji Ministry of Transport and Tourism	Tourism development plan ^b	Fiji
2007	Gold Coast City Council	Coastal management report	Kirra, Gold Coast, AU
2007	Maui Land and Pineapple Company, Inc.	Recreational carrying capacity	Honolua Bay, Hawaii, USA
2007	Ontario Ministry of Tourism and others	Profile report ^b	USA and Canada
2007	Surfing Victoria, Inc.	Economic impact report ^b	Bells Beach, Victoria, AU
2007	Tourism New South Wales	Scoping study ^b	New South Wales, AU
2007	Tourism New South Wales	Inventory report ^b	New South Wales, AU
2007	Tourism New South Wales	Focus report ^b	New South Wales, AU
2007	Vans, Inc.	Economic impact study ^b	Oahu, Hawaii, USA
2008	Brevard County, Florida (Economic Segment)	Feasibility study ^b	Brevard County, Florida, USA
2008	Corepoint and local authorities	Physical, ecological, and socioeconomic impact study	Cornwall, UK
2008	Gold Coast City Council	Best practice research report	Gold Coast, AU
2008	Griffith Center for Coastal Mgt	Socioeconomic study	Gold Coast, Queensland, AU

(Continued)

Table 6 Continued

Year	Commissioning organization	Type of research ^a	Field location
2008	Oregon State University	Recreation carrying capacity and management	Kailua Beach Park, Hawaii, USA
2008	Waikiki Improvement Assoc.	Economic impact analysis	Waikiki Beach, Hawaii, USA
2009	Gold Coast City Council	Economic contribution assessment ^b	Gold Coast, AU
2009	Tourism New South Wales	Action plan ^b	New South Wales, AU
2010	Central Coast Tourism	Destination management plan	Central Coast, AU
2010	Surf Coast Shire	Coastal management plan ^b	Bells Beach, AU
2010	Sydney Coastal Council Group	Scoping study	Sydney, New South Wales, AU

^aTerminology follows that employed in individual studies.

^bResearch dedicated to surf tourism.

^cJournal article.

Table 7 provides a detailed account of field research sites whereby the category ‘global’ identifies research findings with discussion in a global context. In the case of countries with research carried out in various regions (such as the coastlines of eastern, southern, or western Australia, various islands in Indonesia, and states or territories of the USA), the data have been segmented for purposes of clarification. The ‘general’ category (for Australia, the USA, Indonesia, and Oceania) indicates discussion targeting the entire country or region as a whole. In some cases, a single research project may offer discussion on more than one country or location and these works may be attributed to more than one category accordingly.

Trends and Implications

With the exception of Augustin (1998), the early journal articles brought the ‘international tourism’ discussion and then shifted toward the ‘domestic tourism’ argument, notably through surf site valuation studies in Australia and the USA. Two key trends are evident in the development of the research literature. First, the call for recognizing the implications of surfing breaks for rural host communities in the developing world in terms of social justice and equality; and secondly, recognizing the economic benefits of surfing breaks for urban communities in the developed world in terms of the need for considering the protection of surfing areas in the coastal management decision process. In both contexts, sustainability is the foundational issue. Thus, with the emergence of a new surf tourism research community, there is an evident call to sustain and manage surfing resources around the world.

Bridging all types of literature in our review are the studies on ASRs and surfing events (contests, competitions, and festivals). With the development of ASR

Table 7. Surf tourism field research locations

Country/region	Location	Sub-total	Total
Global			30
Australia	General	15	50
	East and South	27	
	West	8	
New Zealand			6
USA	General	4	30
	California	10	
	Hawaii	10	
	Florida	4	
	Puerto Rico	2	
Indonesia	General	5	26
	Mentawai	17	
	Bali	2	
	Lombok	2	
Europe	UK	14	22
	Spain	3	
	France	1	
	Ireland	2	
	Portugal	2	
Oceania	General	4	12
	Fiji	4	
	Samoa	1	
	Papua New Guinea	3	
Africa	South Africa	5	6
	Morocco	1	
Latin America	Costa Rica	3	7
	Mexico	2	
	Chile	1	
	El Salvador	1	
Others	Thailand	5	6
	Maldives	1	

technology, research assessing the potential touristic contribution of surfers drawn to use an ASR has been evident since at least 1999 (Gough, 1999) and future arguments for ASR development have inevitably incorporated tourism as a component to some degree. While the majority of ASR studies lie on the outer periphery of surf tourism research and have not been listed in our review, 43 pieces of research acknowledge the relevance of ASRs to sport and tourism, 11 of which are committed in this regard: Bicudo and Horta (2009), Fletcher et al. (2011), Gough (1999), MacWilliam (2011), Mead (2009), Mead and Black (2002), Rafanelli (2004), Slotkin et al. (2008, 2009), Tourism Resource Consultants (2002), and Weight (2003).

The acknowledgement or discussion of surfing events appears in 99 papers (nearly two-thirds of the total research reviewed). Many of these papers can be more broadly

defined as papers on the socioeconomic impact of surfing, which underscores the economic importance of events in the touristic context. Sixteen pieces of research are devoted to surf events: Ahmed et al. (2008), Carlsen (2003), Cochetel (2007), Getz and Fairley (2003), Getz et al. (2001), Halsall (1997), Markrich Research (2007), Ntloko and Swart (2008), O'Brien (2006, 2007a, 2007b), O'Brien and Chalip (2008), O'Brien and Harrison-Hill (2005), O'Neill et al. (1999), Pulford (2007), and Tindall (2011).

As the genesis of surf tourism research is evident in terms of the quantity of studies produced over time, the types of studies produced, and the progression of themes and topics in the field, we have placed the research into three conceptual stages for discussion: an *Early Period* (1997–2000); a *Formative Period* (2001–2006); and a *Progressive Period* (2007–2011).

The Early Period (1997–2000)

The *Early Period* indicates surf tourism research as a novel and dynamic new field of study and features the very first works which are largely descriptive and social science based: Halsall (1997) recognized the positive and negative aspects of an international surfing competition on a rural community in Western Australia; Augustin (1998) discussed the trendy development of coastal resorts near surfing areas in France; Reed (1999) argued the commodification of surf travel; and Poizat-Newcomb (1999a, 1999b) distinguished the early-stage surf tourism development in Puerto Rico with a sense of the peculiarities of a new sport activity. Although Augustin (1998) had previously published in works in French, his 1998 paper is arguably the first-ever international journal article dedicated explicitly to surf tourism. Capacity management issues at surf sites were first identified by Buckley (1999, 2000), and this will become a significant and reoccurring theme in future studies by him and other authors. The research carried out before the turn of the twenty-first century indicated that the far-flung global reach of surf tourism was eminent well before the development of academic inquiry into the field. With the early period came the first statistical marketing data targeting surf tourist behaviors and preferences (Ponting, 2000), and these primary data would be foundational to future studies in the *Formative Period* by Ponting and other authors.

The Formative Period (2001–2006)

While Fluker (2003) forged the first-ever definition for surf tourism and identified areas for further research, Buckley (2006, p. 194) denoted that defining surf tourism in economic terms encompasses four distinct segments: (1) specialist surf tour companies that run scheduled tours to prime surfing locations worldwide (often using charter live-aboard boats and/or specialist surf resorts); (2) experienced surfers who travel to surf using mainstream transport and accommodation (not easily identified as surf tourism); (3) low-budget surf safaris that take organized groups of surfers to a series of sites; and (4) surf schools offering surfing lessons as part of a tourist's

travel experience (e.g. the 'backpacker' market). We find that social science research during this period originally captures the representation of the 'surf tourist' by characterizing surf tourism in two broad aspects. First, studies aim at surfers' demographic and economic statistics, travel patterns, and behavior (Buckley, 2002a, 2002b; Dolnicar, 2005; Dolnicar & Fluker, 2003a, 2003b, 2004; Fluker, 2003; Ford & Brown, 2006; Hugues-Dit-Ciles et al., 2003; O'Brien, 2006; Ponting, 2000; Ponting & McDonnell, 2002; Rafanelli, 2004; Ryan & Cooper, 2004; Tourism Resource Consultants, 2002; Williams, 2002). The second aspect is the discussion on the use and success of surf imagery as a psychodynamic construct, including the chimera of paradise as a marketing device and the commodification of 'surfing space' alongside the impacts that surfers' have on host communities, particularly in foreign countries (Buckley, 2002a, 2002b, 2003, 2006; Canniford, 2005; Fluker & Hageman, 2006; Ford & Brown, 2006; Hageman, 2004, 2006; Ormrod, 2005; Persoon, 2003; Ponting, 2001, 2002, 2006; Ponting & Wearing, 2003; Ponting et al., 2005; Tantamjarik, 2004).

Over the 6 years of this period, field research was carried out in Africa, Australia, the Caribbean, Europe, the Indo-Pacific, and North and Central America. Primary data collected from the Surf Travel Company in the *Early Period* by Ponting (2000) subsequently provided Dolnicar (2005), Dolnicar and Fluker (2003a, 2003b, 2004), and Ponting and McDonnell (2002) with data for their quantitative studies. Buckley (2002a, 2002b) produced the most cited papers in the field to date, and this research is foundational in emphasizing the limited practical or theoretical investigation into surf tourism and brings to light 'capacity management' as a significant factor in the sustainability of destinations with high wave quality. While Ponting (2001) produced the first-ever Master's thesis on sustainable surf tourism management, other graduate students followed in developing the sustainability theme in their studies during this period (Hageman, 2004, 2006; Hugues-Dit-Ciles et al., 2004, 2005; Tantamjarik, 2004) and sustainability issues continued to evolve as a chief area of concern for graduate-level research during the *Progressive Period* which followed.

The Progressive Period (2007–2011)

Nearly two-thirds of the total literature was produced from 2007 to 2011 (94 studies), marking a genesis in both the types and sources of research. Graduate students contributed greatly to the development and awareness of the field through conference papers, theses, and published articles, and several of these researchers remain key innovators and authors in the field today. The period saw the completion of nine Master's theses targeting the resource base through three central themes, namely the assessment, management, and sustainability of surf tourism and associated sites (Eberline, 2011; Froom, 2007; Iatarola, 2011; Kelly, 2008; Krause, 2007; Mach, 2009; MacWilliam, 2011; Martin, 2010a; Pijoan, 2008). Highly significant to the field are four doctoral theses (Hugues Dit Ciles, 2009; Ingersoll, 2009; Lazarow, 2010; Ponting, 2008). Ponting (2008) produced the first-ever PhD thesis dedicated to surf tourism, a theoretically grounded research which transcends the social, psychological, spatial, and managerial concerns and impacts at remote Indonesian islands; Hugues Dit Ciles

(2009) examined impacts and sustainability at remote destinations in Western Australia, Fiji, and Nias, Indonesia; while Ingersoll (2009) offered ontological and cultural perspectives on Polynesian seascape epistemology as an integral base upon which contemporary tourism is placed. While not dedicated to surf tourism, Lazarow (2010) steers the surf research community toward *Integrated Coastal Management* (ICM) through five theoretical and practical perspectives:

- (1) The relationship of surfers and surfing to coastal environs; (2) the socio-economic impact and value of recreational surfing to particular locales; (3) the importance of local knowledge in coastal communities, including the role of individual and especially organized surfers in shaping environmental perceptions, policy and management; (4) the challenges for incorporating local or lay knowledge into public policy; and (5) our capacity for social and institutional learning through improved monitoring and evaluation of ICM. (p. iii)

Although on the periphery of the tourism argument, yet similarly concerned with ICM, Scarfe (2008) completed a PhD thesis in Earth and Ocean Sciences which built a case for surf break management and protection in the context of resource scarcity and significance. Collectively, the 14 graduate theses discussed here call attention to the interdisciplinary nature and diversity of research problems particularly in the social sciences.

Marking the development of an entirely new context and body of research, studies commissioned by governments, tourism associations, not-for-profit organizations, and private interest groups account for 27 pieces of research during this period (as was presented in Table 6). A landmark in this category of literature came with a series of made-to-order scoping studies and reports (Calais Consultants & Dhatom Tourism Consultants, 2007; Dhatom Tourism Consultants, 2007; Tourism New South Wales, 2007) produced in lead of Tourism New South Wales (2009) constructing the first-ever government action plan to consolidate the state's comparative 'surf resource' advantages and to conceptualize the region as a premier domestic and international surf tourism destination. The report identifies the significance for consumer engagement (enhancing destination appeal), product and distribution development (quality and supply of surf tourism experiences), and business support (assisting surf schools and tour operators with training to implement good business practices) (Tourism New South Wales, 2009). The recent acceleration of commissioned research is an indication of the concern and response by government and the private sector to the social, economic, environmental, and institutional implications and relationships among surf tourists and coastal communities. Equally, extensive reports identifying surfing waves as dynamic and valuable natural resources emerge from the not-for-profit sector, including SAS (Butt, 2010, 2011; Surfers Against Sewage, 2009) and *STW Coalition* (Coffman & Burnett, 2009; Murphy & Bernal, 2008), signaling that surfers and the wider surf community are key stakeholders in surf site advocacy, custodianship, and protection.

Conservation features prominently in the research literature of this period with Farmer and Short (2007, 2009) who proposed the promulgation of surfing areas in Australia through the formation of national 'surfing reserves' as designated and

protected surfing areas in the government legislature; and with FFLA (2010) who revealed the official *Bells Beach Surfing Reserve Coastal Management Plan*. These types of studies indicate that surfing reserves increase habitat protection, enhance natural resource values, and retain existing social, cultural, economic, and environmental values while providing a strategic and institutional framework to address current and future user and management needs and issues (FFLA, 2010).

As the current trend in research development is underpinned by commissioned works and graduate studies alike, the research led by PhD candidates N. Lazarow and C. Nelsen serve to synthesize the source, content, and direction of the field.⁴ Correspondingly affiliated with universities and public and private sector organizations, these PhD candidates offer the research community a series of socioeconomic studies which illuminate the significance of surfing to society and particularly to coastal communities (Lazarow, 2006, 2007, 2008, 2009, 2010; Lazarow & Castelle, 2007; Lazarow & Tomlinson, 2009; Lazarow et al., 2007a, 2007b, 2008; Nelsen et al., 2007, 2008; Wagner et al., 2011). These works bring home the argument for the value of local surf sites in urban areas and broaden our understanding of the implications of domestic surf tourism.

Future Research and Conclusion

Research Horizons

The 2010 formation of the not-for-profit *SDSU Center for Surf Research* at San Diego State University is an indication of the significance and future direction of surf tourism research, offering an avenue for graduate research, inviting insight and sponsorship from the private and corporate community, and through organizing symposia (J. Ponting, personal communication, 20 August 2012). The mission of the SDSU research and teaching center includes providing leadership in the struggle for sustainability:

Creating and disseminating specialist knowledge to governments, the surf industry, tourism developers, destination communities, non-profits, and tourists; Inspiring and driving active stakeholder engagement with the social and economic development of destination communities, sustainable use of their resources, and conservation of their critical environments. (SDSU Center for Surf Research, 2013)

In 2011, the world's inaugural *International Symposium on the Protection of Waves* (Global Wave Conference, 2013) introduced international initiatives for the preservation of surf sites wherein previous research (including those found herein) and personal experiences of surf researchers were presented and made available to the general public online.

At the time of writing we are aware of a considerable number of research projects, research grants, and graduate studies that are either underway, in press, or recently published. The following journal articles and affiliated universities serve as examples: Bond University, Australia and San Diego State University, USA (O'Brien & Ponting, 2013); North Carolina State University, USA, and St. Ignacio de Loyola University,

Peru (Barbieri & Sotomayor, 2013); University of Melbourne, Australia, and University of Southern Denmark, Denmark (Canniford & Karababa, 2012); Southern Cross University, Australia (Fendt & Wilson, 2012a, 2012b); University of North Carolina Wilmington, USA (Reynolds & Hritz, 2012).

Of particular interest among the works in progress is the concern for the vulnerability and adaptation of surfing areas in the wake of climate change, as addressed by the Griffith Centre for Coastal Management and Bond University's *Beach and Surf Tourism and Recreation in Australia: Vulnerability and Adaptation (BASTRA) Project* (Beaches, Surfing and Climate Change in Australia, 2013; Griffith Centre for Coastal Management, 2013). Other ongoing sustainability-related works include Short and Farmer's research on the documentation and development of surfing reserves at regional, national, and global levels (2012), and Martin and Assenov (2012)'s *Surf Resource Sustainability Index (SRSI)* projects.

Based on our review and the survey of the works under development, we identify two dynamic trends in the production of research: one is the prolific growth in research dedicated to surf tourism among commissioned studies and studies produced at the graduate level, wherein graduate studies can be expected to contribute significantly at the conference and journal levels; the second is the integration of surf tourism with a great number of other fields of research and areas of discussion due mainly to its acceptance as a component of the wider sport and tourism market and the growing vogue of the activity on the global stage.

Concluding Thoughts

Surfing-related touristic activities have now expanded well beyond the scope of research and academic knowledge in the subject area, and this is evident in the limited number of field sites to date (18 countries) relative to the global presence of surfing (at least 161 countries). In terms of human geography, two practical and theoretical areas of consideration are most evident: one is the positive and negative effects that surf tourism activities have on the developing world; the other is the concern for age-old surfing locations in developed countries in mainly urban settings which experience high-use, high-impact exposure to predominantly domestic surfers (particularly in the USA and Australia). Research in the former is directed toward 'surfing space' (and the exploitation of surfing space) in terms of capacity management in relation to social, economic, and cultural interaction and impacts on rural host communities; research in the latter area is focused toward the threats and impacts of urbanization in terms of coastal development with negative implications for the resource, as well as acute and visible environmental impacts, such as pollution and degradation.

As this study serves as the first-ever formative body of surf tourism research literature compiled specifically for analysis and future inquiry, we find that this new and global subfield of tourism research has arisen not only by several well-known theoreticians writing about it, but by graduate students, consultants, and diverse authors – and this is evident in the quantity of gray literature and degree conferrals in the field.

Issues of double publication are an indication of the immaturity of the field and this is likely to become rarer as the field matures. From academic and developmental perspectives, surf tourism research represents new and rapidly expanding areas in the touristic academe, reflecting the interdisciplinary nature of tourism not only as a professional field, but within the fields of ecology, environmental and coastal management, and engineering, and the concern for the custodianship and conservation of surfing areas wherein the preservation of habitat is an increasingly important point. Surf tourism research appears across a wide spectrum of touristic fields, including sport tourism, event tourism, adventure tourism, marine tourism, water-based tourism, nature-based tourism, ecotourism, sustainable tourism, coastal tourism, tourism marketing, tourism management, recreational management, sport management, travel industry management, coastal zone management, and tourism planning; and social science disciplines include human geography, anthropology, economics, sociology, psychology, and political science.

The broad expansion of surf tourism research areas may suggest a need to redefine the meaning, boundaries, and activities of surf tourism in order to better capture the emergent dynamics of the field. Further research may consider the growth of surfing activities in new regional and demographic markets, cultural shifts in the surfing sub-cultures, and the impacts of technology and engineering innovations which allow wave pools and ASRs to produce waves of sufficient quality to potentially act as tourism drivers.

Surf tourism research denotes a genesis in sport tourism literature in little over a decade set in the contexts of globalization, exploration, and diversity amidst natural and political borders and backgrounds of disciplines and authorship. While in recent years significant progress has been made in developing new approaches and topics in surf tourism research, the field has yet to develop to a level which benefits the myriad stakeholders of the coastal zone – and we are currently left with a somewhat subjective and inconclusive approach to recognizing, evaluating, and conserving coastal surfing resources in the prevalence of the expanding tourism industry.

Recommendations

Further content analysis is required in order to better identify contributions to the field of study alongside emergent theories and methodologies. Foreign language works are in need of review, particularly those in French, Spanish, and Portuguese. Given that the majority of the existing English language research is on prolific surf tourism areas in Australia, Indonesia, and the USA, there exists an opportunity to conduct research in new or less-publicized surf tourism destinations, such as much of coastal and insular Africa, South America, India, and East and South-east Asia. Along this line of thinking, research can broaden to include countries where although surf quality may be somewhat marginal, other tourism experiences (such as cultural or adventure tourism) are already shared with surfing, such as in Vietnam, Thailand, Malaysia, Myanmar, or Bangladesh. With the growth of the international and interdisciplinary field of tourism, and given the increased petition for empirical research by

graduate students and faculty, surf tourism research offers a new and dynamic area and element of inquiry for students and theoreticians alike. As this new body of research continues to expand, future systematic reviews can narrow the scope and criteria for inclusion of studies which more clearly define the field.

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Notes

- [1] Includes two journal articles (Dolnicar, 2005; Dolnicar & Fluker, 2003a) not authored by graduate students and based on primary data from a graduate report by Ponting (2000).
- [2] Includes two conference papers (Dolnicar & Fluker, 2003b, 2004) not authored by graduate students and based on primary data from a graduate report by Ponting (2000).
- [3] Note that the discrepancy between 33 non-refereed studies (from Table 1) and the 32 commissioned studies indicated here is due to subtracting two non-commissioned studies (non-refereed ENCORE reports) by O'Brien (2006, 2007a) and adding the commissioned study by Ryan and Cooper (2004) which appeared in an international journal.
- [4] Neil Lazarow completed his PhD in 2010 and Chad Nelsen in 2012.

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PAPER II

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**Developing a Surf Resource Sustainability Index as a Global Model for Surf
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Developing a Surf Resource Sustainability Index as a Global Model for Surf Beach Conservation and Tourism Research

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The growth of surfing activities and surf tourism has gained significant attention in the academia during the past decade. This paper is aimed at developing a framework of indicators and methods used in assessing the sustainability factors of surf sites. The research puts forward a Surf Resource Sustainability Index (SRSI) as a conceptual model to study the sustainability of surf tourism sites. The literature review, previous experience, and discussion with veteran surfers and scholars were used to develop indicators and determine their measurability and aptitude. Index pilot testing was carried out in Phuket, Thailand, where an emerging surf culture and tourism market segment add to the island's bustling economy and coastal resource-management issues. The case study underpins the importance of social, economic, environmental, and governance factors in the conservation process. The SRSI metrics provide a direct method for assessing surf sites and offer tangible benefits to surfers and other stakeholders.

Key words: surf tourism, coastal resources, sustainability indicators, index, Thailand

Introduction

Surfing is generally defined as the act of riding an ocean wave while standing on a surfboard and broadly includes other aspects of wave riding, such as riding prone on a “bodyboard” or simply “bodysurfing”. Surf tourism is essentially travel for the sake of surfing and has

evolved into a rapidly expanding market segment of the wider tourism industry, gaining significant attention in the academia during the previous decade (Martin & Assenov, 2012a). For the purposes of this research, the broad and contemporary definition of “surf tourism” has been adopted from Tourism New South Wales (2009):

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An activity which takes place 40 km or more from the person's place of residence, where surfing or attending a surfing event are the primary purpose for travel. Surf tourists stay at their destinations for at least one night or can undertake their visit as a day trip. (p. 3)

In recent years, recreational surfing and surf tourism have emerged as multibillion dollar industries encompassing equipment manufacturers (such as *Cobra International* in Thailand), clothing corporations (such as *Quiksilver*, *Billabong*, and *Rip Curl*), amateur and professional sporting events, and domestic and international tourism. As surf tourism activities and the industry grow and expand around the world, surf beaches are under ever-increasing pressures from tourism, coastal development, pollution, and other anthropogenic factors, and this research introduces and illuminates surf sites as valuable and integral natural resources.

Rationale

The premise of the research is that the conservation of surf tourism sites can benefit from the innovation of a *Surf Resource Sustainability Index* (SRSI). The paper is aimed at developing and defining the indicators most relevant to gauging a surf site's aptitude for conservation in four contexts: social, economic, environmental, and governance. SRSI is designed as a practical hands-on methodology for the assessment of surf beaches and is based on earlier research by Martin and Assenov (2012b, 2012c). Although research into the sustainability of tourism sites is not new, this study contributes new knowledge to the emerging modern-day field of surf site conservation. Given the modest scholarly attention in this area, the research develops

new and direct methods and metrics for assessing surf sites and offers tangible benefits to surfers, policy-makers, managers, and theoreticians. Accordingly, the broad intention of the research is to develop a systematic and open-source method for use by stakeholders from diverse backgrounds. This type of approach has proven particularly effective and widely applicable in conservation field studies wherein the key objective is to create a user-friendly research instrument geared for achieving results rather than exclusively engineering a system of measurement for academics (TNC, 2007).

The model is empirically tested through a pilot study of two surfing sites in the resort island of Phuket, Thailand. Phuket was chosen as a case study site given the rapid growth of surf culture and surf tourism, mounting attention to sustainability issues, and the uniqueness of the Andaman Sea region as a new surfing destination. Martin (2009, 2010a, 2010b, 2013a, 2013b) and Martin and Assenov (2011) identify Phuket as the key surfing location in Thailand based on its natural resources, the consistency and quality of waves, and the proximity of surf sites. Given that the island has over 700 hotels and an estimated 45,000 rooms (C9hotelworks, 2013) there are countless environmental and sustainability issues raised about the rapid development and urbanization of Phuket by the private and government sectors and in the media. However, the researchers acknowledge that small islands have an eco-system of their own and the impacts are not similar to large coastal regions. The paper recognizes that island destinations are particularly vulnerable to tourism impacts and many islands rely on surf tourism as part of their growth strategy for adventure tourism (Buckley 2002a, 2002b, 2006).

Figure 1 illustrates the main surfing sites on the island of Phuket, Thailand, and the pilot survey sites (Nai Yang and Kata Beaches) have been marked.

Relevant Literature

Surf Tourism Research

Surf tourism research is an outgrowth of the research literature related to the activity of surfing framed in the discipline of tourism. Martin and Assenov (2012a) identify that surf tourism research as a field of study is little more than a decade old, and therefore the majority of research is grey literature. They found that until 2011 there were only 156 pieces of related research (including journal articles, book chapters, Master's and Ph.D. theses, conference papers, and commercial materials). Currently, published surf tourism research includes topics on the visitation of surf sites for recreation and tourism in both domestic and international frameworks. The most prolific research areas are: marine tourism and water-based tourism (Orams, 1999; Ryan, 2007); adventure tourism (Buckley, 2003, 2006, 2007, 2010; Reynolds & Hritz, 2012); sustainable tourism (Buckley, 2002a, 2002b; Ponting, 2009a; Wearing & Ponting, 2009); entrepreneurship and the growth of surf tourism as a new industry (Buckley, 2002a, 2002b; Poizat-Newcomb, 1999a, 1999b; Ponting, 2009a; Ryan & Cooper, 2004; Wearing & Ponting, 2009); image, marketing, and the commodification of the industry (Buckley, 2003; Ormrod, 2005; Ponting, 2009b; Ponting, McDonald, & Wearing, 2005); behavioral and market segmentation (Dolnicar, 2005; Dolnicar & Fluker, 2003); psychological constructs of surfing space (Ponting, 2009b; Preston-Whyte,

2001, 2002); surf events (Getz & Fairley, 2003; Getz, O'Neill, & Carlsen, 2001; Ntloko & Swart, 2008; O'Brien, 2007; O'Brien & Chalip, 2008; O'Neill, Getz, & Carlsen, 1999); and socioeconomics, particularly in the discussion of domestic tourism (Lazarow, Miller, & Blackwell, 2007, 2008; Nelsen, Pendleton, & Vaughn, 2007).

Two practical and theoretical areas of consideration are most evident in the surf tourism research literature. First, there are the positive and negative effects that surf tourism activities have on the developing world (Buckley, 2002a, 2002b, 2007; Ponting, 2009a, 2009b; Ponting et al., 2005; Wearing & Ponting, 2009). Second, there is concern for age-old surfing locations in developed countries in mainly urban settings which experience high-use, high-impact visitation from predominantly domestic surfers seeking recreational space (especially in Australia, the USA, and the UK) (Lazarow et al., 2007, 2008; Marchant & Mottiar, 2011; Nelsen et al., 2007; Phillips & House, 2009; Shaw & Williams, 2004; Shipway, 2007). Whereas research in the former is directed toward capacity management in relation to social, economic, and cultural interaction with impacts on rural host communities, research in the latter area is focused on the threats and impacts of urbanization (including coastal development) with negative implications for the resources as well as the intricacies of small business developments and economics.

Surf Tourism Site Conservation

Surf site conservation strategy first sprang from within the diverse surfing communities around the world, particularly those in Australia, New Zealand, and California, USA. Scarfe, Healy, Rennie, and Mead (2009)

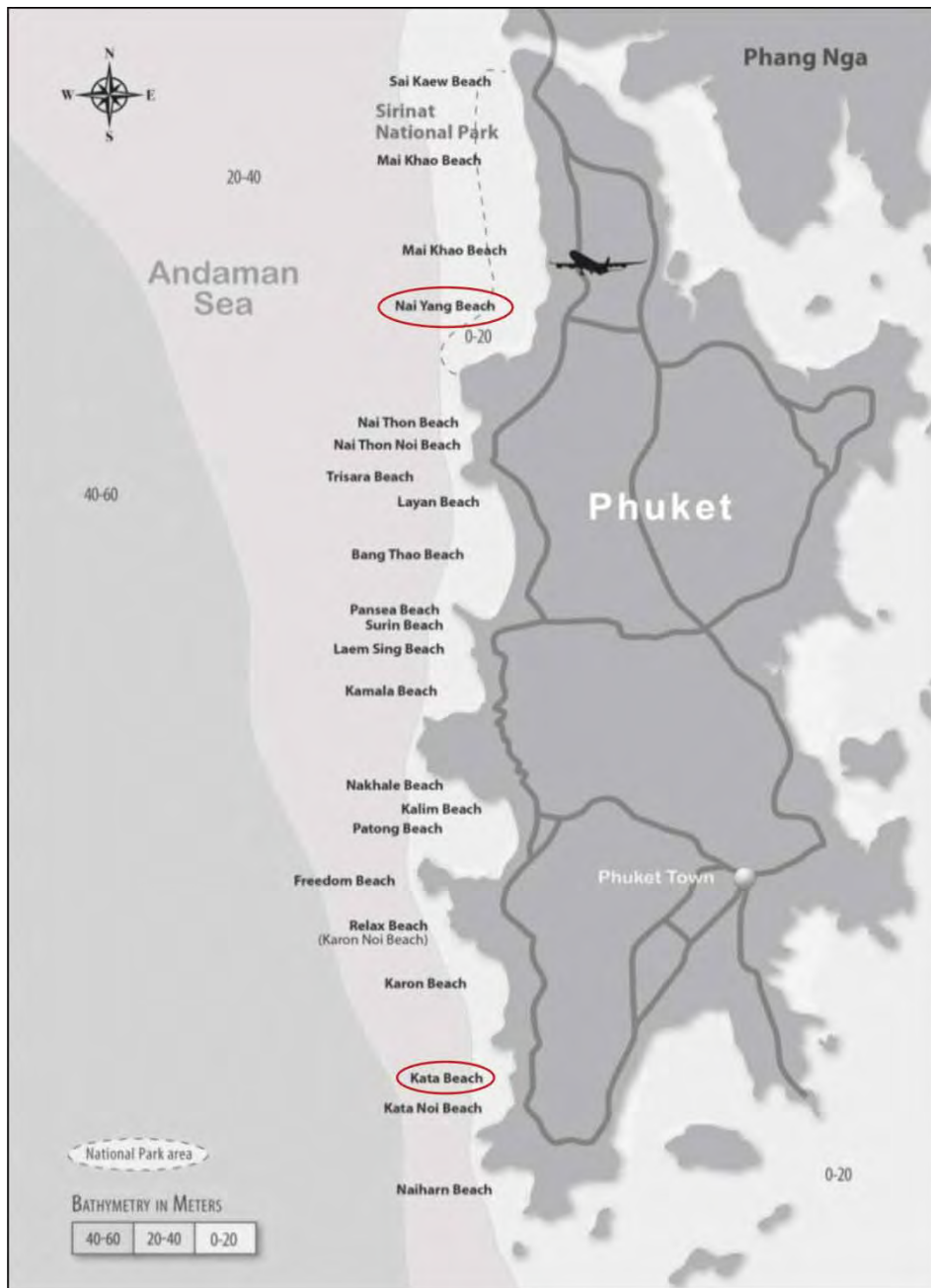


Figure 1 Key Surf Sites in Phuket.
Source: Martin (2010a, 2010b).

suggest that as the social, economic, and environmental benefits of surfing breaks are realized, surfers are increasingly integral in coastal resource management. For example, surfer and academic Neil Lazarow expanded Lanagan's (2002) concept of *Surfing Capital* to include a range of ecological features of surfing areas as both intrinsic and valued assets (Lazarow, 2010; Lazarow et al., 2007, 2008). He indicates that wave quality and frequency are ecologically dependent and easily altered by the construction of coastal protection/amenity structures (e.g. groynes, seawalls, piers, breakwaters, and/or artificial reefs) or through sand management (e.g. beach filling, dredging, and/or sand bar grooming); he notes that environmental or biophysical conditions may affect a surfers' physical health, including biological impacts (e.g. water quality or nutrient loading); and he suggests that climate change and amenity of the surrounding built and natural environment are also of key significance (Lazarow, 2010; Lazarow et al., 2007, 2008). In making a clear connection between the ecological health of marine systems and surfing, Shuman and Hodgeson (2009) note that coral reef areas are among the best locations in the world for surfing and stress the significance of increasing knowledge and awareness of the health of coral reefs on a global scale in an effort to actively assist in the conservation of these ecosystems.

Butt (2010) identifies a number of ways in which waves can be lost, including the construction of solid structures (which are common and permanent), dredging river mouths and canals, chemical pollution and sewage, oil spills, nuclear waste, litter and marine debris, and loss of access. Lazarow (2010) offers four key strategies to manage user impact and resource base at surf locations: (1) do nothing; (2) legislate/regulate; (3) modify

the resource base; and (4) educate/advocate. Accordingly, inherent strategies to manage and protect surf sites include the policy development of *Surfing Reserves* (Farmer & Short, 2007; FFLA, 2010 Short & Farmer, 2012; Tourism New South Wales, 2009) wherein dialogue is generated for the theoretical, practical, and political applications of surf site recognition and conservation. Farmer (2011) suggests that the cornerstone for surfing reserve development lies in raising awareness and formally recognizing the waves, surfers, and surf culture in eight aspects: recording the "surfing history" of the site; proactively protecting and preserving sites; discouraging "early" threats; empowering and galvanizing communities; claiming a form of sovereignty by the surfers; creating a legislative basis for the future; educating and engaging governments, media, industry, and surfers; and creating public awareness of sites and surfers. To this end, the promulgation of surfing reserves as natural sanctuaries has four important aspects (Lazarow, 2010): it recognizes surfing as the primary or one of the most important uses of a particular area; it puts all parties on notice that the surfing community cares passionately about *Surfing Capital* in a particular area; it recognizes the socio-economic and cultural value of surfing to a particular area; and it recognizes that the surfing community is interested in developing a long-term plan to manage and protect a particular area, ideally in conjunction with the local land management authority.

Tourism Sustainability Indices

Sustainability has emerged as a critical policy focus across the world – and organizations are increasingly required to explain their performance on a range of natural resource

management challenges with reference to quantitative metrics (Emerson et al., 2010). An index for sustainable tourism can be used to monitor the desirability of future tourism developments from the point of view of sustainability and as a benchmark against which different sites or destinations can be evaluated (Basu, 2003). Index design is a detailed and lengthy process which requires the development of indicators or pointers which serve to measure and calibrate attributes. Indices are often developed in the context of a need for better policy design whereby highly data-driven information can be processed accurately.

However, tourism sustainability is a complex concept due to its latent, multidimensional, and relative nature (Pulido-Fernandez & Sanchez-Rivero, 2009) and therefore quantifying it and measuring it with indicators is intrinsically difficult. As a result, although many attempts have been made to develop sustainability indicators, there is no single set of indicators that can be universally applied to allow cross-sectional comparisons of tourism destinations.

To address the multidimensional nature of sustainability, Pulido-Fernandez and Sanchez-Rivero (2009) develop a sustainable tourism index which groups indicators into four dimensions: environmental, social, economic, and institutional, thus allowing for a more comprehensive evaluation of sustainability of a destination. Subsequently, their overall composite index can be used to analyze the situation at tourism destinations and facilitate decisions made by their stakeholders whereby the same system of indicators is used in calculating the index for different tourism destinations, which allows for the comparison of the destination characteristics in terms of tourism sustainability (Pulido-Fernandez & Sanchez-Rivero, 2011).

Tanguay, Rajaonson, and Therrien (2011)'s response to the complexity and multiple interpretations of sustainable tourism is the initial selection of an extended list of 507 potential sustainable tourism indicators, from which, through the application of several selection criteria, they extract a parsimonious list of 20 operational indicators. They recognize that indicators are likely to evolve over time, and there is a need to review them periodically. The most important attributes of indicators are defined as credibility, pertinence, and value.

Surf and Beach Quality Indices

The US-based *Surfrider Foundation* has been at the forefront of surf site conservation for some time and publishes an annual *State of the Beach Report* whereby various assessments of beach and water quality are outlined. In an effort to offer and implement a standardized methodology for assessing ecological health, the *Surfrider Foundation* has identified metrics which provide an instructive picture of the status of beach systems (Surfrider Foundation, 2012a). A systematic procedure for assessing ecological health has been engineered to meet the goals of ecosystem-based management and to help bridge the gap between science and policy. Four sets of metrics are used to complete ecological health assessments of sandy beaches: (1) quality of habitat; (2) status of "indicator" species; (3) maintenance of species richness; and (4) management practices (Surfrider Foundation, 2012b). Each beach system is rated based on the four criteria resulting in a composite "ecological health" score. However, Pijoan (2008) is perhaps the first to conceptualize a basic index specifically for the assessment surf sites in physical and

social contexts. Her research offers an *Integrated Aptitude Index* for surf beaches in Ensenada, Mexico, which is based on the sum of indicators rated in terms of quality, particularly beach and water quality; seasonality, types and quality of waves (break singularity); local and international users (contribution); and infrastructure (access, facilities, and parking).

Using a more complex set of metrics, Ariza et al. (2010) designed an integral quality index for urban and urbanized beaches whereby a composite index, based on function analysis and including 13 sub-indices, was developed. The sub-indices assist with the environmental management and monitoring of beaches and in the planning process. Their research identified that the index, as a “hierarchical management scorecard” made planning more proactive, especially by synthesizing the state of the most important beach processes.

SRSI Framework

Indicator Development

Social, economic, environmental, and governance indicators for surf tourism sites were developed from primary and secondary sources and based on Martin and Assenov (2012b, 2012c)’s framework. Research conducted by Martin and Assenov (2012a) identified key scholars in the emergent field of surf tourism, and consultations with six of these authors were carried out through the exchange of emails and were foundational in developing the indicators and assessment criteria for this study. Other primary sources of knowledge included prior experience, field observations, and 89 semi-structured interviews with experienced surfers from Asia, Australia, Europe,

and the USA. Interviews were carried out in Phuket, Thailand, and online via Skype. Respondents were chosen based on their position as key stakeholders and for their practical experience and knowledge of the resource. They were of diverse backgrounds and included academics, surf industry professionals, veteran lifeguards and lifesavers, professional surfers and international surf tourists. Secondary sources included the systematic review research on surf tourism literature as framed by Martin and Assenov (2012a) which incorporated research appearing in journals, conference papers, commercial studies, and graduate theses. The researchers also looked at the *National Surfing Reserve* (NSR, 2013) and *World Surfing Reserve* (WSR, 2013) nomination and management criteria as well as the aforementioned criteria for *Surfing Capital* (Lazarow, 2010; Lazarow et al., 2007, 2008).

Twenty-seven indicators were selected based on their importance for conservation in terms of integrity, use, value, quality, and sustainability attributes. The term “conservation aptitude” was employed in order to place the measurement scale into a positive context. For the purposes of this study, “aptitude” can be further defined as potentiality, propensity, or general suitability. Indicators, assessment criteria, and implications form modules and make up the four indices (social, economic, environmental, and governance) (as suggested by Pulido-Fernandez & Sanchez-Rivero, 2009).

Preliminary SRSI indicator validity was further investigated by Martin and Assenov (2012c). The study found that nearly all indicators were identified as highly important by respondents and note that it is not surprising given that the indicators were selected in the first place based on their presumed significance as essential surf site conservation markers.

However, their study accounts for the fact that all respondents, including the scholars, were also surfers, which may have biased the weighting of the indicators.

Multidimensional Framework

Given the difficulty in quantifying indicator criteria and data, and to improve the verifiability and validity of the index, a multidimensional framework for the description of conceptual and analytical values has been constructed, appearing in two layers, qualitative/quantitative for indicators and purely quantitative for the indices and the composite index. Thus, the micro-level forms the qualitative layer which is based on observation and description, and subsequently a value is attached at the discretion of the researchers (as illustrated in the pilot study), whereas the macro-level represents the combined indicator assessment and is purely numerical. The generation of qualitative data gathered from field work and framed into the 27 indicators is foundational to the modular design of the SRSI. It is assumed that the systematic and qualitative assessment of sites at the indicator level would be of particular interest to policy-makers.

The field assessment measurement scale is based on a 1–5 number value (*Likert* scale) such that high values or qualities reflect a high aptitude for conservation. Thus, the minimum and maximum indicator values are 1 and 5, respectively, and fall into the following five categories: very low aptitude for conservation (1.00–1.80); low aptitude (1.81–2.60); moderate aptitude (2.61–3.40); high aptitude (3.41–4.20); and very high aptitude (4.21–5.00). A reverse scale is applied for two negative indicators (i.e. marine life

hazards and physical hazards). Indicators are listed alphabetically within each index.

In line with methodologies commonly employed in calculating indices, and to construct the basis for a straightforward and practical SRSI design, the index values are calculated as equally weighted averages of the indicators composing them, and the composite index is calculated as an equally weighted average of the four indices. Thus, an arithmetic mean was employed following findings by Martin and Assenov (2012c) where respondents of various backgrounds identified all four indices to be of comparably high importance. When combined these indices comprise the SRSI (Tables 1–4).

Thailand SRSI Pilot Test

The pilot testing at Phuket, Thailand, was based on the assessment criteria and implications for each indicator (from Tables 1–4). Initially, general data were collected through 71 semi-structured interviews with foreign resident and Thai surfers at the Phuket Surfing Contest in September 2011 and 2012, at local surf sites during 2012, and through previous coastal surveys conducted by Martin (2009; 2010a, 2010b, 2010c, 2010d, 2013a) and Martin and Assenov (2011). The respondents were not asked to rate the 27 indicators or make quantitative site assessments; rather, the interviews inquired after their insights into socioeconomic, environmental, and management concerns at local surf sites on the island. Ultimately, visits to field sites were carried out prior to the time of writing and individual site assessment details and values were prepared by the researchers based on a synthesis of the collected primary data from the respondents and from the individual observations.

Table 1 The SRSI. Societal Index (SocSRSI)

Indicator	Assessment criteria	Implications
(1) Clubs – boardriders	Identify the number of private or public clubs or organizations who access and use the site, including the number of members in a given club. Identify the activities and actions undertaken by the club	Boardriders clubs can provide a level of organized communication and collaboration among surfers. In some cases, they are not-for-profit organizations which may provide custodianship of the site
(2) Clubs – lifesavers	Identify the number of private or public lifesaving organizations, such as the number of members, types of services provided, including education for youth or the community	Lifesaving clubs promote public water safety and site awareness, particularly for local youth. Clubs may be a sign of the benefit of surfers as surf lifesavers and indicate site custodianship
(3) History	Document the number of years that the surf site has been surfed. Assess the usage, popularity, number and types of surfing activities occurring at the site over time. Consider the pre-surfing significance of the site (e.g. indigenous cultural significance)	History provides context to the surf site background and culture and serves as a key factor in the argument for site recognition and protection, particularly when aiming for surfing reserve status
(4) Public safety	Assess the presence of crime, such as vehicle safety, theft, violence, or local gangs. Consider the past record and present account of public safety at the site	A safe and secure atmosphere contributes to site integrity and attracts or detracts community use and participation accordingly
(5) Social experience	Gauge the societal conditions surrounding the surfing experience at the site. Account for local ethics. Seek local knowledge on the integrity and use at the site	As surf sites provide benefits in terms of health, well-being, destination awareness, and community spirit, these difficult-to-measure attributes are increasingly relevant (i.e. the human experience)
(6) Socio-psychological carrying capacity	Estimate the number of surfers the area can accommodate in terms of crowdedness (i.e. gauge the size of the surfing area and type of wave	Use and satisfaction are strongly influenced by the number of surfers as well as the local ethics of surfers at the site. A high social carrying capacity

(Continued)

Table 1 Continued

Indicator	Assessment criteria	Implications
	relative to visitation). Consider site characteristics, such as a beach, reef, or point breaks	may increase the argument for surf site conservation
(7) Surf community	Estimate the number of surfers in the community and identify any surfing community-supported actions or activities at the site	A strong surfing community can provide a social base and structure for surf site custodianship
(8) Surf events	Assess the number and size of contests per year, including the number and types of participants (e.g. local and international competitors, amateur and professional surfers, spectators and other stakeholders). Consider the positive and negative social implications on the surfing community	Surf events generate awareness of the surf site and the significance of surfing. Events may help to identify surfers and the surfing community as stakeholders of the resource and to facilitate communication. Social experience and carrying capacity may indicate a need for research into the wider implications of events, particularly in high-use urban areas

Table 2 The SRSI. Economic Index (EconSRSI)

Indicator	Assessment criteria	Implications
(9) Surf amenity and infrastructure	Account for the presence of beneficial infrastructure and amenities at the site, such as parking areas, walkways, showers, and bathrooms. Identify amenities for public safety (e.g. fences for unstable cliff areas or stairs on slopes). Assess the success or failure of <i>Artificial Surfing Reefs</i> (ASRs) if any	Surf site amenities may provide convenience and safety, and create awareness of the site, allowing communities improved interaction with the site; this may be particularly relevant to families with children
(10) Surf events	Identify the key stakeholders' economic interests and relationship with the site. If possible, estimate the short-term and long-term economic contributions of surf events by conducting studies by established methods (i.e. economic impact studies, <i>Hallmark Events</i> , or event-leveraging studies)	Surf events create a focal point for economic impact assessment and stakeholder presence. The results of surf event economic impact studies are progressively of interest to stakeholders
(11) Surf industry and commercial activity	List the number of surf shops, clothing outlets, or other businesses catering directly to surfers at or near the site. Consider aspects of corporate surf presence at the site. Estimate direct values to the local economy and account for other general commercial activities attracted to the site. The affects or changes in real estate values may be considered	Surf sites are increasing exploited in terms of surf-related enterprise, including surf-entrepreneurs and corporate interests. The presence of surf industries and other commercial activities at the area form an economic hub which may provide an impetus for the protection of the site
(12) Surf-related non-market values	Estimate the economic significance of the site in terms of social, cultural, existence, vicarious, and other non-market values. Consider the host	Non-market values are not easily measurable in monetary terms (e.g. social and cultural values, health and fitness, aesthetics and nature viewing,

(Continued)

Table 2 Continued

Indicator	Assessment criteria	Implications
	community along with local and tourist surfing populations. If appropriate, employ contingent valuation methods, such as <i>travel cost</i> or <i>willingness to pay</i>	beach visits, loss of recreational opportunities due to anthropologic or natural environmental disasters, etc.), yet they are significant in terms of the broad economic implications of surf sites. Non-market values are increasingly relevant in the argument for conservation and protection
(13) Surf tourism	Estimate the number of domestic and international competitors and tourists who interact with the site. Gauge the economic impacts related to the surf tourism experience, including hotels available to surf tourists, surf lessons, and surfboard rentals. Consider various market segments (i.e. “hard” surf tourists, “soft” surf tourists, and friends and families of surf tourists)	Given the limited literature on the economic benefits and impacts surrounding domestic and international surf tourism in rural and urban environments, research in this area is foundational and significant for the sustainable use and development of sites

Table 3 The SRSI. Environmental Index (EnvSRSI)

Indicator	Assessment criteria	Implications
(14) Biodiversity	Assess the overall health and vitality of the littoral as a natural environment. Evaluate the condition of the coral reef and the presence of marine life. Seek local knowledge, access literature, or conduct biodiversity research when feasible	The overall existence and health of flora and fauna are relative to the pressures from external forces and the estimated site resilience. Although measuring biodiversity as a scientific process is the preferred approach, careful observation can serve as an indication of the broad issues
(15) Coastal engineering*	Identify the significance and effects on the environment of coastal engineering projects or structures (i.e. groynes, seawalls, piers, breakwaters, and artificial reefs), including sand management projects, such as beach fill, dredging, and/or grooming. Document physical changes to the site. Account for current and future coastal engineering plans. Consider positive and negative impacts	Coastal engineering projects are a significant factor affecting the resource base with high potential to change the natural dynamics of the surfing area. While in some cases surf sites have been created as a result of various projects, there are a considerable number of sites which have been permanently altered or entirely destroyed. Pristine sites (altogether free from engineering projects) receive a high environmental score
(16) Eco-physical carrying capacity	Document the level of usage in relation to user impacts in order to determine the natural carrying capacity of the site (i.e. how many surfers or visitors can the site accommodate before negative environmental consequences are likely to occur). Consider effects of surf charters' anchors on reefs	Impacts on local flora and fauna, such as foot traffic over sand dunes, encroachment on bird nesting areas, or surfers stepping on coral reefs, damage from boat anchorage, etc. are indicators of the site's aptitude to sustain human interaction and conservation

(Continued)

Table 3 Continued

Indicator	Assessment criteria	Implications
(17) Hazards – marine life**	Document the known or reported presence of aquatic life or marine predators which may pose hazards to site users, including sharks, sea urchins, jellyfish, man-o-war, caiman or saltwater crocodiles, sea snakes, etc. Seek and document local knowledge	Marine life hazards are highly relevant to the human interaction with the resource and are inherent to conservation planning. While marine hazards may pose threats to site users, they are also a component to biodiversity
(18) Hazards – physical**	Identify and document moving and stationary physical hazards. The former could be the presence of dangerous ocean currents, such as rip currents and headland currents; the latter include the presence of features, such as rocks (submerged or near shore), unstable cliffs, unsafe access on trails, etc.	Physical hazards at surf sites are a public safety issue which, if identified, can be managed. Implications for identifying hazards may include intervention, such as signage or constructing fences above unstable cliff areas to protect visitors
(19) Quality – beach	Assess the overall condition of the beach, including its general aesthetics, cleanliness, and presence of beach litter; identify aspects of urbanization or encroachment; document signs of erosion or other degradation of the site	The quality and integrity of the site are key indicators for the value, concern, and custodianship at the time of assessment. In terms of natural quality and conservation, visible human impacts and development are significant factors to be weighed along with other aspects of degradation, such as coastal erosion
(20) Quality – water	Identify point and non-point sources of pollution. If possible, assess the turbidity and levels of nutrient loading at the site. Document the presence of marine debris and plastics in the water and consider their sources. When appropriate and possible, conduct water testing using test kits or other suitable methods. Interview surfers regarding health issues	Water quality is a highly significant factor in the integrity and sustainability of surf sites. Issues may stem from surrounding watersheds, urban runoff and sewage, construction sites, agriculture, aquaculture, golf courses, industrial discharge, and the general levels of nutrients or bacteria including <i>Escherichia coli</i>

(21) Surf type and quality	Identify and document the local wave types, average wave frequency during the year or season, and the overall seasonality of the site for surfing. Estimate the average wave heights alongside the number of available surfing days per year. Account for various skill levels and stakeholders when estimating “quality”. Seek local knowledge	The implications of wave types and overall wave quality include a number of aspects and considerations, including the diverse skill levels of surfers and interests of stakeholders, and are therefore somewhat subjective. For example, easy-to-ride point breaks, fun beach breaks, or dangerous barreling waves are of “quality” to distinct groups
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*If effects are positive, give high score; if effects are negative, give low score.

**Reverse scale: if hazards are high, give low score; if hazards are low, give high score.

Two key sites in Phuket, one urban (with high surf tourism use) and one rural (with low surf tourism use), were selected for testing the SRSI metrics. Although there are some 30 surf sites in Phuket (Martin, 2010a, 2010b, 2013a), the selection of one urban and one rural site serves to place the study in a comparative context. Both sites had been previously recommended for surfing reserve consideration (Martin, 2010a, 2010b). The highly urbanized *Kata Beach* in southern Phuket, with various beach breaks, is the focal point of surfing and surf culture in Thailand, the most visited site by traveling surfers, and known among surfers to have issues of water pollution, carrying capacity, and mixed uses with other activities such as swimming and jet-ski and parasail operations (Martin, 2010a, 2010b). The comparatively rural *Nai Yang Beach*, located in the Sirinart National Park (NP) of northern Phuket, encompasses several different reef and beach breaks and is known among surfers for its relative natural integrity in terms of NP protection, minimum foreshore development, and reasonable water quality (Martin, 2010a, 2010b). Distinctions for each site are placed in a regional rather than an international context (i.e. conceptually, each area is assessed in context with other areas in Phuket). The purpose of the pilot survey was to test SRSI metrics in the field in order to refine the methodology (Tables 5–12).

Pilot Test Results

SRSI composite values for both Kata Beach and Nai Yang Beach were at the moderate level (3.01 and 2.85, respectively) but for different reasons. Considerable variance was found between the urban and rural surf beaches at the individual indicator and index

Table 4 The SRSI. Governance Index (GovSRSI)

Indicator	Assessment criteria	Implications
(22) Beach and water safety	Estimate the number of lifeguards (if any) as well as lifeguard towers and facilities (if any). Determine the seasonality of services. Gather statistics on drowning rates (when possible)	Beach and water safety are highly relevant to the sustainable use of the area. Beaches with lifeguard presence may have a higher degree of safety management, particularly in developed countries
(23) Education and interpretation	Identify the types, numbers, and visibility of signage and interpretation at sites as well as printed materials which acknowledge the site and any relevant issues or aspects. Determine if there are currently or have been any community meetings, workshops, research, or advocacy for site integrity	The successful petition for conservation of natural sites is enhanced through the development and availability of information to stakeholders, including the public. The participation of the general public and various stakeholders in the education process is an indication of the conservation aptitude of the site. Edification may indicate the host community's psyche and sense of place
(24) Legislative status	Define the type or level of governance at the site, including entities or branches of local, state, or federal government with jurisdiction. Seek clarity on existing conservation policy or protection status (if any). Identify any overlapping policies or laws in the context of Integrated Coastal Zone Management	The implications of legislative status are wide ranging and may be anchored to the indicator for "management". Determining the conservation status is a key starting point and strong indicator for site conservation. Examples of legislation status for surf sites include NP, marine-protected area (MPA), national surfing reserve, and world surfing reserve
(25) Management	Identify the existence of guidelines or standards for activities at the site and assess, as best as possible, the effectiveness of enforcement (i.e. gauge the active policy measures in context and practice)	Implications of management include aspects of multi- and mixed-use areas alongside beach and ocean safety. Research literature indicates that conservation management is tied to planning, enforcement, and stakeholder engagement
(26) Not-for-profit organizations	Determine the number or type of not-for-profit or related activity affecting authority and activity at the site (if any). Identify past and present successes and failures. Consider project support and potentialities	Not-for-profit organizations may help to identify, monitor, report, and support issues related to the integrity of the site and usage. These organizations are an indicator of conservation aptitude as they signify

<p>stakeholder engagement (e.g. <i>Surfrider Foundation</i>). However, successes and failures must be determined jointly and in context</p>	
<p>As conservation normally considers the interaction of stakeholders with the resource as a component to sustainability, the presence of entities or infrastructure inhibiting access (public, private, or governmental) is an indication of reduced conservation aptitude. In unique cases, limited or restricted access may perform a conservation role by limiting over-use of the site</p>	<p>(27) Public access Identify the level of accessibility alongside laws or other issues surrounding public right of entry, such as laws, hotels, or infrastructure which inhibit or prohibit entry to sites. Consider if access restrictions at rural sites or islands are in an agreement with traditional resource owners and provide any conservation function (e.g. indigenous management)</p>

levels. For example, the urban Kata Beach index reveals a high societal aptitude (3.50), high economic aptitude (3.80), moderate environmental aptitude (3.25), and very low governance aptitude (1.50). In contrast, the rural Nai Yang Beach index reveals a low societal aptitude (2.38) and low economic aptitude (2.0), but high environmental aptitude (3.50) and high governance aptitude (3.50). This helps to identify the significance of individual indices and the potential for comparisons among indices at a particular site or cross-sectional comparison with other sites (Table 13).

The pilot tests were functional in terms of using the indicator criteria to pinpoint the attributes at each site within the context of each index. The field test revealed that assigning values to the indicators in the societal index (*socSRSI*) and the governance index (*govSRSI*) was a relatively straightforward process (save for the indicator for management which includes criteria for enforcement), while the calculation of the economic index (*econSRSI*) was more challenging in terms of, for example, surf industry and commercial activity or surf-related non-market values, as these factors can require specialized research methodologies. The environmental index (*envSRSI*) estimate was somewhat subjective in terms of measuring the indicators with temporal variance, such as beach quality, biodiversity, and water quality, where the assessment was based on the researchers' judgments and secondary data rather than precise scientific measurement.

The Phuket pilot test approach encountered challenges in assigning site-specific ratings for indicators. For example, the indicator for history at Kata Beach was assessed as high relative to other beaches on Phuket; however, if the assessment was global in scope and famous surf beaches in Australia

or Hawaii were considered as benchmarks, then Kata Beach would likely receive a low score. This may underscore the importance of the localized approach to ratings whereby the beaches of a given island or coastal area are assessed in context with each other; such a cross-sectional analysis improves the reliability and validity of site evaluation outcomes. Furthermore, testing the index in a small island setting such as Phuket is inevitably dissimilar to testing in a large and highly urbanized coastal region, and future applications of the index can be adapted to address, for example, problems faced by “global surf cities”, such as the Gold Coast, Australia, Hossegor, France, and Donostia-San Sebastián, Spain (World Surf Cities Network, 2013).

Implications

At the base of the study is the process of identifying key indicators and constructing a set of building blocks which include qualitative and quantitative metrics. The research finds that although it is intrinsically problematic to attach quantitative values to qualitative attributes, the process serves to catalogue and measure sustainability factors with two significant implications. The first is the creation of a standardized framework to study surf tourism sites within different contexts (e.g. social, economic, environmental, and governance); the second is focusing the attention on the diverse interests fundamental in the argument for surf site conservation (e.g. stakeholder values and perceptions), particularly at the indicator level.

The two-layered approach of SRSI serves to base the assessment through qualitative means whereby the descriptive component of each indicator offers validity to the assessment

process and third parties can cross-check the indicator values relative to the qualitative data. Additionally, qualitative assessments at the indicator level create a comprehensive register of information which can be used outside the context of the index by policy-makers, researchers, or other stakeholders. As descriptions are somewhat time-specific, they serve to document and catalogue surf site details, and these records can subsequently be used for trend analysis.

Methodological Issues

The research finds that while identifying indicators is reasonably straightforward, assessing and rating the subordination of criteria is a comprehensive task and somewhat ambiguous. For example, while indicators are employed as a baseline in developing a given index, they could be fractioned into sub-indicators in order to achieve a higher accuracy of measurement. In point of fact, many of the indicators employed here could also be developed at the index level, with sub-indicators as their constructs (“water quality” is an obvious example).

The temporal variance of indicators (i.e. a given indicator’s propensity for change) is also of significant consideration. For example, while water quality often degrades after heavy rains or may vary seasonally, coastal engineering projects are comparatively more permanent. Thus, the importance of indicators can be weighed against how their attributes or phenomena exhibit flux.

Furthermore, when placing indicators in context, the clear aim of the measures and framework, such as aptitude, sustainability, or management, must be carefully examined. The researchers acknowledge a limitation in

Table 5 Kata Beach SRSI Pilot Survey. Societal Index (SocSRSI)

Indicator	Site assessment detail	Assessed value
(1) Clubs – boardriders	Local surf club (<i>Kata Krew</i>) established in 2005 with 20+ members; regional surf club (<i>Phuket Boardriders</i>) had some presence but was dismantled in 2010; surf rental stands may have club atmosphere and foster organization and communication among surfers	3
(2) Clubs – lifesaving	There are currently no lifesaving clubs, lifesaving culture or educational programs for local youth. However, surfers regularly perform rescues and aquatic accidents and drowning are commonly reported in the media.	1
(3) History	Longest continuously surfed site in Thailand (from the early 1980s to the present). Focal point for Thai surfing culture and history	4
(4) Public safety	Relatively safe area with fairly low levels of personal or vehicle-related theft. Issues of public safety result mainly from mixed usage of area (i.e. shared use among swimmers, surfers, jet-ski, and parasail). Conflicts arise among surfers which occasionally spill over to the beach and parking area. Some history of crimes occurring at night	4
(5) Social experience	Overall good sense of experience for most surfers. Issues affecting experiential attributes include conflicts among surf tourists of various skill levels and nationalities (e.g. accidents among beginners renting boards and experienced surfers). Interviewees note an increase in conflicts among Thais and foreign surfers at the site	4
(6) Socio-psychological carrying capacity	Based on an average surfable day, maximum social capacity is approximately 50 surfers while the current average number of surfers in the water at a given time is roughly 30–50. Average surfers per day are roughly 120–150. Interviewees note that crowding has increased significantly since 2007 and that surf rage and aggression due to overcrowding had increased noticeably in 2011 and 2012	4

(Continued)

Table 5 Continued

Indicator	Site assessment detail	Assessed value
(7) Surf community	Approximately 80 surfers, including a mixture of Thai and foreign surfers. There is some division between Thai and foreign surf communities at the site. Seasonal surf tourists often integrate with the surfing community and influence the sense of surf community	4
(8) Surf events	Focal point for the development of organized surf contests (i.e. <i>The Phuket Surfing Contest</i>); occasional contests for kids (i.e. <i>Rip Curl Grom Search</i>). While interviewees report a sharp division between contests supporters and non-conformists dating back to the first contest held in 1999, the overall social aptitude has benefited from surf events	4
<i>Mean</i>	<i>High</i>	3.5

Note: The italic serves to delineate the index values from the individual indicator values.

indicator qualification and quantification and faced challenges in assessing some indicators' implications for sustainability, such as whether or not surf contests or an increase in surf tourism can be interpreted as a benefit or a detriment. Thus, for the purposes of this paper, the distinction was made to assess individual indicators through qualitative description targeting their "conservation aptitude". However, future research can address this and other choices in metrics and new and more comprehensive methods can be developed to improve the reliability and validity of the methodology.

The most significant factor in data collection and defining indicators was found to be the subjective nature of measuring various attributes (for the researchers and respondents alike). For example, what is considered good water quality at a select site in Thailand by surfer "A" visiting from the urban Huntington Beach, California, may be considered as poor by surfer "B" visiting from Hawaii; or a particular criteria of wave height and quality sought after by experienced surfer "C" from West Australia is likely very different from that of a beginner surfer "D" who would like to practice in smaller surf or take surf lessons.

While the pilot tests provided a baseline for adapting the assessment method employed in this study, they indicate the potential for a more comprehensive approach. For example, site assessment details and values could be prepared by a formative team of researchers or stakeholders. Such focus groups could include coastal resource specialists, tourism academics, consultants, or not-for-profit organizations and involve in-depth discussion at the indicator level during field research. Such an approach could serve to produce extensive reports, reduce bias and improve reliability.

Table 6 Kata Beach SRSI Pilot Survey. Economic Index (EconSRSI)

Indicator	Site Assessment Detail	Assessed Value
(9) Surf amenity and infrastructure	Basic amenities are available at the site with several small parking areas, some curbside parking, and one public bathroom with paid admittance. However, the southern end of the beach, a key focal point for surfing activities, has no parking or bathrooms. There are no public showers at the beach, save for those exclusively for hotel guests	3
(10) Surf events	Contributions to hotel occupancy (short-term benefits). Exposure of the site from contest sponsors' global advertisement (long-term benefits). Varying degrees of hotel and governmental support and advertising. Interviewees report disagreements among the municipality and sponsors resulting in the <i>Phuket Surfing Contest</i> being relocated to Patong Beach and this may indicate a reduction in economic aptitude	3
(11) Surf industry and commercial activity	Two beachfront surf shops and 7 surfboard rental stands. All 9 entities offer equipment for hire and surfing lessons. Given the seasonality of surfing at the location, commercial activities may not be centered on surfing	4
(12) Surf-related non-market values	Well-established local and foreign resident surfers exploit the area for social and cultural experiences, health and fitness, and recreational opportunities, and these activities contribute indirectly to the local economy. Although comprehensive economic impact methodologies were not employed, essential non-market values can be assumed	4
(13) Surf tourism	Overall dynamic growth in surf tourism activity at the site. Surf tourism is a key factor in addressing seasonality (i.e. drawing tourists to visit during the monsoon season and providing year-round employment). Interviewees report a significant increase in surf tourists in recent years, particularly beginners from Russia and Japan and experienced surfers from Australia and Japan	5
<i>Mean</i>	<i>High</i>	3.8

Note: The italic serves to delineate the index values from the individual indicator values.

Table 7 Kata Beach SRSI Pilot Survey. Environmental Index (EnvSRSI)

Indicator	Site assessment detail	Assessed value
(14) Biodiversity	Low visibility of marine biodiversity given the prolific level of development and the lack of healthy coral reefs. See “water quality” for other issues	2
(15) Coastal engineering	No apparent issues save for existing beachfront sea walls located above the high tide mark. Some potential negative effects to incoming ocean swell from offshore artificial reef projects	4
(16) Eco-physical carrying capacity	Minimal impact by surfers using the area. As sand dunes were previously replaced by foreshore development, there are currently no sand dunes to damage. Surfing area has sand bottom and surfers offer no threat to reefs located offshore	4
(17) Hazards – marine life	No shark sightings reported. No sea urchin or stingray accidents reported. Occasional jellyfish stings – <i>Reverse scale (low hazard receives high score)</i>	4
(18) Hazards – physical	No cliffs or physical hazards on land per se. Key issues are the shorebreak and ocean currents. Strong headland current along the southern end of the beach. Several rip currents at intervals down the beach. Mixture of swell types and periods during the monsoon season can cause dangerous flash rips to appear unexpectedly. Long-period swell during the off season can cause dangerous shorebreak – <i>Reverse scale (low hazard receives high score)</i>	3
(19) Quality – beach	Considerable beach litter during monsoon season (point sourced mainly from canals and the sea). Concessionaires normally clean their own areas in the mornings. Extensive foreshore developments fronting the surfing area and issues of encroachment by beach concessions are obvious	3
(20) Quality – water	Water quality degrades rapidly during rainy periods from urban runoff. Klongs (canals) located at each end of the beach release pollutants into the sea (northern end may be related to long-tail fishing boats and sewage from hotels). Interviewees complain of marine debris,	2

(Continued)

Table 7 Continued

Indicator	Site assessment detail	Assessed value
(21) Surf type and quality	<p>especially plastic bags, food wrappers, and fishing supplies in the surfline</p> <p>High aptitude of the site to accommodate wide variances in swell directions and types, tides, and winds. Particularly, the surf break can remain surfable during the predominant onshore monsoonal wind flow (i.e. the site remains surfable). The site offers areas for various skill levels, including beginners. Favorable sand bars develop for surfing during monsoon season (May to October). However, the off season sees unfavorable sand bars for surfing (i.e. sand re-deposits on the foreshore)</p>	4
<i>Mean</i>	<i>Moderate</i>	3.25

Note: The italic serves to delineate the index values from the individual indicator values.

Taking into account the inherent values of social and physical capital, the index could be adapted to the particularities of different surfing sites and to the needs and priorities of different stakeholders. For example, indicators could be assigned different weights based on surveys and one could compare the preferences and concerns of diverse stakeholder groups. Ultimately, the innovation of indices for precise applications can be designed, such as for gauging the conservation value of sites, identifying threats to the natural resource base, or addressing particular management priorities.

Theoretical and Managerial Contributions

The SRSI is a research approach designed to create an adaptable framework for surf site sustainability in two key areas: one being the

theoretical socio-dynamics thread; the other a practical policy and management thread.

The theoretical thread is related to the value brought to the academia through the bridging of existing knowledge gaps, standardization of terminology in the area, and the development of a new method for coastal studies by graduate students and field researchers.

Surf tourism research has for the most part focused on prolific surf destinations, and therefore new and less-known surf tourism destinations are not well represented in the tourism literature (Martin & Assenov, 2012a). This gap in the literature is addressed through this study and the development of a method that can be easily applied to destinations where surf quality may be marginal or seasonal but other tourism experiences (i.e. cultural or adventure tourism) are already shared with surfing, such as in Thailand and other South East Asian countries.

Table 8 Kata Beach SRSI Pilot Survey. Governance Index (GovSRSI)

Indicator	Site assessment detail	Assessed value
(22) Beach and water safety	One permanent lifeguard tower. Unpredictable presence of lifeguard services due to unstable lifeguard contracts. Interviewees note key issues of ungoverned mixed-use area (i.e. the surf zone is shared by swimmers, surfers, jet-ski, parasail, etc.). Aquatic accidents and drownings are commonly reported in the media. Surfers regularly perform rescues	2
(23) Education and interpretation	Several signs warning of surf-related ocean currents. However, these signs are only visible from particular locations. Information at hotels and from other sources is non-existent or very limited. Lifeguards may post red or yellow flags; however, tourists of different nationalities may not understand their significance	2
(24) Legislative status	Interviewees report that there are currently no policies for the protection of the site in the context of surfing or in terms of environmental management	1
(25) Management	The key issue at the site remains the unmanaged mixed-use area (surf zone is shared by swimmers, surfers, jet-ski, parasail, etc.). Interviewees report lack of management and enforcement, resulting in a string of injuries in recent years and environmental degradation	1
(26) Not-for-profit organizations	There are currently no not-for-profit organizations operating at the site (e.g. <i>Surfrider Foundation</i> or other entities)	1
(27) Public access	Foreshore development is highly condensed and considerably limits public access. The small parking area north of Kata Beach Hotel is the only public point of entry to the surf zone	2
<i>Mean</i>	<i>Very low</i>	<i>1.5</i>

Note: The italic serves to delineate the index values from the individual indicator values.

This research also provides a primary step in developing a standard lexicon for surf site sustainability and outlines and defines SRSI indicators in context. A standardization of

terminology for surf site evaluation and conservation can address the problems associated with the contradicting definitions in conservation studies and allows policy-makers and

Table 9 Nai Yang Beach (Center Reef) SRSI Pilot Survey. Societal Index (SocSRSI)

Indicator	Site assessment detail	Assessed value
(1) Clubs – boardriders	There are currently no surf clubs in the area; however, account should be taken of the nearby local kite-surfing club/culture during the monsoon season.	2
(2) Clubs – lifesaving	There are currently no lifesaving clubs or local lifesaving culture	1
(3) History	Undocumented surf history. The site has been visited by relatively small groups of surfers for the past 10 years. Interviewees note that the surf site may have been created only 12+ years ago when dead coral began to build up inshore of the reef causing the wave to peak and break on the outer reef	2
(4) Public safety	Good record of public safety and low crime within the NP. However, interviewees report that there have been several cars broken into in recent years	4
(5) Social experience	High sense of experiential quality. Interviewees attest to a sense of personal well-being in visiting the site. Surfers identify an ethic of self-regulation in the water with no concerns over localism. A rule of secrecy is expected among regular surfers at the site in order to keep the site “uncrowded”	5
(6) Socio-psychological carrying capacity	Due to the rural nature of the site and distance of the break from shore, crowding has yet to become an issue; however, the potential for crowding is of key concern to local surfers. The small shifting peaks can accommodate only 6–12 surfers before crowding occurs	2
(7) Surf community	Very small community of foreign resident surfers access the site along with occasional Thai surfers. Most surfers who frequent the site travel from other locations in Phuket and there is little communication among them	2
(8) Surf events	There has never been a surf contest held at the site. Interviewees indicate that they would strongly oppose any event activity at the site	1
<i>Mean</i>	<i>Low</i>	2.38

Note: The italic serves to delineate the index values from the individual indicator values.

Table 10 Nai Yang Beach (Center Reef) SRSI Pilot Survey. Economic Index (*EconSRSI*)

Indicator	Site assessment detail	Assessed value
(9) Surf amenity and infrastructure	Ample parking area for the NP. Bathrooms and enclosed showers exist behind the parking area although they are in disrepair and virtually unused. Trash bins are in place along the beach road. Easy-walking trails to the beach	3
(10) Surf events	There has never been a surf contest held at the site. Interviewees indicate that they would strongly oppose any event activity at the site	1
(11) Surf industry and commercial activity	While there are no surf shops catering to surfers at the site, there are several kite-surfing businesses that also rent surfboards. A number of restaurants are located south of the surf area. Interviewees note that they rarely visit these shops or eateries	2
(12) Surf-related non-market values	Interviewees note that most surfers arrive, surf, and leave the park area immediately after surfing. Use of the area has increased considerably in recent years. Interviewees suggest that there are significant <i>option</i> , <i>bequest</i> , and <i>existence values</i> to the site	3
(13) Surf tourism	The number of surf tourists is low but increasing with each season. Interviewees report that groups of Japanese surfers visit the site by long-tail boat on occasion. Interviews with local hotel managers showed an interest in exploiting the surf tourism potential alongside a perceived need to protect the area	1
<i>Mean</i>	<i>Low</i>	<i>2.0</i>

Note: The italic serves to delineate the index values from the individual indicator values.

researchers from different field locations to better communicate and exchange information and data.

Given the global rise in surfing activities and the relatively low level of awareness among local communities and governments, academic inquiry should continue and expand, and the SRSI offers a much-needed set of foundational and standardized metrics. The data-driven

SRSI methodology puts forward a pragmatic and objectively arrived way of generating qualitative and quantitative information placed into a publicly available and easy-to-manage framework. Its framework includes a mixture of physical and social sciences which address the complex issues and interrelationships among stakeholders now emerging at surf sites around the world.

Table 11 Nai Yang Beach (Center Reef) SRSI Pilot Survey. Environmental Index (EnvSRSI)

Indicator	Site assessment detail	Assessed value
(14) Biodiversity	Presence of marine life (fish, sea urchins, coral reefs) is evident. Previous issues of dynamite fishing and the effect of the 2004 <i>Indian Ocean Tsunami</i> on the health of the coral reef. Staghorn and other corals are regenerating in some areas, while other areas, particularly to the far north of the site, are in decline. Unexplained increase of coral debris inshore of the surfbreak (i.e. coral bleaching or other phenomena causing dead corals to accumulate)	4
(15) Coastal engineering	Little apparent coastal engineering due to the NP status of the area. Fishers dump rocks, bricks, and other materials inshore of their mooring areas to counter the effects of erosion	4
(16) Eco-physical carrying capacity	Small shifting peak with a relatively low physical capacity to accommodate surfers. Flat and very shallow reef areas susceptible to trampling by surfers. Currently unexplained depositing of dead corals south of the site is creating a second peak and surf site	2
(17) Hazards – marine life	Sea urchins in coral areas and occasional reef sharks on outer reef areas. – <i>Reverse scale (low hazard receives high score)</i>	3
(18) Hazards – physical	While outer reefs defuse most of the wave energy, nearshore ocean currents appear during high-surf episodes. Very shallow reefs inshore of the break may unexpectedly trap surfers at sea and result in reef cuts. The physical distance of the break for shore may be of some concern. – <i>Reverse scale (low hazard receives high score)</i>	3
(19) Quality – beach	Natural aesthetics are reasonably intact due to the limited foreshore development in contrast to most surfing sites in Phuket. Evidence of beach litter (point sourced to park users and fishers). Emergent and unexplained issues of coastal erosion; field assessments indicate that wave refraction caused by the increasing coral mound may be a factor in the coastal erosion	4

(Continued)

Table 11 Continued

Indicator	Site assessment detail	Assessed value
(20) Quality – water	Two key point sources of pollution are the klongs (canals) at the southern and central areas of the beach. These klongs are particularly of concern during the rainy Southwest Monsoon season. Fishing-related pollution includes oil from locally moored “longtail” boats. However, the surf site is offshore where water quality is normally good, save for the presence of marine debris carried from currents and shifting winds during the Southwest Monsoon season	4
(21) Surf type and quality	Reef break, single peak, with other less favorable peaks located northward. The break is normally surfable on small to mid-range swells (1–2 meters). Poor ability to handle windy or sloppy conditions. The site is particularly unique in Phuket for its highly favorable seasonality (i.e. it receives groundswell year round) and can be surfable during the high season when most beach areas are flat or unsurfable (i.e. December to March)	4
<i>Mean</i>	<i>High</i>	3.5

Note: The italic serves to delineate the index values from the individual indicator values.

The SRSI is particularly applicable and recommended in assisting policy-makers and non-governmental organizations to rank and prioritize surf sites for tourism management and conservation, including the legislation of surfing reserves. For example, the index approach can be employed when designing a site-specific framework to gauge and study surf tourism in a variety of contexts, and this can be particularly useful in order to pinpoint strengths and weaknesses in coastal resource policy and management.

In the wake of global “surf environmentalism”, the SRSI can be tailored to serve as an eco-guide for surf tourism operators and surf tourists alike. Site-specific attributes and sensi-

tivities can be systematically gauged and outlined in order to illuminate key issues and address impacts accordingly. The index can serve to alert that particular indicators are sensitive, identify thresholds of sustainability, and raise the level of common awareness among stakeholders. Consequently, the index can serve not only as an early warning system for threats; it can provide an impetus to protect and manage the resource for future use.

The application of SRSI for the conservation of coastal surfing resources and tourism management is recommended in five contexts: (1) comparing the quality of different surf beaches in the same area or region (through cross-sectional analysis); (2) identifying

Table 12 Nai Yang Beach (Center Reef) SRSI Pilot Survey. Governance Index (GovSRSI)

Indicator	Site assessment detail	Assessed value
(22) Beach and water safety	Presence of NP staff in nearby offices. As with other sites in Phuket, the presence of lifeguards is unpredictable, mainly due to unstable and seasonal employment contracts. Drowning is rare due to minimal nearshore currents (high-surf episodes notwithstanding) and the gradually sloping shore and shallow seafloor	3
(23) Education and interpretation	Limited printed materials are available at park headquarters; however, no information is present at the surf site. Occasional local campaigns by various hotels and organizations to educate youth on environmental issues which can include organized beach clean ups. Very little signage exists	3
(24) Legislative status	NP and MPA designation. No motorized tourist craft allowed, such as jet-ski or boats for parasail. Fishers and <i>longtail</i> boats may enter and moor in the area	4
(25) Management	No immediate issues of mixed-use area (surf zone is occasionally shared with kite-surfers). Recycling containers are in place and maintained. Interviewees note that key concerns include the effectiveness of MPA management and enforcement, particularly regarding issues surrounding fishers and pollution discharge from <i>longtail</i> boats. Interviewees pinpoint the gap between legislation and management	3
(26) Not-for-profit organizations	Presence of several not-for-profit organizations which occasionally organize events at the site which work toward improving environmental management and awareness among hoteliers and the local community (e.g. <i>SEEK – Society, Environment, Economy, and Knowledge</i>). Some progress has been made such as the placement of trash bins labeled with recycling symbols	4
(27) Public access	Appropriate public access and parking. Easy access to the beach given the absence of hotels and other infrastructure. Interviewees note that park entrance gate keepers may ask non-Thai visitors for cash	4
<i>Mean</i>	<i>High</i>	3.5

Note: The italic serves to delineate the index values from the individual indicator values.

Table 13 Pilot Survey Index Values

	Kata beach	Nai Yang beach
SocSRSI	3.50 (high)	2.38 (low)
EconSRSI	3.80 (high)	2.00 (low)
EnvSRSI	3.25 (moderate)	3.50 (high)
GovSRSI	1.50 (very low)	3.50 (high)
SRSI	3.01 (moderate)	2.85 (moderate)

changes over time at a given surf beach (trend analysis); (3) conducting beach and water safety assessments; (4) providing the framework for a consultative process whereby different stakeholder groups can offer their own weights to the clusters of factors; and (5) prioritizing surf sites in the legislative aspect, particularly as regional or national surfing reserves.

Concluding Thoughts

Surfing and surf tourism are experiencing rapid growth in prolific and non-prolific destinations around the globe, and sustainability concerns are well documented in the literature. However, data-driven index methodology for employing comprehensive metrics related to surf site sustainability had not previously been designed. The index system was found to be a useful method for surf site assessment, offering a clear-cut set of indicator criteria and implications. By systematically framing the research process and the qualitative data generated through field work into 27 indicators, the modular SRSI approach offers a new set of metrics for understanding and measuring the value and context of coastal surfing resources from various standpoints. Ultimately, SRSI metrics serve as qualitative and

quantitative leveraging tools in a policy-driven argument for the sustainable use and management of valuable and vulnerable coastal surfing resources and provide a global model for surf site conservation.

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PAPER III

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**Measuring the Conservation Aptitude of Surf Beaches in Phuket, Thailand: An
Application of the Surf Resource Sustainability Index**

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Measuring the Conservation Aptitude of Surf Beaches in Phuket, Thailand: An Application of the Surf Resource Sustainability Index

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ABSTRACT

The research seeks to measure the conservation aptitude of nine surf beaches in Phuket, Thailand by employing the *Surf Resource Sustainability Index*, an assessment methodology comprising 27 social, economic, environmental and governance indicators used to frame and quantify attributes for conservation development. The research identifies and documents key areas of concern for the sustainability of the island's coastal surfing resources and distinguishes steps forward to address emergent issues. The study finds that by improving the awareness, legislative status and management of surfing sites, the overall conservation aptitude for the island could be raised considerably. Copyright © 2013 John Wiley & Sons, Ltd.

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KEY WORDS surf resource sustainability index; surf tourism; conservation; Phuket, Thailand

INTRODUCTION

Surf sites around the world are under ever-increasing pressures from tourism, coastal development, pollution and other anthropogenic factors; and strategies to protect these resources first came forward from diverse surfing communities, particularly those in Australia, New Zealand and the USA. Influential in the promotion of surf site custodianship, Australian researchers Short and Farmer (2012) suggested the promulgation of 'Surfing Reserves' at international, national and regional levels, whereby sites are recognized and afforded a level of protection, either symbolically or legislatively. Martin and Assenov (2012c) noted that fundamental themes in the twenty-first century surf tourism research literature include the sustainability and conservation of coastal surfing resources. Studies in the sustainable management of surf sites are interconnected with domestic and international tourism, particularly the use and impacts from surfers, tourists and other stakeholders of the coastal zone (Buckley, 2002a, 2002b; Butt, 2010; Farmer and Short, 2007; FFLA, 2010; Lazarow, 2010; Lazarow *et al.*, 2007; Lazarow *et al.*, 2008; Martin and Assenov, 2012a, 2012b, in press; Mead, 2009; Nelsen, Pendleton and Vaughn; Nelsen *et al.*, 2007; Ponting, 2009a; Ponting *et al.*, 2005; Ryan, 2007; Scarfe *et al.*, 2009; Short and Farmer, 2012; Shuman and Hodgeson, 2009; Surfrider Foundation, 2012a, 2012b; Tourism New South Wales, 2009; Wearing and Ponting, 2009). To address these concerns, this research employs the *Surf Resource Sustainability Index* (SRSI), a perceptive index methodology comprised of social, economic, environmental and governance indicators used to measure and frame surf site integrity (Martin and

Assenov, 2012a, 2012b, 2013). The aim of this study is to apply the SRSI in practical circumstances by documenting and rating the conservation aptitude of nine key surf beaches on the resort island of Phuket, Thailand, and subsequently to identify key areas of concern for the sustainability of the island's coastal surfing resources. Although this is a case study of Phuket, the paper serves to illuminate the wider international significance, applicability and replicability of the index.

Rationale

The rationale of the study is threefold. First, it offers a window to the usefulness and versatility of SRSI in a practical setting. Second, it affords an opportunity to apply SRSI methodology to a variety of beaches in a given region and place the index in a cross-sectional context. Third, it provides a means to gauge the potential contribution of the index to sustainability in local context and to understand limitations to its repeatability as a global model.

Surf tourism in Phuket

Phuket is the definitive surfing destination in Thailand based on its natural resources, consistency and quality of waves, and proximity of surf sites (Martin, 2010a, 2010b; Martin and Assenov, 2011). Given that the island has over 700 hotels and an estimated 50,000 hotel rooms (C9hotelworks, 2013), there are countless environmental and sustainability issues raised about the rapid development and urbanization by private and government sectors and in the media. With 23 surf beaches in Phuket, surf tourism is an emergent niche market in the wider beach tourism industry (Figure 1).

The surfing season is earmarked by the rain and winds of the Southwest Monsoon (May through October) of the Andaman Sea region and corresponds with the tourism industry's low season; therefore, surf tourism is a welcome market segment, serving to address various issues of

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Figure 1. Surf beaches of Phuket.

seasonality. Although waves on the Andaman coast are mainly generated by locally-occurring monsoon winds, groundswells from the Indian Ocean occasionally pass through the Great Channel (a corridor between Banda Aceh, Sumatra and Great Nicobar Island) and may deliver clean high quality waves at any time of the year (Martin, 2010a, 2010b).

Foreign travelers in the 1970s and 1980s introduced the sport of surfing to Phuket; and by the early 1990s, a small group of Thais were surfing. Although a number of traveling surfers passed through Phuket, especially Australians, Americans and Europeans, Suchin Aksorndee was probably the first Thai surfer to embrace the sport and lifestyle in Phuket in the 1980s (P. King, personal communications, 22 September 2011). At the dawn of the twenty-first century, a second

generation of young Thai surfers had come of age. On 25 September 1999, Thailand's first international surfing contest was held at Kata Beach in Phuket. Fostered in part by employees from *Cobra*, the world's largest surfboard manufacturing company (located in Chonburi, Thailand), the contest has remained an annual event. Currently, the researchers estimate that there are approximately 300 Thai nationals and 300 expatriate surfers in Phuket and surrounding areas (including those who reside in Phuket only during the surf season).

Surf tourism is cornerstone to viewing surfing resources through a socio-economic lens. Given Thailand's prolific and successful *Amazing Thailand* tourism advertising campaign, which promotes tourism in all its forms (from beach, adventure and ecotourism to luxury hotels and

shopping), surf tourism has been a relatively overlooked market segment (Martin, 2009, 2010a, 2010b; Martin and Assenov, 2011). As many overseas surfers now visit Phuket, the island has emerged as a seasonal yet significant surf tourism destination. This new market has kindled entrepreneurial spirit among Thais in recent five years, evident by the increase in board rental enterprises at local beaches. Figure 2 shows a group of Thai surfers who are directly involved in the local surf tourism industry.

SURF TOURISM RESEARCH

Martin and Assenov (2012c) found two themes most evident in the surf tourism research literature. First, there are the positive and negative effects that surf tourism activities have on the developing world, and studies are mainly directed toward capacity management in relation to social, economic and cultural interaction with impacts on rural host communities (Buckley, 2002a, 2002b, 2007; Ponting *et al.*, 2005; Ponting, 2009a, 2009b; Wearing and Ponting, 2009). Second, there is concern for age-old surfing locations in developed countries in mainly urban settings which experience high-use, high-impact visitation from predominantly domestic surfers seeking recreational space (especially in Australia, the UK and the USA), and this research area is focused on the threats, impacts and negative implications of urbanization (including coastal development), as well as the intricacies of small business developments and the positive aspects of socioeconomics (Shaw and Williams, 2004; Lazarow *et al.*, 2007; Nelsen *et al.*, 2007; Shipway, 2007; Lazarow *et al.*, 2008; Phillips and House, 2009; Marchant and Mottiar, 2011). With respect to the study of urban and rural surfing environments, Martin and Assenov (2012a) drafted the SRSI, an index methodology that identifies surf sites as integral and nonrenewable natural resources. The index is based on the

premise that the sustainability of surfing sites can benefit from the innovation of a conservation-orientated metric framework, particularly in the context of surf tourism. Subsequently, Martin and Assenov (2012b) investigated indicator importance among surfer-stakeholders from diverse backgrounds and identified key areas of concern among this group. For example, the environmental index scored highest in importance, in particular the quality of water and beaches alongside biodiversity.

THE SURF RESOURCE SUSTAINABILITY INDEX

The broad intention of this research is to apply and further develop the SRSI as a systematic and open source method for use by stakeholders from diverse backgrounds – an approach proven particularly effective and widely applicable in conservation field studies wherein the key objective is to create a user-friendly research instrument geared for achieving results rather than exclusively engineering a system of measurement for academics TNC (2007). This research represents the first comprehensive application of the index in a cross-sectional framework.

The SRSI is designed as a perceptive index comprised of 27 indicators framed into four indices: social, economic, environmental and governance. As a modular approach to surf site field assessment, the index provides qualitative and quantitative metrics; a multidimensional framework offering a description of conceptual and analytical values in two layers, qualitative/quantitative for indicators and purely quantitative for the indices. Thus, the micro level forms the qualitative layer on the basis of perceptive and descriptive field observations, and subsequently a numerical value is attached. The generation of qualitative data gathered from field work provides a static snapshot of a site and is foundational to the SRSI design.



Figure 2. Phuket surfing contest, Kata Beach, 2008.

The field assessment measurement scale is based on a 1–5 *Likert Scale* such that high values or qualities reflect a high aptitude for conservation. Whereas previous SRSI tests held the indicator assessment scale at whole numbers, fractioning of the indicator ratings was adapted to include intermediate values (i.e. '.5'); and this was done to increase the assessment accuracy in the cross-sectional context. Thus, the minimum and maximum indicator values are 1 and 5 respectively, and fall into the following five categories: very low aptitude for conservation (1.00–1.80), low aptitude (1.81–2.60), moderate aptitude (2.61–3.40), high aptitude (3.41–4.20) and very high aptitude (4.21–5.00). A reverse scale is applied for two negative indicators (i.e. marine life hazards and physical hazards). Equal weights have been applied in the study of all indicators and indices. This was done to place the focus of the research on the assessment methods, particularly to create a single assessment chart whereby a number of beaches are rated within a given region.

Background information on the criteria and implications of indicators are not provided but are available from Martin and Assenov (2012a, 2012b, 2013). However, a brief description of the applied assessment methods has been provided for each indicator in Table 1. Indicators are listed alphabetically within each index.

ASSESSMENT OF PHUKET SURF BEACHES

Of the 22 surf beaches listed in Figure 1, nine surf sites on eight beaches were selected for this study. Previous research indicated that these sites are focal points for surfing activities on the island based mainly on wave type and quality (Martin, 2010a, 2010b). Field assessments were carried out by the researchers through visiting sites, participant observation, prior knowledge and through personal interviews with surfers. As one of the researchers is a surfer and member of the Phuket surfing community, participant observation was useful in communicating with local surfers on the beach and in the parking area at specific sites, while waiting for waves in the surf line, and through follow-up emails and phone conversations. Prior knowledge was based on life experience and previous research in the region (Martin, 2009, 2010a, 2010b; Martin and Assenov, 2011, 2012a, 2012b, 2013). Seventy-one semi-structured personal interviews were carried out at the Phuket Surfing Contest at Patong Beach, Thailand, in September of 2011 and 2012 with Thai, expatriate and visiting surfers. Interviews were also carried out at local surf sites when possible with surfers and other stakeholders.

As assessment tables comprise several pages of text per site, this paper provides field data only for the centrally-located Surin Beach, and Table 2 offers an example of the descriptive assessment and rating process for that location. Judgments were ultimately made by the researchers and took into account the aforementioned data gained from prior knowledge, participant observation, interviews and repeat visits to each site from April to November 2012.

Indicator assessment chart

The complete SRSI assessment chart is provided in Table 3. The nine beaches are listed in order of their location from north to south, and the assessed values for each indicator at individual beaches are provided. Mean values based on equal weights are calculated for each beach within a given index. Mean values are also provided for each indicator (across the nine beaches) in order to gauge individual beach indicators relative to the island's averages.

When looking at the nine beaches as a whole, the social and economic aptitude is moderate (2.74 and 2.71 respectively). In contrast, the lowest overall outlook for Phuket surf beaches is given to governance (1.90, low). The environmental index fared best overall with an aptitude in the upper-moderate range (3.26). In terms of ranking the beaches on the basis of the SRSI composite index, Kata Yai Beach and Surin Beach have the highest aptitude and rank moderate at 3.23 and 2.86 respectively, and the lowest-ranked sites are Kata Noi and Kalim beaches at 2.21 and 2.40 respectively.

Mean index values

An analysis of the SRSI assessment results and differences between beaches lends insight as to why some of them have higher aptitudes for sustainability. For example, given that conservation is a human construct (Anthoni, 2001), socially-based indicators serve to differentiate site-specific aptitudes. In the case of comparing surf beaches in Phuket at mean index values, Kata Yai Beach (3.69, high) and Surin Beach (2.94, moderate) were the top ranked in terms of social aptitude as well as economic aptitude (4.3 and 3.4 respectively), which can be attributed to the fact that they are both focal points for the Phuket surfing community and rate high in terms of social experience. Both beaches have strong standing in terms of their public safety and socio-psychological carrying capacity. In contrast, Kata Noi Beach rated the lowest in social and economic aptitude, because of the absence of club activities and surf events, low public safety and limited commercial surf activities. Similarly, the Nai Yang beaches were low in economic score (at 2.0), and the reasons for this include the rural atmosphere and the lack of surf tourism, events and commercial activities.

The quality and integrity of the natural environment are key indicators of conservation aptitude. In this respect, the Nai Yang beaches ranked highest (at 3.56), followed by Nai Harn Beach (at 3.5). This is attributable mainly to good water quality, eco-physical carrying capacity and limited foreshore development. Kalim beach was identified as having the lowest environmental aptitude among the beaches surveyed (at 2.69), and this was due mainly to the unhealthy reefs, point-sourced pollution from the local klong (canal), and the seawalls that have caused beach degradation and altered the shape and character of the waves during high tides.

Governance indicators are pivotal in that they target whether an area is afforded any level of conservation policy or management as a straightforward indication of current conservation aptitude. For example, mean values in the governance index show that Nai Yang National Park Reef (Center Reef) was rated highest (at 3.17) due in part to its

Table 1. SRSI methodology applied in Phuket, Thailand

Social indicators	
1. Social indicators – boardriders:	Identified the number of private and public clubs or organizations who access and use each site, including the number of members and activities undertaken.
2. Clubs – lifesavers:	Identified the number of private and public lifesaving organizations and considered the number of members, types of services provided and educational activities for youth or the community.
3. History:	Documented the number of years that each surf site has been surfed and assessed the usage, popularity, number and types of surfing activities occurring over time.
4. Public safety:	Assessed the presence of crime, such as vehicle safety, theft, violence or local gangs, including the past record and present account of public safety at each site.
5. Social experience:	Gauged the societal conditions surrounding the surfing experience at each site, including local ethics and knowledge.
6. Socio-psychological carrying capacity:	Estimated the number of surfers each site can accommodate in terms of crowdedness, including the size of the surfing area and type of wave.
7. Surf community:	Estimated the number of surfers in the community and identified the surfing community-supported activities at each site.
8. Surf events:	Assessed the number and size of contests per year at each site, including the number and types of participants (amateurs and professionals) and the positive and negative social implications.
Economic indicators	
9. Surf amenity and infrastructure:	Accounted for the presence of beneficial amenities at each site, including parking areas, walkways, showers and bathrooms.
10. Surf events:	Identified the key stakeholders' economic interests and relationship with each site, including the short-term and long-term economic contributions.
11. Surf industry and commercial activity:	Identified the 'economic hub' at each site relative to the number of surf shops, clothing outlets or other businesses catering directly to surfers.
12. Surf-related nonmarket values:	Estimated the economic significance of the site in terms of social, cultural, existence, vicarious and other nonmarket values; took into account the host community along with local and tourist surfing populations.
13. Surf tourism:	Estimated the number of domestic and international tourists who interact with each site; took into account the economic impacts related to the surf tourism experience, including hotels available to surf tourists, surf lessons and surfboard rentals.
Environmental indicators	
14. Biodiversity:	Assessed the overall health and vitality of the natural environment, including the condition of the coral reef and the presence of marine life at each site.
15. Coastal engineering:	Identified the significance and effects on the environment of coastal engineering projects or structures and documented physical changes to each site (note: negative effects received lower scores).
16. Eco-physical carrying capacity:	Identified the number of surfers or visitors that each site can accommodate before negative environmental consequences are likely to occur.
17. Hazards – marine life:	Documented the known or reported presence of aquatic life or marine predators, which may pose hazards to site users, including sharks, sea urchins, jellyfish (note: lower hazards received higher scores).
18. Hazards – physical:	Identified the presence of dangerous ocean currents and the presence of near shore and submerged rocks and reefs at each site (note: lower hazards received higher scores).
19. Quality – beach:	Assessed the overall esthetic condition of each site, including cleanliness, presence of beach litter, urbanization, encroachment, erosion or other aspects of degradation.
20. Quality – water:	Identified point and non-point sources of pollution as well as turbidity, nutrient loading and the presence of marine debris and plastics in the water at each site.
21. Surf type and quality:	Documented the local wave types and average wave frequency during the year or season; considered various skill levels of surfers who use each site.
Governance indicators	
22. Beach and water safety:	Estimated the availability and number of lifeguards as well as lifeguard towers and facilities in conjunction with the seasonality of services at each site.
23. Education and interpretation:	Identified the types, number and visibility of signage and interpretation at sites alongside any community meetings, workshops, research or advocacy for site integrity.
24. Legislative status:	Outlined the type or level of governance at each site (i.e. conservation status), including entities or branches of local, state or federal government with jurisdiction.
25. Management:	Identified the existence of guidelines or standards for activities at each site alongside the effectiveness of enforcement.
26. Not-for-profit organizations:	Determined the presence and activity of not-for-profit organizations or other authority at each site.
27. Public access:	Identified the level of accessibility alongside laws or other issues surrounding public right of entry, such as hotels or infrastructure, which inhibit or prohibit entry at particular sites.

Table 2. SRSI Surin beach assessment

Social index (SocSRSI)	
1. Social index (SocSRSI) – boardriders: Although no formal boardriders club exist at the site, local surf bars may create an informal club atmosphere and serve as gathering place for boardriders.	1.5
2. Clubs – lifesaving: There are currently no lifesaving clubs or culture. However, surfers perform rescues and respond to aquatic accidents at times. There are officially no lifesaving programs for local youths, but occasional education activities are provided by local expatriates.	2
3. History: Although the site has some degree of surfing history, there has been very little documentation. Prior to the development of roads to the area in the 1990s, which connected the site to southern beaches, surfing activities occurred in isolation.	3
4. Public safety: Interviewees report occasional crime in the parking area and clashes among beach vendors.	3.5
5. Social experience: Interviewees suggest that surfing in the area provides good experience with a relatively low level of localism or other negative social issues.	4
6. Socio-psychological carrying capacity: A variety of peaks spread out over the length of the beach provide a number of spots where surfers gather to catch the waves, providing more surfing space than many other reefs or point breaks in Phuket.	3.5
7. Surf community: Two generations of Thai surfers at the site, with the newer generation comprised mainly of teens. Expatriate surfers are a significant component of the community, serving as role models, lending equipment and offering free surf lessons to the Thai youths.	4
8. Surf events: Little or no surf event activity at the site. Local surfers attend nearby competitions, such as those at Kamala Beach.	2
Economic index (EconSRSI)	
9. Surf amenity and infrastructure: Beachfront parking area and one public bathroom (located south of the car park). There are no public showers in the beach park.	3.5
10. Surf events: Little or no surf event or contest activities at the site.	2
11. Surf industry and commercial activity: Several board rental stands on the beach. Several 'surf bars' which offer food and drinks and serve as a place for surfers to keep their boards. One of the most established surf shops in Phuket is located nearby. Expatriate surfing community may contribute economically through purchasing foods, surf gear, petrol, etc. when visiting the site.	3.5
12. Surf-related nonmarket values: The site serves as a focal point for Phuket surfing culture (second to Kata Beach). Interviews indicate that a number of Thais, expats and tourists frequent the beach because of the reputation and availability of waves, and this has led to an accountable surfing community in the area. Potentially significant existence values and vicarious values attached to the site.	4
13. Surf tourism: Board rentals and surf lessons are offered during the surf season. Interviewees report that surf tourists and surf tourism businesses have increased significantly in recent years.	4
Environmental index (EnvSRSI)	
14. Biodiversity: Tin mining during the previous century resulted in the destruction of many coral reefs in the area. Although studies on the ecological integrity of the site were not conducted before or after the tin mining era, anecdotal evidence suggests that considerable change had taken place at the site.	2
15. Coastal engineering: Although not aimed at coastal engineering <i>per se</i> , decades of dredging from the maritime tin mining industry has altered the coastal area. Given that the area was not surfed prior to the tin mining era, the effect on coastal surfing resources cannot be identified for sure. Interviewees speculate that there were reef breaks at one time, whereas today there are only near shore beach breaks.	3
16. Eco-physical carrying capacity: Surfers cause a relatively low impact at the site in relation to other activities occurring at the beach, such as jet ski rentals and parasail boats. Interviewees suggest that the ecological carrying capacity for surfers is relatively high.	4
17. Hazards – marine life: No shark sightings, sea urchin or stingray problems reported. Occasional jellyfish stings occur. <i>Reverse scale (low hazard received high score)</i>	4
18. Hazards – physical: No cliffs or physical hazards on land <i>per se</i> . Key issues are the shorebreak and ocean currents. The site is known for strong currents. Approximately 4 rip currents form in small to medium sized surf (i.e. head-height waves) and may converge to form 2 large rips during high surf episodes. Rocky area in the center of the beach which may be partially submerged during high tides. Strong currents may be related to loss of reefs. Sharp transition from shallow to deep water. <i>Reverse scale (low hazard received high score)</i>	2.5
19. Quality – beach: Extensive foreshore developments fronting the surfing area and issues of encroachment by beach concessions are well-known (e.g. reported in the Phuket media). Beach litter, while a visible and daily issue, is normally gathered and removed by beach concessions in the mornings. Beach litter is better controlled than at larger beaches (e.g. Karon and Kamala).	3
20. Quality – water: Although there are no major klongs (canals) at the site, urban runoff is suspect and restaurants and hotels may be point sources of pollution. Issues of water quality may be associated with the loss of coral reefs in the past and due to the suspension of mine tailings during the surf season.	3.5

21. Surf type and quality: Multiple-shifting beach breaks. Surfable waves at all tides. Favorable sand bars develop for surfing during the surf season (May to October). However, the off season sees unfavorable sand bars for surfing (i.e. sand re-deposits on the foreshore). Waves are particularly vulnerable to onshore winds (i.e. the beach is not sheltered from the wind).	
Governance index (GovSRSI)	
22. Beach and water safety: Unstable lifeguard contracts (unpredictable presence of lifeguard services). Interviewees note significant issues of ungoverned mixed-use area (i.e. the surf zone is shared with swimmers, surfers, jet ski, etc.). Area is notorious for tourist drownings. Surfers regularly perform rescues.	2.5
23. Education and interpretation: One warning sign in the parking lot. Information at hotels and from other sources is nonexistent or very limited. Lifeguards may post red or yellow flags; however, tourists of various nationalities may not understand the meaning of warning flags or signage.	2
24. Legislative status: Although the area is well-known as a key surfing destination in Phuket, interviewees report that there is currently no legislation or governance of surfing resources or other activities, including the environmental protection of the site.	1
25. Management: The key issue at the site remains the unmanaged mixed-use area. Interviewees report that existing guidelines or standards, if any, are not enforced, particularly those pertaining to development and encroachment.	1
26. Not-for-profit organizations: Although not-for-profit activity is uncommon at the site, occasional beach cleanups may be organized by local not-for-profit and hotel-supported organizations. However, these efforts are mainly temporary remedies with limited long-term effects.	1.5
27. Public access: Access is provided by a beachfront parking area and a narrow park located in the center of the beach. The beach park is easily accessible here; however, much of the beach is overwhelmingly clustered with restaurants and hotels, which inhibit use and access.	3.5

location within the Surin National Park. Kalim Beach and Kata Noi Beach were rated equally as the lowest in governance in Phuket (1.42), performing poorly for most indicators in the index. Overall, governance scores ranked the lowest of all four indices in Phuket, with legislative status, management and not-for-profit activities rated as very low for many of the beaches, particularly at Kalim, Karon, Nai Harn and the two Kata beaches.

Figure 3 offers a diagram of the social, economic, environmental and governance indices for the nine Phuket surf sites assessed in this study.

Mean indicator values

An analysis of mean indicator values revealed strong and weak attributes in each index (Figure 4). Within the social index the weakest point is the lack of boardrider and lifesaving clubs, which normally advance communication and collaboration among surfers as stakeholders in the resource base as well as provide educational activities for youth and the community. In contrast, the strongest attribute is social experience, and this suggests that the overall practice of surfing is favorable as a conservation attribute. Surf history, which is foundational to surf site protection strategy (Farmer and Short, 2007; Short and Farmer, 2012), rates moderately, suggesting an opportunity for research and documentation in order to improve the conservation aptitude in this regard.

The economic index for Phuket indicates that the surf industry and commercial activity at sites could be better developed, particularly alongside the areas of surf amenity and infrastructure and the organization of events. Surf tourism rates moderately, suggesting an opportunity to recognize and bring awareness to this particular market segment. As the highest-ranked indicator in this index, surf-related nonmarket values should be recognized given the significant resident surfing population, particularly the expat community as identified by Martin (2010a) and Martin and Assenov (2012b, 2013).

Environmental indicators point to a relatively strong eco-physical carrying capacity at most sites alongside minimal hazards in terms of marine life, such as sharks, and these attributes indicate a relatively conducive environment for surfing activities. Beach and water quality were rated moderately, and this area is in need of improvement considering the overall high importance attributed to these indicators by Phuket surfers as identified by Martin and Assenov (2012b).

As the lowest-ranked group of indicators in the Phuket assessment, governance emerges as a key area of concern. Although management is the lowest rated, the significance of this indicator is inexorably tied to surf site legislation (Martin and Assenov, 2012b), and this suggests a need for increased attention to surf sites at an institutional level. Similarly, the lack of surf site-related not-for-profit activity and of education and advocacy for site integrity signal that there may be a knowledge gap in the understanding of the value and significance of coastal surfing resources in Phuket.

Table 3. SRSI Phuket assessment chart

	Nai Yang (Park Reef)	Nai Yang (Island Reef)	Surin Beach	Kamala Beach	Kalim Beach	Karon Beach	Kata Yai Beach	Kata Noi Beach	Nai Ham Beach	Mean
Social index (SocSRSI)										
(1) Clubs – boardriders	1.5	1.5	1.5	2.5	1	2.5	3	1	1	1.72
(2) Clubs – lifesavers	1	1	2	1.5	1	1	1	1	1	1.17
(3) History	2	2	3	3	3	2	4.5	3	3	2.83
(4) Public safety	4	4	3.5	3	4	4	4	2	4	3.61
(5) Social experience	5	4.5	4	3	3.5	4	4	3	3.5	3.83
(6) Socio-psychological carrying capacity	2	4	3.5	4	4	4	4.5	3	3	3.56
(7) Surf community	2	2	4	3	3	3	4.5	3	3	3.06
(8) Surf events	1	1	2	2.5	3	2	4	1	2.5	2.11
Mean	2.31	2.5	2.94	2.81	2.81	2.81	3.69	2.13	2.63	2.74
Economic index (EconSRSI)										
(9) Surf amenity and infrastructure	3	2	3.5	2.5	2.5	3	4	2	2	2.72
(10) Surf events	1	1	2	2.5	3	2	4	1	1	1.94
(11) Surf industry and commercial activity	2	2	3.5	2.5	2	2	4	1.5	2	2.39
(12) Surf-related nonmarket values	3	3	4	3.5	3.5	3.5	4.5	2.5	4	3.50
(13) Surf tourism	1	2	4	3	2.5	3.5	5	3	3	3.00
Mean	2	2	3.4	2.8	2.7	2.8	4.3	2	2.4	2.71
Environmental index (EnvSRSI)										
(14) Biodiversity	4	3.5	2	2	1	2	2	2	2.5	2.33
(15) Coastal engineering	4	4	3	3	2	3	3	2	3	3.00
(16) Eco-physical carrying capacity	2	4	4	4	3	4	4	4	4	3.67
(17) Hazards – marine life (<i>reverse scale</i>)	3.5	3.5	4	4	4	4	4	4	4	3.89
(18) Hazards – physical (<i>reverse scale</i>)	3	3	2.5	3	3	3	3	3	2.5	2.89
(19) Quality – beach	3.5	3	3	3	2.5	3.5	3	3.5	4	3.22
(20) Quality – water	4.5	3.5	3.5	3	2	3	2.5	4	4	3.33
(21) Surf type and quality	4	4	3.5	3	4	3	4	4	4	3.72
Mean	3.56	3.56	3.19	3.13	2.69	3.19	3.19	3.31	3.5	3.26
Governance index (GovSRSI)										
(22) Beach and water safety	2.5	1	2.5	2	1.5	2.5	2.5	2	2	2.06
(23) Education and interpretation	2.5	1	2	2	1	2	2	1.5	2	1.78
(24) Legislative status	4	4	1	1	1	1	1	1	1	1.67
(25) Management	2.5	2	1	1	1	1	1	1	1	1.28
(26) Not-for-profit organizations	3.5	1.5	1.5	2.5	1	1	1	1	1	1.56
(27) Public access	4	3	3.5	2.5	3	3	3	2	3.5	3.06
Mean	3.17	2.08	1.92	1.83	1.42	1.75	1.75	1.42	1.75	1.90
Composite index mean	2.76	2.54	2.86	2.64	2.40	2.64	3.23	2.21	2.57	2.65

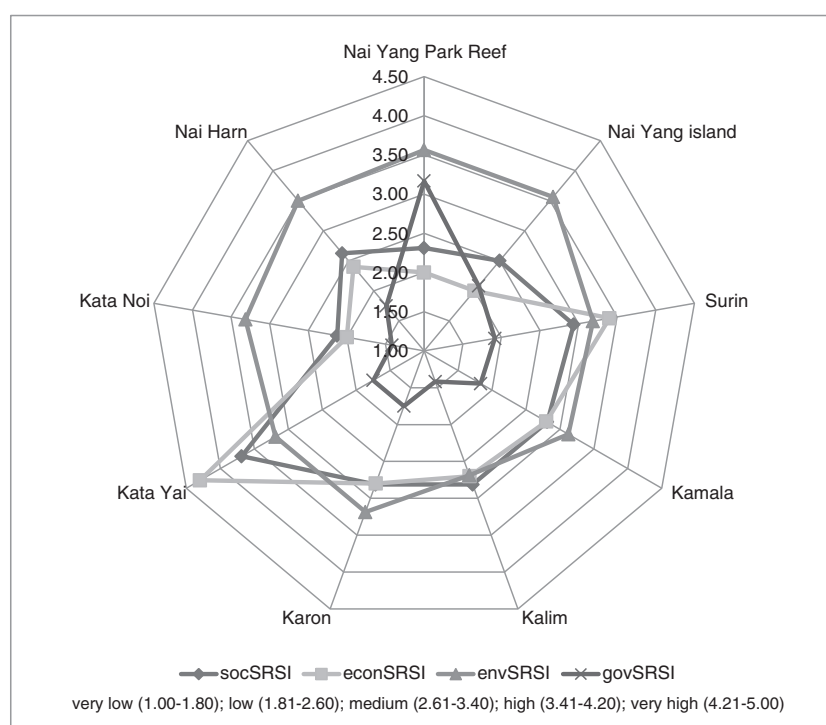


Figure 3. SRSI for nine Phuket surf sites.

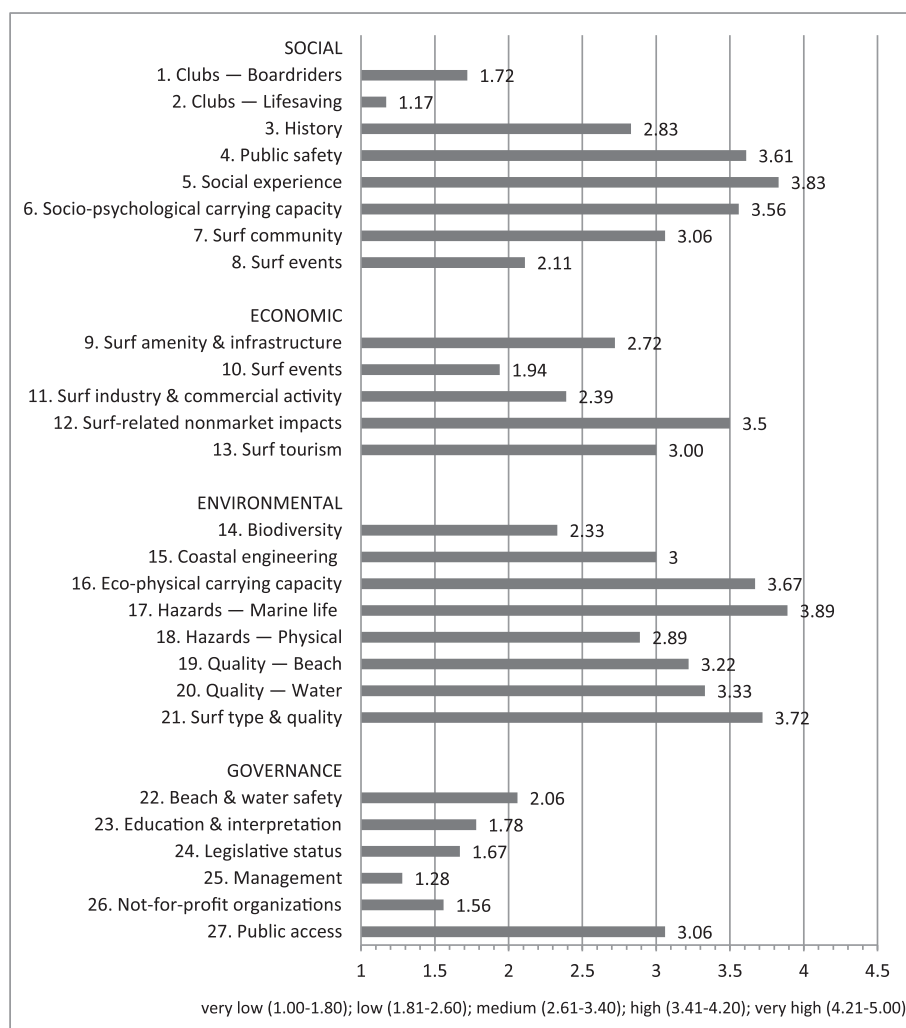


Figure 4. SRSI mean indicator values for Phuket surf sites.

IMPLICATIONS

Application of the SRSI was beneficial in two particular areas: one being the results for the conservation aptitude of nine surf sites on the resort island of Phuket and the other being the critical analysis of the SRSI method and design. Tangible benefits of the study include the potential to foster conservation policy and to discuss the potential for future applications and adaptability of the index.

Phuket case trial

Although this research provides the first in-depth application of the SRSI, the study was limited to the resort island of Phuket and therefore lacks a wider and global scope. The researchers acknowledge that small islands have an eco-system of their own, and the impacts are not similar to large coastal regions. However, as island destinations are particularly vulnerable to tourism impacts, and many islands rely on surf tourism as part of their growth strategy for adventure tourism (Buckley, 2002a, 2002b, 2006), this case was chosen as a starting point for index case trials and development.

The Phuket case application found that the assessment in a cross-sectional context (i.e. rating one beach in context with another) and fractioning of the rating scale to half numbers (i.e. '.5') afforded the assessors an opportunity to rate beaches more accurately, whereby minor variances between beaches could be discerned, and this detail could be significant when trend analysis is employed.

A significant outcome of the research is the generation of relevant qualitative and quantitative data on coastal surfing resources in Phuket. The paper designates the strengths and weaknesses in aptitude at the indicator level for individual beaches, and this knowledge can aid coastal resource managers and policy makers to better understand key issues at particular sites and take actions accordingly. For example, Kalim Beach received the lowest assessment for water quality among the nine beaches, which serves as a signal for the need to address the issue if tourism activities at the site are to continue and be sustainable. As another example, the research indicated that lifesaving clubs – which normally supply education for youths – are all but absent in Phuket, which is an indication for policy makers to seek improvement in this area.

At the index level, the research identified that the conservation aptitude of surf beaches in Phuket is only moderate in socio-economic and environmental contexts. The low rating for the governance index, which includes the key indicators for education, legislation and management, identifies that Phuket surf beaches are in less than sustainable situation – this may also be a sign that the future trend is less than favorable unless these and other indicators are adequately addressed.

The research illuminates surf sites in Phuket as integral components to the tourism industry and provides evidence of the growth of surfing activities on the island. In contrast, the awareness and understanding of the resource in Phuket trails behind the myriad issues raised by the SRSI analysis.

Methodological issues and limitations

The process of rating beaches relative to each other led the researchers to identify the need for a high level of familiarity with the physical and human attributes of each site. Although interviews with surfing community members and other stakeholders at individual beaches helped considerably in the research process, an in-depth and holistic understanding of field sites is paramount and could take several surfing seasons or years to gain. This judgment is based on the researchers' own experience, which included a five-year study of the sites listed in this research, and it is unlikely to get similar results without this level of familiarity. Thus, if assessments are undertaken by researchers with limited experience at study sites, extensive and in-depth local knowledge should be sought. This approach was developed by Lazarow (2010) who examined the importance of local knowledge and surf breaks to coastal communities. His study indicates that surfers are inevitably vital players when seeking to evaluate and manage coastal surfing resources. However, perceptive surveys based solely on surfers could lead to potential bias. In cases where previous experience and knowledge are limited, the method can be adapted to capitalize on any available knowledge from direct and tangential stakeholders, including surfers, fishers, local residents, communities and businesses. A focus group and comprehensive consultation with diverse stakeholders could prove to be productive, providing participants are familiar with the surf sites and their attributes and significance in various contexts.

When taking into account that data collection and qualified judgments for a perceptive index is extremely dependent upon the knowledge of the researchers and their approach to public surveys, key issues include the subjectivity and usefulness of the model in future applications by other researchers in alternative locations. To address this issue, the descriptive layer of the index can serve to document site attributes and aptitudes for review by third parties and can provide clarity in pinpointing the quantification process in future studies. In order to reduce subjectivity, a more detailed account is needed of exactly how judgments are made in terms of assigning numbers to each of the factors listed.

As the index encompasses 27 indicators framed in four different contexts, its complexity is a possible limiting factor in terms of the usefulness and global applicability of the model. The authors acknowledge that the exact approach adopted in this study may not be ideal when conducting research at large coastal areas or at sites that are isolated in terms of amenities and access, such as surf tourism sites accessible only by charter boats in the developing world. Thus, further research and case trials in new and diverse locations can foster the applicability and adaptability of the SRSI.

Although this study recognizes the distinct need for objective and insightful data collection and analysis, manageability of the method is foundational to the SRSI design, whereby keeping the research process relatively straightforward is central in facilitating future research to take place and expand at surf sites around the world.

Future applications and adaptability

The research indicates a need for conservation planning and codes of best practices if Phuket surfing resources are to be managed and preserved for future generations. For example, a strategy to develop 'Surfing Reserves' similar to those in Australia and the USA (Farmer and Short, 2007; Short and Farmer, 2012) could be developed for some of the surf beaches outlined in this study. The case of Australia has shown that once the surfing reserve process is initiated, petitioning new sites for protection can follow (Farmer and Short, 2007; Short and Farmer, 2012), and the SRSI could provide new impetus for policy makers to consider this type of approach. For example, given that Kata Beach has the highest social and economic aptitudes of any surf beach in Phuket, the data could provide impetus for the promulgation of the island's first surfing reserve (see Figure 5). Such designation could also spotlight indicators, which received low SRSI scores for the site, such as the governance indicators for management and legislation and the environmental indicator for water quality, and this could increase aptitudes directly as well as indirectly through increased awareness.

While surf-activism for the protection of sites was born in the not-for-profit sector, such as the *Surfrider Foundation*, *Save the Waves Coalition* and *Surfers Against Sewage* (Martin and Assenov, 2012c), governmental surf break conservation strategy is a relatively new construct. For example, at the time of writing, the first-ever 'Surf Management Plan' was put into legislative development by the Gold Coast City Council (2013), Australia, under their *Draft Gold Coast Ocean Beaches Strategy 2013–2023*:

The Surf Management Plan will recognize the importance of surfing to the City's lifestyle and economy. The plan will be developed in consultation with the community, businesses and key interest groups. It will identify and prioritize surfing research, prioritize actions to improve surf etiquette and surf tourism, celebrate our surf economy and facilitate growth in surf related information, education, recreation, management and investment. (p. 12)

As sponsor of the 2013 Global Surf Cities Conference, Gold Coast Surf City, Inc. recognized the SRSI methodology as a plausible approach to foster surf site research and policy

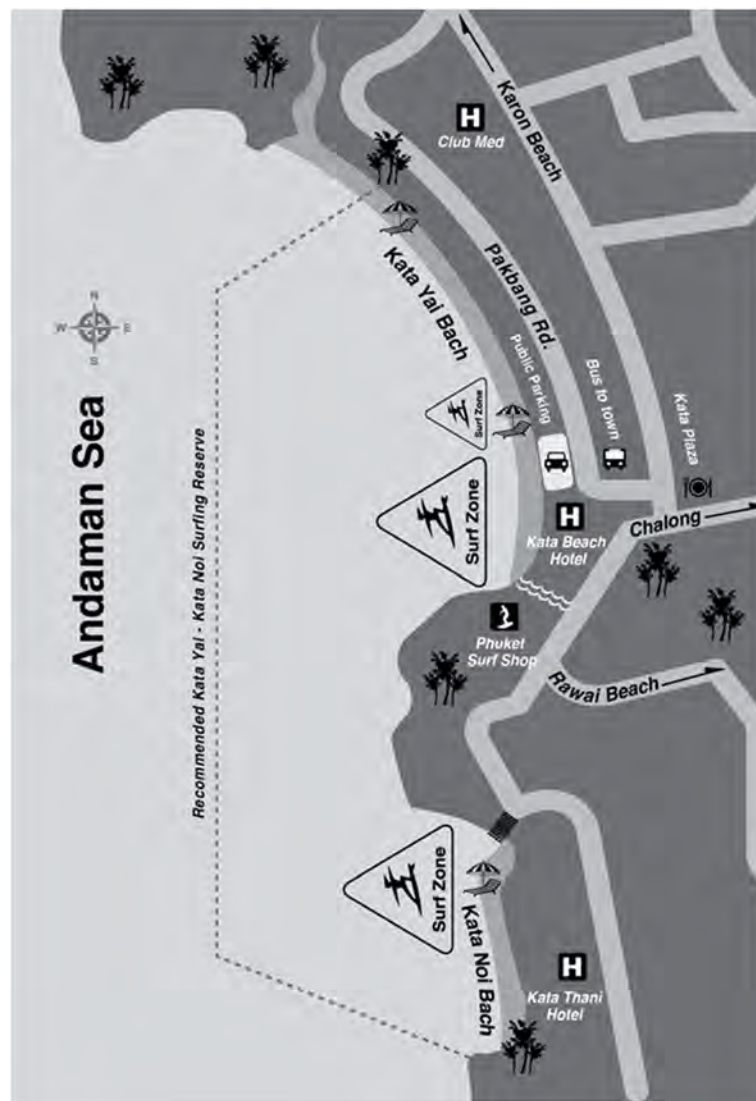


Figure 5. The Recommended Kata Beach surfing reserve.

development (Martin, 2013), whereas other potential areas of integration include collaboration with the newly formed *Center for Surf Research at San Diego State University* (SDSU Center for Surf Research, 2013). The center develops best practices in surf tourism sustainability and provides access to the SRSI methodology.

CONCLUSION

The SRSI process can provide qualitative and quantitative assessment of surf site conservation aptitude. In new and developing surf tourism destinations such as Phuket, the systematic rating of surf beaches through the SRSI framework is a plausible approach to developing conservation knowledge of coastal surfing resources. This is due in part to the recent development of surfing activities on the island and given the relatively low level of awareness for the research base at local government and community levels. Through appraisal of the 27 key surf site attributes at nine beaches in Phuket, relative strengths and weaknesses become visible and signal opportunity to address a variety of sustainability issues. Thus, the data-driven SRSI methodology offers a pragmatic and objectively-arrived way of generating qualitative and quantitative information placed into an easy-to-manage framework.

The conservation of coastal surfing resources has the potential to spawn cultural heritage, protect habitat, improve coastal resource management and offer immediate benefits to the physiological and psychological wellbeing of individuals. In this way, the community and the tourism industry benefit greatly from recognizing and appreciating surfing resources. Conversely, increased use, crowding, pollution and coastal development all pose significant risks, which if not proactively addressed will degrade these resources. The attributes and risks to surf sites have been highlighted in this research alongside opportunities to maintain and enhance surfing resources through innovative research design in environmental management, such as the SRSI. By working cooperatively with various stakeholders to identify, document and measure coastal surfing resources and to recognize and seize conservation opportunities, surf management planning can help Phuket and other surfing destinations to maintain surf site integrity, to benefit local communities and to support the wider tourism industry.

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