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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)

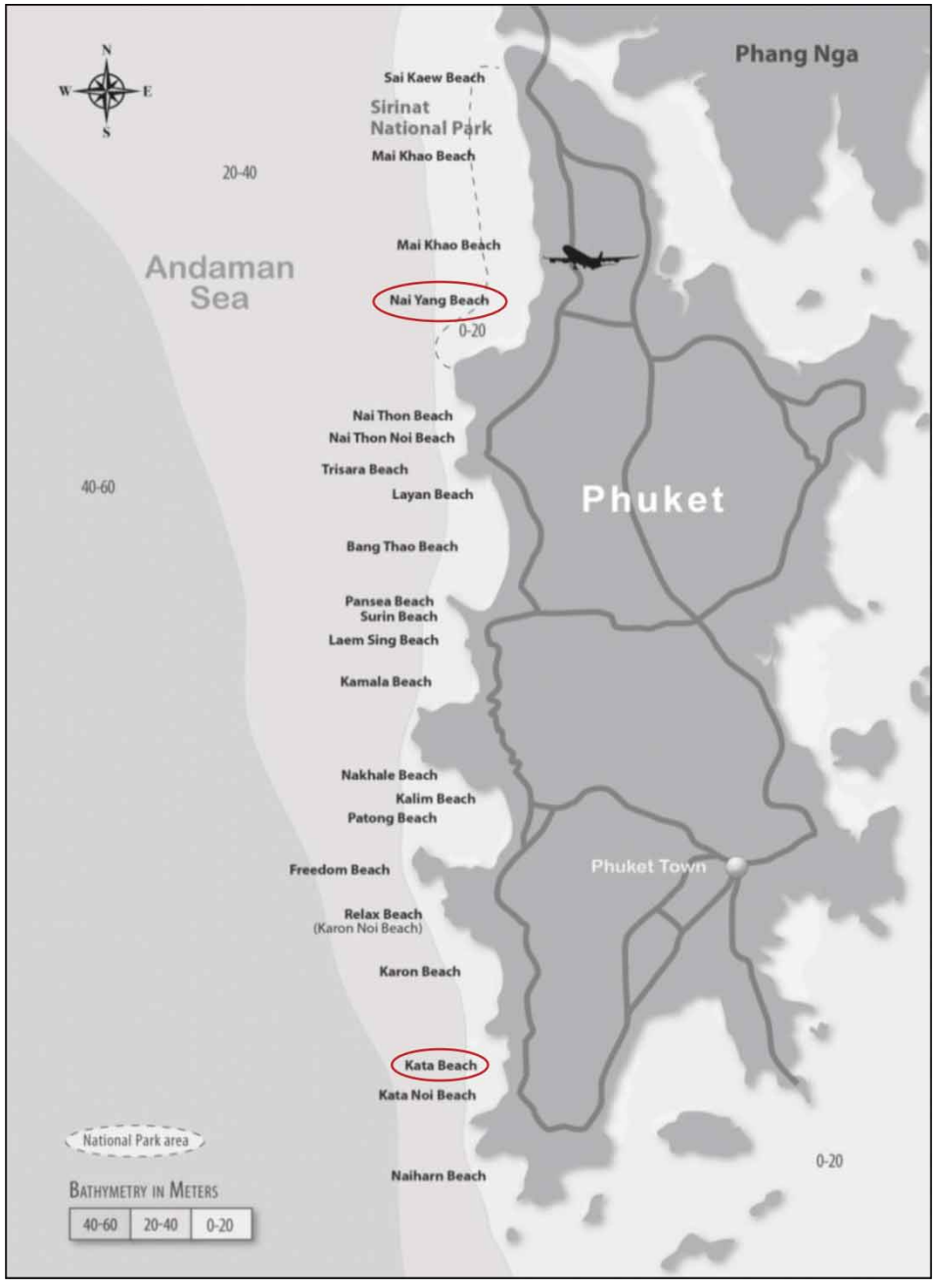

Figure 1 Key Surf Sites in Phuket.
Source: Martin (2010a, 2010b).

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 policymakers.

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	Indentify 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 *Artificial Surfing Reefs* (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, *Hallmark Events*, 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 *travel cost* or *willingness to pay*	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 *Escherichia coli*

(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

*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

		stakeholder engagement (e.g. *Surfrider Foundation*). However, successes and failures must be determined jointly and in context
(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)	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

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 (*Kata Krew*) established in 2005 with 20+ members; regional surf club (*Phuket Boardriders*) 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. *The Phuket Surfing Contest*); occasional contests for kids (i.e. *Rip Curl Grom Search*). 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
Mean	*High*	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 *Phuket Surfing Contest* 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
Mean	*High*	*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 – *Reverse scale (low hazard receives high score)*	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 – *Reverse scale (low hazard receives high score)*	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
	especially plastic bags, food wrappers, and fishing supplies in the surfline	
(21) Surf type and quality	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)	4
Mean	*Moderate*	*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. *Surfrider Foundation* 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
Mean	*Very low*	*1.5*

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
Mean	*Low*	*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 *option*, *bequest,* and *existence values* 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
Mean	*Low*	*2.0*

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 Indian Ocean Tsunami* 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. – *Reverse scale (low hazard receives high score)*	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. – *Reverse scale (low hazard receives high score)*	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
Mean	*High*	*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 sensitivities 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 *longtail* 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 *longtail* 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. *SEEK – Society, Environment, Economy, and Knowledge*). 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
Mean	*High*	*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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