TOWARDS A SURF RESOURCE SUSTAINABILITY INDEX: A GLOBAL MODEL FOR SURF SITE CONSERVATION AND THAILAND CASE STUDY

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ABSTRACT

The growth of surfing activities and surf tourism has gained significant attention in the academe during the previous decade. This paper is aimed at developing indicators and methods to assess the relative sustainability factors and intrinsic values of surf sites. The research puts forward a *Surf Resource Sustainability Index* (SRSI) as a conceptual and global conservation model. Index outlining and testing were carried out through a case study in Phuket, Thailand, where an emerging surf culture and tourism market segment are additive to the island's bustling economy and escalating coastal resource management issues. Literature review, previous experience, and discussion with veteran surfers and scholars were used to identify indicators and determine the relevance, measurability, and propensity for surf resource conservation. The research finds that while key indicators for surf site conservation are complex and difficult to calculate, through outlining conceptual benchmarks and the indictor selection processes, qualitative attributes are quantifiable. The case study delineates the importance of social, economic, environmental, and governance factors in the conservation process and finds that these measures can serve as building blocks in constructing sustainability-orientated indicators, indices and associated methodologies. The innovation of *SRSI* metrics and design may offer tangible benefits to stakeholders interested in coastal resource sustainability.

Key words: surfing sites, coastal resources, sustainability indicators, index, Phuket, Thailand

INTRODUCTION AND RATIONALE

Surf sites around the world are under ever-increasing pressures from tourism, coastal development, pollution, and other anthropogenic factors. The research introduces and illuminates coastal surfing areas as an important global issue in terms of being valuable and integral non-renewable natural resources. The premise of the research is that the conservation of surf sites can benefit from the innovation of a composite index methodology. As a work in progress, the paper is aimed at identifying and defining the indicators most relevant to gauging a surf site's aptitude for conservation management. This paper offers a conceptual framework toward developing a *Surf Resource Sustainability Index* (SRSI) as a global model and case study of two surfing sites in Phuket, Thailand. Thailand was chosen as a case study site for several reasons, including convenience, the rapid growth of surf culture and surf tourism, mounting attention on sustainability issues, and the uniqueness of a the Andaman region as a non-prolific surfing destination. While significant intellectual attention has been given to high-profile world class surf sites, little has been given to non-prolific surfing areas, which make up the greater part of the world's coastal surfing resources. Based on a five year exploratory research, Martin (2010a,b) identifies the resort island of Phuket as the key surfing destination in Thailand based on the natural resource and the consistency and quality of

waves together with the proximity of surf sites. In economic terms Phuket is unequivocally the focal point of the nation's surf tourism activity (ibid.). Given that the island has over 700 hotels and 43,759 hotel rooms (and another 6,272 rooms currently under construction) (C9hotelworks, 2012) there are countless environmental and sustainability issues raised about rapid development and urbanization in Phuket by the private and government sectors and in the media. Figure 1 illustrates the main surfing sites on the Island of Phuket, Thailand, and case study sites (Nai Yang and Kata Beaches) have been circled.

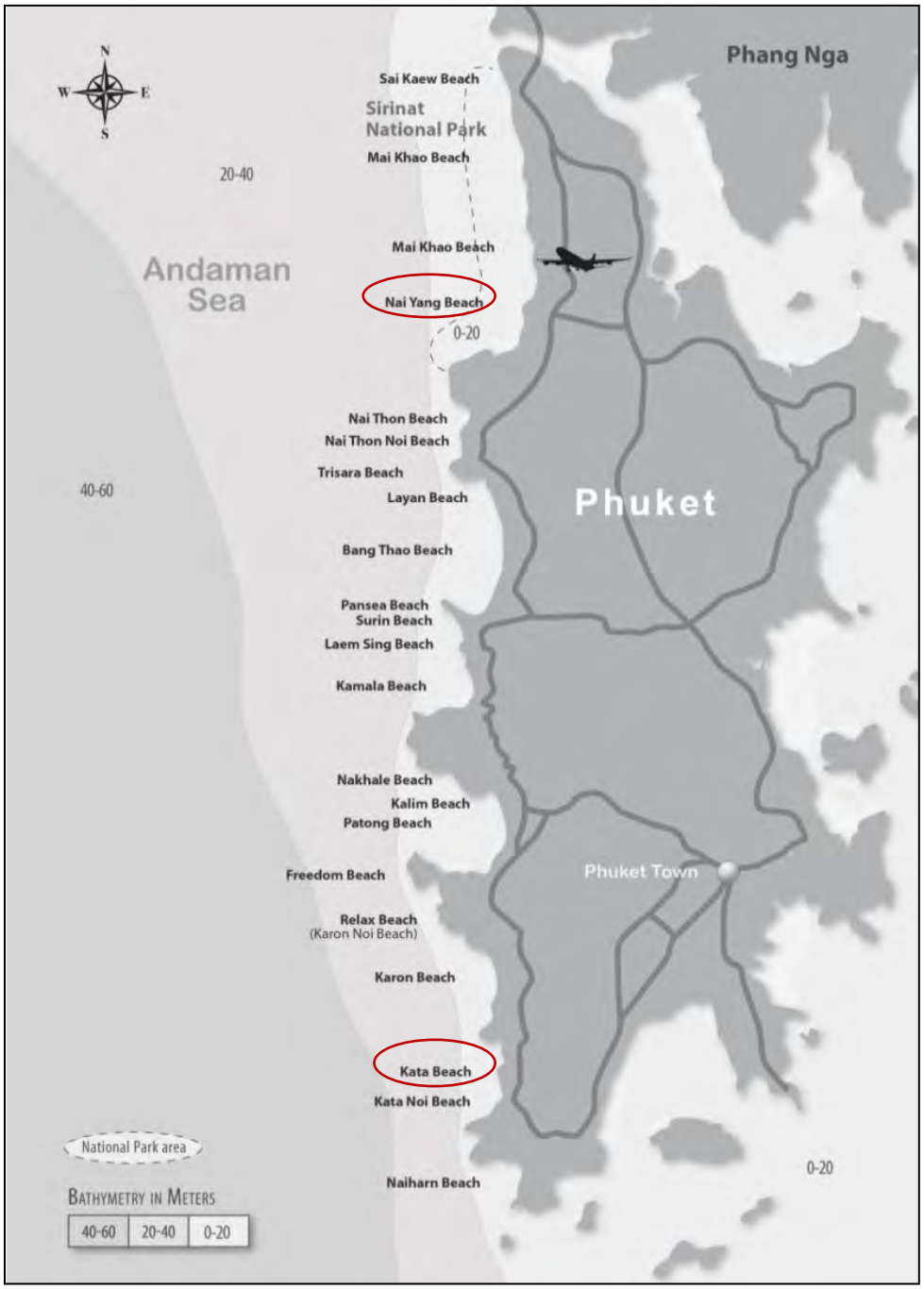

Figure 1: Key Surf Sites in Phuket (Martin, 2010a,b)

RELEVANT LITERATURE

The significance of surfing and the conservation of coastal surfing resources are

prominent themes in 21st century literature (Assenov & Martin, 2010; Martin & Assenov, 2011). Surfing has emerged in recent years as multibillion dollar industry encompassing surf equipment manufacturers (such as Cobra in Chon Burri, Thailand), large clothing corporations (such as Quiksilver, Billabong, and Rip Curl), domestic and international surf tourism, national and international sporting events, and other direct and indirect values discussed in this paper.

Surf 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 et al. (2009) 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 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 et al., 2007; Lazarow, 2010). For instance, wave quality and frequency are ecologically dependent and easily altered by the construction of coastal protection/amenity structures (i.e., groynes, seawalls, piers, breakwaters, artificial reefs) or through sand management (i.e., beach fill, dredging, sand bar grooming); and environmental or biophysical conditions may mitigate against a surfers' physical health, including biological impacts (i.e., water quality or nutrient loading). Also, climate change and amenity of the surrounding built and natural environment are of key significance (ibid.). 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 access. To this end, 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 in the strategy to manage and protect surf sites is the concept of the ***Surfing Reserve*** (Farmer & Short, 2007) whereby a 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 recognising 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 galvanising 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 gazettal of surfing reserves as natural sanctuaries has four important aspects (Lazarow, 2010): 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 cares passionately about ***Surfing Capital*** in a particular area; it recognises the socio-economic and cultural value of surfing to a particular area; and it recognises 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.

Social and Environmental Indices

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. With the concept of ‗sustainability' increasing in significance in the wake of globalization, defining theory and practice in environmental protection through an empirical approach using indicators and indices requires the familiarity with specific sets of concepts and principles. Consequently, the computation of indices is on the whole a complex process of contending with variable selection, missing data treatment, aggregation and weighting methodologies, as well as performance testing (OECD 2003, in Esty, 2005). Nonetheless, the concept and methods of developing and employing indicators and related indices in sustainability and conservation efforts are increasingly popular. 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" (Emerson, 2010: 6).

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 to beach and water quality are outlined. In an effort to offer and implement a standardized methodology for assessing ecological health, ***Surfrider Foundation*** 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. 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 thirteen sub-indices, was developed. Aggregation of components and sub-indices were based on two questionnaires, one completed by beach users and another for experts. The 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. However, Pijoan (2008) was effectively the first to conceptualize a basic surf site assessment index. Her thesis offered an ***Integrated Aptitude Index*** for surf beaches in Ensenada, Mexico which was 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) (ibid.).

INDEX DEVELOPMENT

Conceptual Global Index

The identification of indicators and indices was based on primary data gathered through researchers' prior experiences, field observations, and interviews with highly experienced surfers and surfer-scholars in the United States and Australia and other stakeholders. Secondary data was gained based on existing surfing-related studies. Subsequently a shortlist of indicators was developed and incorporated into the *Surf Resource Sustainability Index* (SRSI). In most instances, indicators were selected based solely on conservation aptitude in terms of use, value, quality, and sustainability. The *SRSI* concept

presented here is not a _threat-based' approach (where indicators are measured in terms of their relative threat to the resource base), such as that employed by The Nature Conservancy (TNC, 2007). The researchers' also looked at ***National Surfing Reserve*** (NSR, 2012) and ***World Surfing Reserve*** (WSR, 2012) nomination and management criteria, as well as the aforementioned criteria for ***Surfing Capital*** (Lazarow et al., 2007; Lazarow, 2010). Individual indicators may be listed in more than one index. For the time being, equal weighting has been assigned to all indices.

Through trial and error, and due to the difficulty in quantifying the criteria within each indicator, a need for the description of conceptual and analytical values for the *SRSI* was developed. Thus, the assessment criteria provided here are in a process of development, and *SRSI* has been constructed as a multi-dimensional framework appearing in two layers, qualitative/quantitative for indicators and purely quantitative for sub-indices and composite indices. Thus the micro level forms the qualitative layer which is based on observation and description, and subsequently a value is attached (as shown the Thai case study example), whereas the macro level represents the combined indicator assessment and is purely numerical. The measurement scale is based on a 1-5 number value (*Likert* scale) such that high values or qualities reflect a high aptitude for conservation (conceptualized as very low—very high for socioeconomic values; and very poor—very good for physical and environmental qualities). The final indicator values appearing in the case study were assessed at the discretion of the researchers; with the potential to apply a less subjective methodology in future works. Due to space constraints for this paper, a limit of twenty-six indicators and four indices was set (See Table 1). Indicators are listed alphabetically within each index. The index values were calculated as the equally weighted averages of the indicators composing them. Thus, the minimum and maximum index values are 1 and 5 respectively, and fall into the following five categories (terms may be used interchangeably): very low/very poor (1.00-1.80); low/poor (1.81-2.60); medium/fair (2.61-3.40); high/good (3.41-4.20); very high/very good (4.21-5:00). A reverse scale may be applied if the indicator is negative (i.e. marine hazards).

Table 1: Shortlist of SRSI Indicators for Conservation Aptitude

Indicator	Assessment Criteria	Implication	Value
SOCIETAL INDEX (*SocSRSI*)		**1-5**	
Carrying capacity *(psychological)*	Number of surfers the area can accommodate in terms of individual or social satisfaction and crowdedness	Use and satisfaction are strongly influenced by the number and local ethics of surfers at the site	*1-5*
Experience	Gauge the societal conditions surrounding the surfing experience at the site	Consider the benefits of health, well-being, and community spirit which the site provides	*1-5*
History	Number of years that the surf site been surfed; assessed usage or popularity of the site over time; number and types of surfing activities occurring at the site	History provides context to the surf site background and culture, which are key factors in the argument for surfing reserve status and stakeholder interests	*1-5*
Lifesaving club	Number of private or public organizations; number of members	Instills water safety awareness and the benefit of surfers as surf lifesavers	*1-5*

Public safety	Presence of crime (vehicle safety, theft, violence)	A safe and secure atmosphere contributes to site integrity	*1-5*
Surf club	Number of private or public clubs or organizations; number of members	Provides a level of organized communication and collaboration among surfers	*1-5*
Surf events	Number and size of contests per year; levels of participation, sponsorship and corporate presence	Creates awareness of the surf site and its significance to the surfers and the community	*1-5*
Surfing community	Estimated number of surfers in the community	Provides a social base and structure for surf site custodianship	*1-5*
ECONOMIC INDEX (*EconSRSI*)			**1-5**
Market and non-market values*	Total expenditures by surf related visitors; use and non-use values	May be particularly difficult to estimate, such as surfers' economic contributions or the existence value of the site	*1-5*
Surf amenity	Account for the presence of infrastructure beneficial to the site; Artificial Surfing Reefs (ASR), if any	Contribution to the local economy in terms of direct and indirect values	*1-5*
Surf events	Short and long term economic contributions; conduct economic impact studies (if possible)	Creates a focal point for economic assessment and stakeholder presence	*1-5*
Surf industry	Number of surf shops, surfboard rentals stands, or other business catering to surfers at or near the site	Contribution to the local economy in terms of direct values	*1-5*
Surf tourism	Number of domestic and international tourists; services available to surf tourists, such as surf lessons and rentals	Contribution to the local economy in terms of direct and indirect values	*1-5*
ENVIRONMENTAL INDEX (*EnvSRSI*)			**1-5**
Beach quality	Level of urbanization; encroachment; erosion; aesthetic values (including cleanliness and beach litter); amenities (such as parking and bathrooms)	Issues surrounding coastal and foreshore development; coastal protection	*1-5*
Biodiversity	Determine the health of the living natural environment; coral reef; presence of marine animals	The overall existence and health of flora and fauna are relative to the pressures from external forces and the estimated resilience at the site	*1-5*
Carrying capacity *(Eco-physical)*	Determine the level of usage in relation user impacts; identify the natural carrying	impacts on local flora and fauna; foot traffic over sand dunes; encroachment on bird	*1-5*

	capacity of the site	nesting areas, etc.	
Coastal engineering	Identify the environmental implications of coastal protection or amenity structures (groynes, seawalls, piers, breakwaters, artificial reefs and surfing reefs; sand management (beach fill, dredging, grooming)	A significant factor affecting the resource base; high potential to change the natural dynamics of the surfing area	*1-5***
Marine and physical hazards	Indentify the presence of marine predators (sharks; jellyfish; man-o-war); physical hazards (dangerous currents, rocks, cliffs)	Aspects of the natural environment of concern in the argument for site use and conservation	*1-5 ****
Surf quality	Identify wave type; frequency; average heights; seasonality; amount of *surfable* days	The significance of point/beach/reef breaks, etc. and their *surfability* through each season to diverse surfer skill levels and stakeholders	*1-5*
Water quality	Identification of point and non-point sources of pollution; turbidity; nutrient loading; marine debris — or any affect of the aquatic environment on the surfer's health	Issues surrounding watersheds on land; urban runoff; sewage; construction sites; agriculture; aquaculture; golf courses; industrial discharge; level of nutrients or bacteria including *Escherichia coli*	*1-5*
	GOVERNANCE INDEX (*GovSRSI*)	**1-5**	
Beach and water safety	Number of lifeguards, towers and facilities (if any); seasonality of services; drowning statistics	Beach and water safety are relevant to the sustainable use of the area	*1-5*
Education	Types and numbers of printed materials; signage; workshops; community meetings; research; advocacy	Information base for the site; availability of information to stakeholders (including the public)	*1-5*
Legislative status	Type or level of conservation policy or protection status, if any.	For example: National Park; Marine Protected Area; National Surfing Reserve; World Surfing Reserve	*1-5*
Management	Identify existing guidelines or standards for activities; existence or effectiveness of enforcement; active policy measures	Consider beach security; area impacts; aspects of multi and mixed use areas; stakeholder engagement	*1-5*
NGO	Number or type of NGO or related activity affecting authority and activity	The ability to identify, monitor, report, and support issues related to the integrity of the site and usage	*1-5*

Public access	Determine the level of accessibility alongside laws or other issues surrounding public right of entry	Consider public/private/governmental entities inhibiting access or use of the site (such as hotels which deny entry)	*1-5*
SRSI COMPOSITE INDEX		***Mean Value of the Four Indices***	

* With or without appropriate economic valuation research and data, follow the 1-5 Likert scale

** Consider if affects are positive (give high score) or negative (give low score)

***Consider if hazards are high (give low score) or hazards are minimal (give high score)

THAILAND SRSI CASE STUDY

The Phuket, Thailand case study follows the methodology outlined for *SRSI* and is based on the indicators within each index (from Table 1). Site details were collected through 80 semi-structured interviews with foreign resident and Thai surfers in Phuket, Thailand during 2011 and early 2012 and previous nation-wide surveys conducted by Martin (2009; 2010a,c,d). Two key sites in Phuket, one urban (with high surf tourism impact) and one rural (with low surf tourism impact), were selected for testing the *SRSI* metrics. Although there are some 30 surf sites in Phuket (ibid.), due to space limitations in this paper, the selection of one urban and rural site serve to place the study into a comparative context. Both sites had been previously recommended for surfing reserve consideration (Martin, 2010a,d). 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 travelling surfers, and is known among surfers to have issues of water pollution, carrying capacity, and mixed uses with other activities such as swimmers and jet-ski and parasail operations (ibid.). The comparably rural *Nai Yang Beach* located in the Sirinart National Park of Northern Phuket encompasses several different reef and beach breaks and is known among surfers for its relative natural integrity in terms of national park protection, minimum foreshore development, and reasonable water quality. Distinctions for each site are placed in regional context rather than in an international context (i.e. conceptually, each area is compared in context with other areas in Phuket) (see results below). The purpose of the case study was to test *SRSI* metrics in the field in order to refine the methodology.

Case Study Results

The Thailand case study approach encountered challenges in assigning site-specific ratings for indicators. For example, the indicator for history at Kata Beach was assessed as high context and this rating is assigned relative to other beaches on Phuket. Alternatively, if the assessment was global in scope and famous surf beaches in Australia or Hawaii were considered as benchmarks for historical context, then Kata Beach would likely receive a low score card. Herein the parameters of the *SRSI* need to be made clear from the outset. Although the *SRSI* Composite values were similar (2.92 for Kata and 2.80 for Nai Yang), considerable variance was found between the urban and rural surf beach in terms of the conservation aptitude. For example, the urban Kata Beach index indicates a high economic contribution, while the environmental aspect is slightly above a fair condition; and although the societal rating is high, the overall governance rating of the site is very low. In contrast, the rural Nai Yang Beach index indicates a low economic contribution from surfing, while the environmental aspect is high; and while the societal rating is low, the overall governance rating of the site is good. Thus we identify a measure of validity at the indicator and index levels and need to further verify the practicality and applicability of the composite index

values given the current approach and application of metrics. However, the results served functional in identifying the specific criteria for ‗conservation aptitude' at each site. Overall, we found that developing the societal index (*socSRSI*) and the governance index (*govSRSI*) were straightforward processes (save for the indicator for management which includes criteria for enforcement); while the economic index (*econSRSI*) was ambiguous in terms of market and non-market values and surf event significance which require in-depth research; and the environmental index (*envSRSI*) was incomplete in terms of measuring the indicators of beach quality, biodiversity, and water quality, which were based on the researchers' perceptions rather than precise measurement. In principle, we found that the case study was significant step toward the development of *SRSI* metrics, and further field work is recommended.

Table 2: Kata Beach SRSI—Conservation Aptitude

Indicator	**Site Detail* Value****	
SOCIETAL INDEX (*SocSRSI*)	**3.50 (High)**	
Carrying capacity *(psychological)*	Based on average *surfable* day: Capacity is determined to be 50 surfers; current average number of surfers in the water at a given time is approx. 30 -50; average surfers per day is approx. 120-150; crowding has increased significantly since 2007; surf rage and aggression (due to overcrowding) increased noticeably in 2011	*4*
Experiential	Overall good sense of experience for most surfers. Issues affecting experiential attributes include: those conflicts among surf tourists of various skill levels and nationalities and those of personal safety due mainly to mixed usage of the surf area	*4*
History	Longest continuously surfed site in Thailand (from early 1980s-present)	*4*
Lifesaving club	No lifesaving clubs or lifesaving culture; surfers regularly perform rescues	*1*
Public safety	Relatively safe area. Low levels of theft (personal or vehicle related). Issues of public safety are mainly: those from mixed usage of area (jet ski/parasail); conflicts among surfers; and those from crimes at night (irrelevant for surfing)	*4*
Surf club	Local surf club (*Kata Krew*) established in approximately 2005 with 20+ members; *Phuket Boardriders Club* dismantled in 2010; surf rental stands may have club atmosphere and foster organization and communication among surfers	*3*
Surf events	Focal point for the development of organized surf contests since 1999 (*The Phuket Surfing Contest*); occasion contests for kids (i.e. *Grom Search*)	*4*
Surfing community	Approximately 80 surfers; mixture of Thai and foreign surfers; seasonal surf tourists may be integrated into the surfing community; focal point of Thai surf culture	*4*
ECONOMIC INDEX (*EconSRSI*)	**3.60 (High)**	
Market and non-market values	Prevalent foreign resident surfing community (residing and surfing in the area specifically for the resource) contributing to the local economy; high economic benefit both hard, soft and incidental surf tourists	*4*
Surf amenity	None	*1*
Surf events	Contributions to hotel occupancy short term benefits, exposure of	*4*

	the site (long term benefits), varying degrees (annually) of hotel and governmental support and advertising	
Surf industry	2 surf beachfront shops and 6 surfboard rental stands. All 8 entities offering equipment for hire and surfing lessons	*4*
Surf tourism	Rapidly increasing numbers of surf tourists, particularly beginners from Russia and Japan and experienced from Australia and Japan; overall dynamic growth in surf tourism activity at the site	*5*
ENVIRONMENTAL INDEX (*EnvSRSI)* 3.28 (Fair)		
Beach quality	Extensive foreshore development fronting surfing areas; considerable beach litter during monsoon season (point sourced from canals and the sea); issues of encroachment by beach concessions	*3*
Biodiversity	Low visibility of marine biodiversity in wake of prolific development and lack of coral reefs; (see water quality for alternative issues)	*2*
Carrying capacity *(Eco-physical)*	Multiple sand breaks afford a wide range of takeoff zones offering a relatively high physical capacity to accommodate surfers; minimal impact by surfers using the area (no sand dunes or reefs to damage)	*4*
Coastal engineering	No apparent issues, save for existing sea walls located well above the high tide mark; some potential negative effects to incoming ocean swells from offshore artificial reef projects ***— Reverse scale (low effect receives high score)***	*4*
Marine/physical hazards	No shark sightings; occasional jellyfish ***—Reverse scale (low hazard receives high score)***	*4*
Surf quality	High aptitude of the site to accommodate wide variances in swell direction, tides, and winds (break may remain *surfable* during the predominant onshore monsoonal wind flow). Seasonality: favorable sand bars develop for surfing during monsoon season (5 months); off season sees unfavorable sand bars for surfing (e.g. sand re-deposits near the foreshore)	*4*
Water quality	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); marine debris, especially plastic bags, food wrappers, and fishing supplies in the surfline	*2*
GOVERNANCE INDEX (*GovSRSI*) 1.33 (Very Low)		
Beach and water safety	1 permanent lifeguard tower; unstable lifeguard contracts (unpredictable presence of lifeguard services); issues of ungoverned mixed use area (surf zone is shared with swimmers, jet ski, parasail, etc.); occasional drowning	*1*
Education	Several signs warning of surf-related ocean currents	*2*
Legislative status	No legislative recognition of surfing activities at the site; no applicable environmental protection policy	*1*
Management	Issues of unenforced mixed use area (surf zone is shared with swimmers, jet ski, parasail, etc.); no existing guidelines and standards	*1*
NGO	None identified	*1*
Public access	Foreshore development is highly condensed and limits access to	*2*

	some degree; small parking area is the only public point of entry to the surf zone	
COMPOSITE INDEX (ComSRSI) MEAN VALUE		**2.92 (Medium)**

*Based on personal observation and interviews with surfers and other stakeholders from 2007-2012

**Value ratings follow a 1-5 *Likert Scale;* High values reflect a higher aptitude for conservation

Table 3: Nai Yang (center reef) SRSI—Conservation Aptitude

Indicator	**Site Detail*** **Value****	
SOCIETAL INDEX (*SocSRSI*)		**2.25 (Low)**
Carrying capacity *(psychological)*	Due to the rural nature of the site and distance of the break from shore, crowding has yet to become an issue, although this matter is of concern to local surfers; small shifting peak accommodating approximately 6 to 10 surfers before crowding is a problem	*2*
Experiential	High sense of experiential quality: well-being, activity, self-fulfillment, and self-regulation. No concerns over localism	*5*
History	Undocumented surf history; site has been surfed by relatively small groups of surfer for previous 10 years	*2*
Lifesaving club	No lifesaving clubs or lifesaving culture	*1*
Public safety	Good record of public safety and low crime within the national park	*4*
Surf club	There are currently no surf clubs in the area; account should be taken of the local kite-surfing club/culture during the monsoon season	*1*
Surf events	There has never been a surf contest at the site	*1*
Surfing community	Very small community of foreign resident surfers; most surfers who frequent the site travel from other locations in Phuket	*2*
ECONOMIC INDEX (*EconSRSI*)		**1.25 (Very low)**
Market and non-market values	Low expenditures by surfers in the area (i.e. most surfers arrive, surf, and leave the park area); however use of the area is increasing	*2*
Surf amenity	None	*1*
Surf events	There has never been a surf contest at the site	*1*
Surf tourism	Very few surf tourists visit the site	*1*
ENVIRONMENTAL INDEX (*EnvSRSI*)		**3.71 (High)**
Beach quality	Limited foreshore development; easy access through national park; parking areas; evidence of beach litter (point sourced park users and the sea); newly emergent and unexplained issues of coastal erosion	*4*
Biodiversity	Presence of marine life (fish, sea urchins, coral reefs); previous issues of dynamite fishing and affect of the tsunami on coral reef. Staghorn and other corals are regenerating. Unexplained growth of coral-rubble mound inshore of the surfbreak	*4*

Carrying capacity *(Eco-physical)*	Small shifting peak with a relatively low physical capacity to accommodate surfers; flat shallow reefs areas susceptible to trampling by surfers	*2*
Coastal engineering	No apparent issues ***— Reverse scale (low effect receives high score)***	*4*
Marine and physical hazards	Sea urchins; reef sharks on outer reef areas ***—Reverse scale (low hazard receives high score)***	*4*
Surf quality	Reef break, single peak, with other less favorable peaks located northwards; only *surfable* on small to mid range swells (1-2 meters); poor ability to handle windy/sloppy conditions; unique in Phuket for highly favorable seasonality accepting groundswell year-round	*4*
Water quality	2 klongs (point sources) of pollution, especially during monsoon season; fisher related pollution including oil from local groups of *longtail* boats. However, surf site is offshore where water quality is normally good. Presence of marine debris during Southwest Monsoon season carried from offshore currents and winds	*4*
GOVERNANCE INDEX (*GovSRSI*)	**4.00 (Good)**	
Beach security and water safety	Presence of national park staff; unstable lifeguard contracts; no local lifesaving culture; drowning is rare due to minimal nearshore currents (high surf episodes notwithstanding)	*3*
Education	Limited materials available at park headquarters; local campaign to educate youth on environmental issues; beach clean ups are organized	*4*
Legislative status	National Park and Marine Protected Area designation; no motorized tourist craft allowed (jet ski/parasail)	*5*
Management	No immediate issues of mixed use area (surf zone is not shared with other stakeholders, save for kite and windsurfers at times); recycling containers in place and maintained; questions may exist to the effectiveness of Marine Protected Area management and enforcement (particularly issues surrounding fishers and discharges from *longtail* boats)	*3*
NGO	Presence of several NGOs at present (Sustainable Smiles; SEEK) working toward improving environmental management and awareness	*4*
Public access	Good public access, limited foreshore development, ample parking	*5*
COMPOSITE INDEX (Com SRSI) MEAN VALUE	**2.80 (Medium)**	

*Based on personal observation and interviews with surfers and other stakeholders from 2007-2012

**Value ratings follow a 1-5 *Likert Scale*; High values reflect a higher aptitude for conservation

KEY IMPLICATIONS

At the base of the study is the process of identifying key indicators and constructing indices. The study offers a set of building blocks which include qualitative and quantitative metrics. The research finds that although it is intrinsically problematic to attach quantitative values on qualitative attributes, the process serves to catalogue and evaluate sustainability factors in such a way as to create an argument for surf site conservation.

Uncertainties

This research is ongoing and a number of issues need to be addressed. While identifying indicators is reasonably straightforward — evaluating, rating and assessing 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, each indicator can be fractioned into sub-indicators in order to achieve accurate measurement. Based on the determination of importance (weighting) a distinction must be made whether the indicator should be treated as a sub-index or index. Thus beyond determining and defining surf resource sustainability indicators, we found the criteria for measurement must delineate the intricate denominators. In point of fact, many of the indicators employed here could be developed at the index level (‗water quality' is an obvious example).

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 indicator qualification and quantification and faced considerable challenges in assessing the 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 simply assess individual indicators through qualitative description aimed at ‗conservation aptitude'. However, future research can address this choice in metrics and a more comprehensive and quantitative approach can be employed. Furthermore, rather than assigning equal weights to indicators or sub-indices (weights as the relative importance of each indicator within a given index), the *SRSI* can benefit from a more comprehensive approach than that employed in this study. A paradigm for indicator and sub-index weighting can be designed based on focus group consensus, scholar consensus, and/or stakeholder surveys. For example, the responses of approximately 10 or 12 experts (chosen for their knowledge and experience in the surf resource topic area) obtained by questionnaire and personal communications could be used.

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 to 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.

Benefits

SRSI may prove beneficial in raising awareness and outlining key issues surrounding surf site integrity and serve as a comprehensive information resource for surfers and other stakeholders. As a methodology, the index concept presented in this paper offers a systematic approach to setting benchmarks for surf site sustainability and conservation. Benefits to the *SRSI* methodology may include:

- Taking into account key values of physical and social capital (i.e. measuring and weighting *Surfing Capital* and other criteria at given sites).
- Assisting policy makers, including authorities and NGOs in the justification of surf site conservation, including the legislation of *Surfing Reserves*.
- Pinpointing strengths and exposing weaknesses in coastal resource policy and management.
- Innovating new metrics for documenting and measuring surf site biodiversity.
- Outlining key concerns in surf beach safety in social, political and environmental contexts.
- Comparing one surf site, island, region, or nation with another.

- Serving as a guide for surfers and surf tourists.

Toward Future Innovation

SRSI is under design to create applicable and adaptable building blocks for surf site sustainability which are both theoretical and practical. Particular issues may require the innovation of particular indices for precise applications, such as gauging the biodiversity of a surf site or assessing the impacts of surf tourism. The following works are currently under *SRSI* development:

- Standard lexicon and codes for indicators and indices.
- Quantifiable weighting and rating metrics for indicators and indices.
- Surf tourism *SRSI*.
- Biodiversity *SRSI*.
- Threat-based *SRSI*.
- Climate change *SRSI*.
- Icons for indicators; color schemes for indices.
- *SRSI* Conservation Action Matrix (see Figure 2).

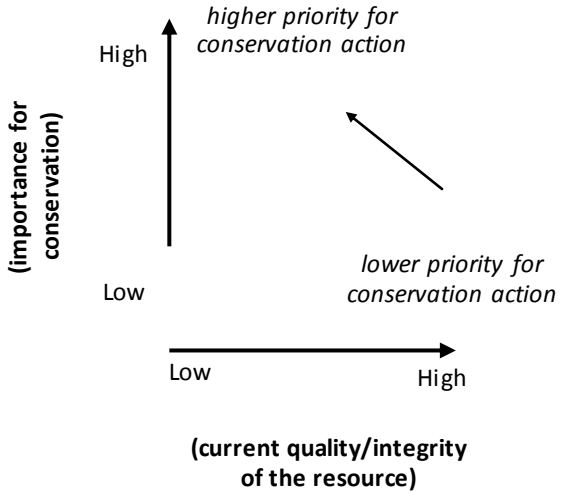

Figure 2: Surf Site Conservation Action Matrix

CONCLUDING THOUGHTS

Surfing is in an exponential state of growth in the world in both prolific and non-prolific surfing areas and nations, and environmental concerns are well documented in the literature. However, data-driven index methodology employing comprehensive metrics had not previously been designed. The core premise of this research is that the conservation of coastal surfing resources can benefit from the innovation of standardized indicators and indices, and given the current trend to earmark iconic surfing areas as surfing reserves, *SRSI* metrics can serve as a leveraging tool in the argument toward surf site protection. Ultimately, *SRSI* will develop into an inventory of standardized indicators whereby site-specific checklists can be adopted to fit the criteria of a given area.

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