



Management priorities and carrying capacity at a high-use beach from tourists' perspectives: A way towards sustainable beach tourism

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ABSTRACT

The growth of beach tourism has increased the need for acceptable, practical and sustainable policies. Overcrowding, sand loss, habitat destruction, littering, water pollution, among others problems, are commonly documented arising from booming beach activities. The objective of this paper was to identify management priorities and estimate carrying capacity of a high-use beach from tourists' perspectives. In this way, managers can make informed decisions, leading to enhanced beach quality. Specific procedures to fulfill this objective were progressively established to identify potential actions that address the concerns facing the beach environment. A body of data was collected by means of questionnaires. Results showed that beach cleanliness, safety, information provision, sediment and habitat management, and overcrowding were considered important by tourists, reflecting the areas of priority for actions. If a policy is set to avoid tourists overcrowding, the carrying capacity limit was estimated to be 680 people at one time and 2040 people on a daily basis. In this scenario, a tourist enjoys on average 22.06 square meters of the beach space. Results from focus group discussion suggest a list of potential actions targeting these management priorities. This helps to build a participative policy approach to sustainable beach development. Finally, taking special care in putting the management priorities into practice was discussed to facilitate beach management.

1. Introduction

Increasing marine and coastal tourism makes marine environments increasingly important for the provision of open spaces and opportunities for tourism and recreation activities [1,2]. The beach, being one such marine environment, is a meeting place between land and ocean, extending from the low tide line landward across the unvegetated sediment to the beginning of vegetation or to the next geomorphic feature in the landward direction, which may be a dune, a bedrock, or nowadays a seawall [3]. With its interesting landscapes, fascinating creatures, and beautiful scenery, beaches are important resources for tourism and make potential valuable economic contribution to tourist destinations [4,5]. However, it is noted that beaches are classical examples of common property resources. Its two inherent characteristics of excludability and subtractability would potentially lead to a tragic loss of the resource [6]. It is therefore not surprising to see that as beach tourism continues to increase, the activity has started to exhibit signs of causing environmental degradation, affecting both ecological status and the recreational experience of tourists and thereby become detrimental to host communities [7,8]. To prevent 'the tragedy of the commons' and secure significant values generated from beach tourism, pursuing sustainable beach tourism is very important.

Therefore, beach conservation and appropriate management should be a priority action [9].

Beaches have diverse types. Based on physical dimensions, they could be covering a spectrum from dissipative to reflective; natural or artificial; pocket, linear or logarithmic spiral shape; consisting of a sediment of mud, sands, gravels, cobbles, and boulders. Based on an anthropogenic dimension, they may be classified as remote, rural, urban or resorts [16]. In this respect, each beach has a unique character and faces its own problems arising from various degrees of human uses. This indicates that each beach needs its own specific management strategies. In fact, beaches are inherently multidimensional environments, comprised of interacting natural, social-cultural, and management systems [10,11]. Due to this multidimensional nature, natural, social and managerial parameters or criteria that are important to beach quality have earned increasing attention from researchers [12–14]. Relevant criteria include habitat management, water quality, clean beach, safety, spatial planning to manage different uses, control over the level of beach use, adequate facilities, among others. An investigation of 50 beach aspects in a number of countries also showed that 'safety, facilities, water quality, no litter and scenery' were five greatest important criteria on beach choice [15,16]. Improving performance of these criteria is a way to prevent 'the

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tragedy of the commons' and to pursue sustainable beach tourism.

Knowing which aspects of the beach in question need priority management and staying within the maximum number of visitors allowed without jeopardizing the beach quality, particularly for high-use beaches, are quite relevant to the improvement of concerned criteria. The former is critical particularly when resources for strategic planning of beaches are limited. The latter is to provide a specific answer on the limit of visitors, which helps pursue a balance between impacts and the level of use. The limit on the number of beachgoers is derived from the concept of carrying capacity, which is quite relevant to the idea of sustainability [17]. Carrying capacity is defined as the maximum number of people that may visit a tourism destination at the same time, without causing destruction of the physical, economic and socio-cultural environment and an unacceptable decrease in the quality of the visitor's satisfaction [18]. This definition indicates that critical social and biological thresholds exist, above which amenity values may be reduced and biological impacts may become significant. Carrying capacity has three dimensions- resource, experiential and managerial and has become one of the most important and long standing ideas in environmental management [19]. It has been considered as an appropriate tool for beach management, as it enables the preservation of the high quality and quantity of coastal resources and long-term economic and ecological benefits for future generations [20].

Taiwan has a number of beaches scattered around its coasts and outlying islets. Some of them are located in popular scenic areas that provide recreational opportunities for the public to engage in various types of water activities. It has been noted that Taiwan used to restrict the access to coastal areas when martial law was imposed (the period from 1949 to 1987). After the lifting of this law, unlocking coastal areas has become one of important policies on governmental agenda and free access to beaches is the top task in putting this policy into practice [21]. With an increasing demand for marine recreational activities due to opening up coastal areas, beach tourism is growing at a significant rate. A significant flow of tourists come to beaches to enjoy nature, escape crowds and relax in very recent years. As an illustrative example, at Nanwan beach, a popular getaway in southern Taiwan, visitors increased exponentially to reach a historical high at 511,848 in 2015, more than double the number in 2010 [22]. Following this rapid growth, several studies documented signs of overcrowding, littering, and environmental degradation [23–25]. However, managers in Taiwan have paid little attention to the impact of beach recreation, even though it potentially generates considerable economic benefits. Given that beaches are considered a major player in the tourism market [5], to benefit from this, it is urgent to take proactive policies along beach areas. It has been noted that tourists' perceptions, needs, and preferences with regard to beach quality should be added to management in order to produce a better-informed and context-based process [26,27]. Therefore, this paper seeks to identify management priorities and estimate carrying capacity from tourists' perspectives. For this purpose, a specific beach in Taiwan, Baisha, was the subject of this study. In addition, tangible actions to operationalize the management priorities and carrying capacity were also proposed. This provides a window into on-the-ground measures to improve beach environment management. It was hoped that the discussions connecting them contribute positively to pragmatic beach planning and management.

2. Study site

The study was conducted at Baisha beach, located on the southern tip of Taiwan (Fig. 1).

The beach is situated in the Kenting National Park. The Park faces the Bashi Channel and is known for its surrounding coral reef coast and turquoise-colored water, being highly attractive to marine activity enthusiasts. Baisha is one of must-visit sites for visitors to the Park and is based on a sun, sea and sand (3 S) market. The beach has a limited space with approximately 700 m in length. The sediment

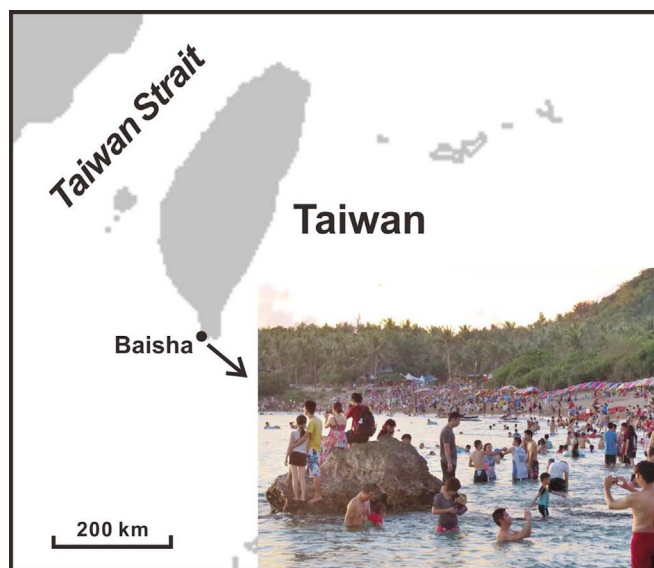


Fig. 1. Location map of the investigated beach, Baisha.

consists of as high as 87.6% of biogenic grains, including mostly coral fragments, calcareous algae, foraminifera and shell fragments. The beach earns the name 'white sand' in Chinese due to its unique sand color. Baisha is designated as a recreation zone, indicating that Baisha mainly has a recreational purpose, subject to the paramount objective of natural conservation as prescribed in the National Park Law [28].

The fine white beach grains, tropical climate with an average temperature of 25°C, as well as a relatively pristine landscape with absence of coastal protection structures (i.e., groins and revetments), make this beach a popular tourist destination. In addition, thanks to good yearlong weather conditions, there are no marked low seasons, though there are apparently more tourists during the summertime.

The beach has faced a rapid growth of tourists in recent years. To accommodate this growth, there are more anthropogenic activities/developments along the beach, including large parking spaces, campgrounds, and a huge wooden platform accommodating food and drink stands. In addition, there are several guest houses to cater to tourists, mostly remodeled from old, shabby ones.

3. Methods

This research draws on a two-stage method. The first stage involves the questionnaire survey, which investigated what management options are perceived important in tourists' minds in terms of improving beach quality. The survey was also used to estimate carrying capacity. The second stage deals with focus group discussions to propose workable actions to the management options and carrying capacity that are drawn from the first stage. A research flow diagram was presented in Fig. 2.

3.1. Questionnaire survey

3.1.1. Estimation of carrying capacity

Several different types of carrying capacity limits exist, and its estimation is based on the concept of limits of acceptable change (LAC) to find the type or amount of change that is unacceptable [19]. The LAC concept has great appeal to environmental managers who desire a simple criterion of specifying what level of human activity can be sustained by a particular activity [29]. The limits or thresholds established are based on physical, biological or management conditions of the environment in question. Illustratively, with increasing use of the beach, some change in the natural resources and visitor experience is inevitable. But sooner or later the type or amount of change may

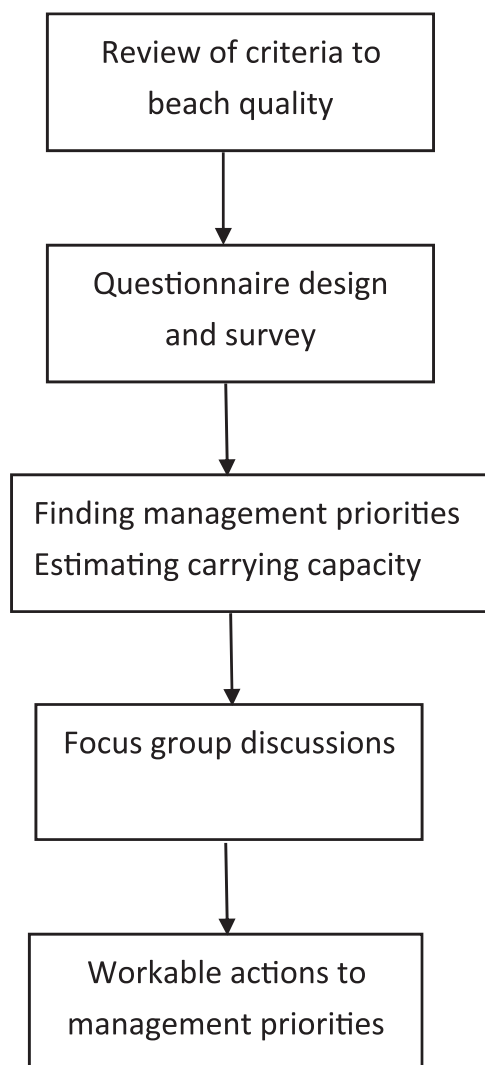


Fig. 2. The research flow diagram.

become unacceptable. The carrying capacity can be found through formation of management objectives (sometimes called desired conditions) and associated indicators and standards [19]. Indicators are measurable variables reflecting the essence of meaning of management objectives. They may include elements of the resource, experiential, and management environments that are important in determining the quality of area conditions. Standards define the minimum acceptable conditions of indicator variables.

In this study, the main management objective was identified as providing public recreational opportunities in light of Baisha being designated as a recreation zone in the zoning project [28]. The indicator of the perceived level of overcrowding was chosen to reflect the recreational experience. This indicator is based on the concept of social carrying capacity and has been widely used in literature [9,30,31].¹

The visual research method is a potentially important approach in

¹ The reasons for the selection of this indicator are two-fold. One is that while Baisha has a recreational purpose, it is subject to the paramount objective of natural conservation. In this sense, ecological carrying capacity might not be a big issue given the quality of natural environment are well maintained by park managers. Particularly, construction and/or remodeling of hard facilities which is quite relevant to the destruction of natural environment is highly restricted by law. In addition, economic carrying capacity might not a big issue either since the Park is a popular tourist destination and local communities have long been used to tourism development and have accommodated tourist functions without showing signs of the loss of local activities. The

the studies of crowding, given they have advantages of providing pertinent information to respondents that would be difficult to communicate through conventional narrative/numerical approaches and present conditions that are difficult to find in the field or that do not currently exist [19]. This method was thus used to measure tourists' perceived sense of overcrowding when they looked at a range of photos. The procedures in estimating the carrying capacity were as following:

Step 1: A linear regression model is established as: $y=a+bx$, where x is the number of visitors and y is the level of overcrowding.

Step 2: The model is checked for statistical significance.

Step 3: If yes, the standard defining the minimum acceptable condition of the indicator variable was chosen and 'x' calculated based on the chosen standard. It was noted that the more stringent the standard, the smaller the carrying capacity.

Step 4: The real area of the beach was 10 times the area shown in the photo. The carrying capacity was thus derived by multiplying 'x' with 10.

3.1.2. Questionnaire design

The questionnaire consisted of three parts. The first part focused on visitors' profiles. The second part measured their sense of overcrowding. Six computer-edited photographs showing a range of visitor number at the beach, 0, 20, 40, 60, 80, and 100, respectively, were presented.² The beach area in the photos was scaled down to be 1-10 of the real area which is about 15,000 m². Respondents were asked to score the perceived levels of crowding for each photograph on a five-point Likert scale from very crowded (=1) to not very crowded (=5).

The third part dealt with tourists' attitudes toward potential management options. The options were devised initially based on the criteria to beach quality established by Chen and Bau (2016) [14].³ A total of 15 management options were presented in the format as 'according to your recreation experience at this beach, how much you agree to have the management options that you think are important in improving beach quality?'. The options were gauged with a five-point Likert scale from very unimportant (=1) to very important (=5).

Lastly, the draft of the questionnaire was revised and finalized based on feedbacks from 12 students of National Cheng Kung University who have been to Baisha before. They were chosen to evaluate the clarity of language, the smoothness of flow of the questions, the appropriateness of the length of the questionnaire, and the time taken to answer the questions.

3.1.3. Data collection and analysis

The anonymity of the questionnaire was guaranteed. Data were collected by means of questionnaire surveys administered at the beach from May to August 2015. The questionnaires were conducted during a span of two days each month from 10:00 am to 5:00 pm.⁴ Using the convenience sampling method,⁵ tourists aged eighteen or older who

other is that social carrying capacity stands as an issue given the growing number of tourists, and solving it would be significant in contributing to the sustainable beach development.

² The photographs were presented in the [Supplementary material](#).

³ The criteria to beach quality were established in the context of a high-use beach, Nanwan, in Taiwan. Due to both beaches, Nanwan and Baisha, being within the same Park and facing the similar problem of the growing number of tourists, the criteria pertaining to Nanwan were thus referred to in devising potential management options in this study.

⁴ The two days were intended to be consecutive and cover working days and holidays. Therefore, mostly Fridays and Saturdays were chosen for the questionnaire survey.

⁵ This method was used for two practical reasons. One is that while the probability sampling method might be more likely to select subjects that are representative of the entire population, this approach seems undesirable since the beach, Baisha, is an open space and it is hard to find specific locations where all tourists may stop by for randomly sampling tourists. The other reason is that given human and financial resources are limited, the convenience sampling methods is comparatively inexpensive, easy and fast and thus be more desirable and suitable for this study.

Table 1
Composition of participants in focus group discussions.

Group	No. of participants
Academia	2
Authorities	2
Marine NGOs	2
Local operators	3
Local communities	2
Beachgoers	3

were willing to participate in the survey were given the questionnaires. A total of 465 questionnaires were obtained.⁶

Data were assembled and summarized in a database. The data were evaluated using percentages or means and standard deviations, depending on the nature of the data. In addition, a linear regression analysis was employed to determine the association between tourists' sense of overcrowding and the number of tourists. This analysis is used to estimate the carrying capacity. The dependent variable is the number of visitors shown in the photos and the independent variable is the visitors' sense of overcrowding. All data analyses were performed using the SPSS programme and a *p* value of 0.05 was used to check if the association between variables is statistically significant.

3.2. Focus group discussion

If there is to be a move towards sustainable tourism, there needs to be an alliance between all the various stakeholders in a particular role for local coordination of efforts [32]. Therefore, stakeholder engagement and management in developing sustainable policies are critical elements within sustainable tourism [33]. In this respect, this study established a list of stakeholders, who are familiar with the Baisha environment and recreation development, using the purposive non-probability sampling strategy [34] to participate in focus group discussions. The composition of participants is presented in Table 1, including 3 local operators, 2 from local communities, 2 from academia, 2 from marine NGOs, 2 from the authorities (the park authority and the local government), and 3 beachgoers who visited Baisha more than two times. Two rounds of discussions were held in September 2015 and each lasted about 2 h. The discussions centered on what workable actions could be used to implement the management options which were perceived important in visitors' minds. It should be noted that reference materials regarding existing marine management strategies were prepared in the discussions. The strategies were broadly grouped into four categories: regulatory, physical, economic and educational [35]. It was intended that the materials help stimulate focused discussion and intense idea exchanges among participants.

4. Results

4.1. Tourists' profiles

Male respondents (56%) slightly outnumbered female. Less than half of tourists were in the age class of 21–30 years (46%), followed by the age classes of 31–40 years (24%) and less than 21 years (18%). The dominant majority of tourists participated in non-motored activities, most of which took place above the tide line, including walking/strolling (100%), playing with sea water and sand (95%). About 20%

⁶ It was noted that Chinese and foreign tourists were not sampled. While tourists from China constituted a significant proportion based on field observations and accounts of local operators, they were often notified by tour guides not to participate in the surveys when they were approached and asked to fill in the questionnaires by researchers. Foreigners were not sampled either since the questionnaire was made in Chinese and their number was quite small, compared to the large number of domestic and Chinese visitors.

Table 2
Tourists profile (n=465).

Items	%
Gender	
Male	56%
Female	44%
Age	
≤ 20	18%
21–30	46%
31–40	24%
≥ 41	12%
Marine recreational activities engaged (multiple choices)	
Non-motored	
Walking/strolling	100%
Playing with sea water and sand	95%
Swimming	20%
Others (e.g. snorkeling, sailing)	3%
Motored	
Jet-skiing	3%
Are you willing to pay the entrance fee to access the beach?	
Yes	52%
No	48%
If you answered 'yes' to the above question, how much you are willing to pay? (n=242)	
< 50	40%
51–100	43%
101–150	12%
151–200	3%
> 201	2%

participated in swimming and as low as 3% in motored activities such as jet-skiing. If entrance fees were charged, slightly more than half of respondents (52%) were willing to pay the fee. Among them, almost similar portions of respondents were willing to pay a fee of less NTD⁷ 50 (40%) or NTD 50–100 (43%), while 12% and 5% were willing to pay a fee of NTD 101–150 and greater than NTD 150, respectively. The summary was shown in Table 2.

4.2. Management priorities

The mean scores of management options were shown in Table 3. Options of 'beach cleanups', 'safe access to the beach', 'monitoring of water quality', 'control over the number of beachgoers to avoid overcrowding', 'information provision', 'controlling waste water discharge', 'sediment and habitat management', and 'emergence plans to cope with emergent natural and man-made events' were rated as the ones with high agreement, with mean scores of 4.30, 4.25, 4.18, 4.15, 4.10, 3.95, 3.80 and 3.78. A *t*-test showed these scores are significantly greater than or equal to 4, indicating that these eight management options were perceived important in visitors' minds with regard to enhancing beach quality.

The options of 'entrance fees', 'adequate waste disposal bins and recycling bins', 'life guards and lifesaving equipment in place', and 'provision of toilet, restroom and shower facilities' came second with mean scores of 3.68, 3.60, 3.58 and 3.43, respectively. A *t*-test showed that the means scores are significantly greater than three but less than four, indicating that tourists slightly agreed with these options. In addition, it is noted that the standard deviation of the option of entrance fees appears to be slightly bigger, compared with other items. This suggests that there exists a larger extent of different views among visitors towards entrance fees.

The remaining options of 'beach spatial planning to manage different uses', 'sufficient parking spaces', and 'a supply of drinking water' were rated with mean scores of 3.28, 3.20, and 3.01, respectively. A *t*-test showed that the scores are significantly equal to 3, indicating that tourists kept a neutral view towards them.

⁷ NTD: New Taiwan Dollar. USD 1=NTD 31.

Table 3
Tourists' perspectives on management options (n=465).

Questions	Mean	SD
Beach spatial planning to manage different uses	3.28	0.785
Controlling waste water discharge	3.95	0.868
Beach cleanups	4.30	0.811
Monitoring of water quality	4.18	0.754
Lifeguards and lifesaving equipment in place	3.58	0.872
Safe access to beaches	4.25	0.068
Emergency plans to cope with emergent natural and man-made events ^a	3.78	0.825
Sediment and habitat management	3.80	0.854
Information provision ^b	4.10	0.782
Adequate waste disposal bins and recycling bins	3.60	0.925
Sufficient parking spaces	3.20	0.900
Control over the number of beachgoers to avoid overcrowding	4.15	0.661
Entrance fees	3.68	1.234
Provision of toilet, restroom and shower facilities	3.43	0.872
A supply of drinking water	3.01	0.752

Note: Using a 5-point scale from 1 (very unimportant) to 5 (very important).

^a Emergent events are such as oil spills, hazardous/toxic waste spills, discharge of storm waters, typhoons, algae bloom, sharks, bacterial contamination.

^b The information is diverse, form beach maps, codes of conduct, regulations, water quality, wave and weather condition, patrolled areas to potential physical and biological hazards such as strong currents, and submerged rocks.

The options above with scores significantly greater than 3 will be referred to the focus group discussions in the next stage and were deemed as management priorities.

4.3. Estimation of the social carrying capacity

Table 4 provides results from the linear regression to examine the association between the number of tourists and level of crowding. With F of 204.821, the model is statistically significant.

It was noted that estimation of carrying capacity involves some element of management judgment. It should consider a variety of factors inherent in carrying capacity, including the purpose and significance of the area, the fragility of natural and/or cultural resources, financial and/or personnel resources available for management [19]. As noted previously, the beach, Baisha, has a recreational purpose. It is easily accessible, highly used, and managed by the National park. Thus, it may be reasonable to choose the standard at the median level of crowding. With this management judgement, the corresponding number of visitors was 68. The social carrying capacity is thus 680 people at one time. In other words, a person would not feel overcrowding if he/her enjoys a space of at least 22.06 m² at the beach. In addition, according to field observations, most tourists stayed at the beach from nine o'clock in the morning to six o'clock in the afternoon. If three hours was used as an average period that tourists stayed at beach, then the daily social carrying capacity is estimated as 2040 people.

If a more lenient standard is considered, with the level of crowding being 4, the carrying capacity increased to 1040 at one time and daily carrying capacity is 3120. People would feel overcrowding if he/she has less than 14.42 m² of the beach space.

4.4. Workable actions to management priorities

A series of potential actions under each management option were proposed and compiled in Table 5. These actions serve as a guideline for managers to make necessary changes in their ways of managing and maintaining the beach environment and recreation quality.

While the options not rated with scores significantly greater than 3 were not under discussion, the option of 'beach spatial planning to manage different uses' had particular attention in focus group discussions. This option is important to beach quality and quite relevant to

Table 4
Results of the linear regression between the number of visitors and level of crowding.

	Coefficients	t value	p value
Constant	1.086	6.558	0.000
B	0.028	12.262	0.000
F=204.821			

safety, particularly at a beach where non-complementary water-based activities exist [36]. At Baisha, conflicts between incompatible activities may not be an issue, since most visitors were engaged in non-motored activities and only a small few in motored ones, and those motored ones always took place far beyond the water area where non-motored ones did. This indicates beach spatial planning might not be a priority for the time being. But it may become an important item as more and more incompatible activities occur at the beach.

5. Discussion

This survey was specifically designed to accomplish the main task of finding management priorities and carrying capacity by examining how tourists rate management options and perceive overcrowding. The focus group discussions were then undertaken to find out potential actions to put these management priorities and carrying capacity into practice.

The study found that beach cleanliness, safety, information provision, sediment and habitat management, and overcrowding are the things tourists were concerned the most about, reflecting the areas of priority for actions. As many as three management options - beach cleanups, monitoring of water quality and controlling waste water discharge pertaining to 'beach cleanliness' indicates that a clean beach environment is one of the most important things perceived by visitors. This is not surprising, since a clean beach environment is the key to tourists' recreational quality and travel intentions [8,37,38]. A study showed that a huge loss of tourism revenues was caused due to a large amount of marine debris being washed up on the beaches of Geoje Island, South Korea in 2011 [39]. Therefore, it is particularly essential to keep the beach as clean as possible since a clean environment has great implications for tourism. In Taiwan, for the beach to be considered in 'good' condition, water quality standards are recommended as "the limit values for microbiological parameters, *Fecal coliform* and *Enterococci*, being 1000CFU/100 ml and 50 MPN/100 ml, respectively" [40]. Water quality at Baisha should be kept under these limits.

Safety is undoubtedly an important concern for tourists. Baisha is, in general, a smooth dissipative beach with lifeguards patrolling in the daytime during summer seasons. The beach is basically safe given this condition. Nevertheless, actions, as listed in Table 5, relating to safe access to the beach, need to be paid attention to. A recent media report of a tourist injured by an iron hook at the beach showed the importance of creating a safe beach space [41].

Information provision is to provide tourists with beach information. With more information provided either in the forms of signage, beach maps, brochures, websites or apps, it is expected that tourists would be more informed, and thus are more likely to be able to avoid potential hazards (e.g. avoiding sites where physical hazards exist and where patrols or rescues have difficult access). Furthermore, information provision is a good vehicle for environmental education, which was highlighted by the United Nations (UN) in 2002. The UN named 2005–2014 the 'Decade of Education for Sustainable Development' [42]. Through education, people's behavioral adjustment occurs as they understand more clearly that human societies are dependent on services and functions (i.e., the production of goods, the basic life-support processes and life-fulfilling conditions, such as serenity, beauty, cultural inspiration and recreation) provided by the earth's

Table 5
Workable actions to management priorities.

Management priority	Action
Beach cleanup	<ul style="list-style-type: none"> ● Cleaning operations on a daily basis by local operators ● Cleaning operations preferably undertaken when darkness falls
Monitoring of water quality	<ul style="list-style-type: none"> ● Monitoring of water quality with a regular sampling frequency ● Checking if water quality is above the limit values for microbiological parameters set by the Environmental Protection Agency
Safe access to beaches	<ul style="list-style-type: none"> ● Access routes to the beach, buildings and facilities properly maintained to ensure safety ● Regularly checking any dangerous ‘stuff’ left at the beach or in the water
Controlling waste water discharge	<ul style="list-style-type: none"> ● Fencing off construction work or hazardous structures ● Preventing direct discharge of waste water into the sea
Control over the number of beachgoers whenever appropriate	<ul style="list-style-type: none"> ● Imposing entrance fees during the summer season to avoid overcrowding ● Fees adjusted depending on the extent that overcrowding is alleviated ● Monitoring the level of use particularly during the summertime. ● If necessary, imposing a limit to the number of tourists, based on the estimated carrying capacity.
Sediment and habitat management	<ul style="list-style-type: none"> ● Monitoring and periodic maintenance of beach, particularly sand sediments and surrounding coral reef ecosystems ● Controlling construction of permanent facilities along coastline.
Emergence plans to cope with emergent natural and man-made events	<ul style="list-style-type: none"> ● Devising emergence plans to cope with any potential natural or man-made emergence events, e.g. oil spills, hazardous waste spills, discharge of storm waters, typhoons, algae blooms, bacteria contamination, drowning etc.
Information provision	<ul style="list-style-type: none"> ● Placing a beach map on a signage post at the entrance, indicating locations of various kinds facilities and services, and patrolled areas, potential physical and biological hazards, such as strong currents, and submerged rocks. ● Setting signage posts at the beach, showing regulations, codes of conducts, emergency call lines, safety tips and others. ● Developing websites or apps to provide updated information such as the beach environment, wave conditions and water quality.
Entrance fees	<ul style="list-style-type: none"> ● The fee could be initially set at around NTD 50 during the summertime.
Adequate waste disposal bins and recycling bins	<ul style="list-style-type: none"> ● Setting adequate number of disposal bins and recycling bins with lids at appropriate sites. ● Regularly checking and emptying trash bins if bins are full of trash.
Life guards and lifesaving equipment in place	<ul style="list-style-type: none"> ● Establishing lifeguard patrols during the summertime. ● Placement of an adequate number of lifesaving and first aid equipment ● Information available on how to get and use lifesaving equipment and how to ask for emergency help
Provision of toilet, restroom and shower facilities	<ul style="list-style-type: none"> ● Toilet, restroom and shower facilities are available and kept clean and have controlled sewage disposal ● Provisions of these facilities to be charged with a reasonable price or free.

physical, chemical and biological systems [43]. Therefore, information provision can facilitate tourists’ behavioral adjustment and environmental behaviors, such as litter collection, sorting garbage in bins, protection of coral reefs, leaving sand and rocks on the beach, among others.

Sediment and habitat management is a pillar of beach tourism since destruction of coastal scenery will have a consequent loss of attractiveness and naturalness [15]. Baisha is within the national park, and thus, construction of permanent facilities along the coastline is, to some extent, restricted by regulations. This may help preserve original landscape. Nevertheless, attention has to be paid to future scenarios. Particularly, as typhoons, big storms, climate change and associated sea-level rise occur, the beach will be exposed to a high risk of erosion. To minimize this risk, a cyclical process of problem recognition, planning, implementation and monitoring, appropriate responses to coastal erosion can be developed [44]. Beach nourishment and dune restoration are such kinds of responses to beach erosion when coastal tourism is the main target for beach management [45].

Respondents were found to be sensitive to beach overcrowding, as indicated by their high agreement on ‘control over the number of beachgoers to avoid overcrowding’. It was noted that there are no official statistics on the number of visitors at Baisha. It is therefore hard to confirm whether or not the estimated carrying capacity has been reached or exceeded by the number of visitors. Nevertheless, it was agreed on by participants in focus group discussions that the overwhelming number of tourists during the high season was a big concern and it is imperative to take actions to alleviate overcrowding. Charging an entrance fee during the high season was proposed as an initial step in this direction. Tourist willingness to pay (WTP) could be taken as a benchmark for setting the fee price; that is a fee at around NTD 50–100, as indicated by the survey results. This price could be adjusted depending on the extent that overcrowding is alleviated. However, it was noted that different categories of visitors (i.e., by age or gender) may have different WTP and policy makers should pay attention to the categories less likely to pay [46]. Along with this action, the number of

tourists, particularly during the summertime, can be estimated, which is a piece of useful information for managers in their decision-making afterward on whether to set a limit on the number of tourists.

6. Conclusion

The management of recreation ecosystem services depends on how they are perceived by people, so in order to improve their management, it is necessary to consider the perception of their users [47]. This paper has demonstrated that investigating tourists’ perceptions of the beach environment can produce useful information to guide beach managers to make informed decisions in the pursuit of sustainable beach tourism. Specifically, it focused on identifying management priorities and estimating the carrying capacity for a specific high-use beach. In addition, potential actions to put these management priorities and carrying capacity into practice were proposed as well. This provides a sound scientific basis for envisioned management plans and facilitate upgrading beach quality given limited resources available for beach management.

In Taiwan, beach recreation represents one of the most important growing markets. Each beach has a unique character and faces its own problems arising from various degrees of human uses. This indicates management priorities and carrying capacity differ across all beaches. The procedures established in this paper, including identification of management priorities, estimations of carrying capacity and listing of potential actions, are significant for local beach managers in practical terms, since it can help them to expeditiously discover ways to address the major concerns faced by the beach environment and consequently enhance beach quality.

However, it is noted that this study did not examine whether a person’s socio-economic status, cultural ties and past experiences influence his/her perception of beach environmental quality. Therefore, it would be a meaningful area for future research to examine if a different perception can be due to a person’s environmental attitude and his/her profile. This kind of research would facilitate more

informed decision-making in the pursuit of a better management of beach tourism development.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2016.09.030.

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