



**VISITOR CAPACITY OF KERACHUT BEACH,
PENANG NATIONAL PARK, MALAYSIA**

By

ZAMRU BIN AJUHARI

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of Requirements for the Degree of Doctor of Philosophy**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Doctor of Philosophy

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September 2022

Chairman : Professor Azlizam bin Aziz, PhD
Faculty : Forestry and Environment

The modern-day visitor capacity frameworks address the importance of indicators and standards of quality in defining and managing visitor capacity. This notion is investigated in this study in a three-stage research process to determine the potential indicators, indicators of quality, and standards of quality for visitor capacity of Kerachut Beach, Penang National Park, Malaysia.

The first stage of the research process is to determine the potential indicators. Forty-five visitors and nine stakeholders were asked a series of questions (open and closed-ended) concerning the resource, social and managerial conditions of Kerachut Beach. Six hundred ninety responses were recorded, representing three dimensions of visitor capacity. Eight potential indicators were determined and carried out in the second stage of the research process.

The second stage of the research process is to determine the indicators of quality. The survey was carried out online via Microsoft Forms Platform and yielded 320 respondents. Indicators of quality were determined using the attitude that was plotted onto the Belief Evaluation Matrix. At this point, six indicators of quality were determined that respondents held disfavor attitudes concerning their experiences at Kerachut Beach.

The third stage of the research process determines the standard of quality that defines the visitor capacity for Kerachut Beach. In this stage, a visual research approach was employed. Respondents were asked to evaluate the computer-edited photographs showing a range of conditions based on four evaluative dimensions: acceptability, preferability, acceptability to others, and management actions. Findings revealed that the standard of quality for the amount of litter on Kerachut Beach ranges from the P.I 2.6 to P.I 4.8, or 5.2% to 8.8% of litter accumulated in the 500m² area. In addition, the standard of quality for the number of people on the beach ranges from 56 to 82 people at one time (PAOT). Regarding the campsite, the standard of quality ranges from 33 to 52 PAOT.

Meanwhile, the standard of quality for the length of root exposure ranges from 165cm to 335cm. The standard of quality for the length of gully surfaces was 230cm to 325cm. Lastly, the standard of quality, the number of unusable toilets ranges from 1 to 4 unusable toilets at one time. Based on the findings, it could be helpful for the authority to incorporate the findings into visitor capacity management in Penang National Park to help maintain the quality of the park's natural resources and visitor experience.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

**KAPASITI PELAWAT PANTAI KERACHUT,
TAMAN NEGARA PULAU PINANG, MALAYSIA**

Oleh

ZAMRU BIN AJUHARI

September 2022

Pengerusi : Professor Azlizam bin Aziz, PhD
Fakulti : Perhutanan dan Alam Sekitar

Rangka kerja kapasiti pelawat kini memerlukan penentuan indikator dan standard kualiti dalam mengurus kapasiti pelawat. Keperluan ini disiasat dalam kajian ini dalam tiga peringkat kajian untuk menentukan indikator potensi, indikator kualiti, dan standard kualiti untuk kapasiti pelawat Pantai Kerachut, Taman Negara Pulau Pinang, Malaysia. Peringkat pertama proses penyelidikan adalah untuk menentukan indikator potensi. Empat puluh lima pelawat dan sembilan pihak berkepentingan telah ditemu bual melalui beberapa soalan (terbuka dan tertutup) mengenai keadaan sumber, sosial dan pengurusan Pantai Kerachut. Enam ratus sembilan puluh respons telah direkodkan, mewakili tiga dimensi kapasiti pelawat. Lapan indikator potensi telah ditentukan dan dibawa ke peringkat kedua proses penyelidikan.

Seterusnya, peringkat kedua penyelidikan adalah untuk menentukan indikator kualiti. Survei dijalankan secara dalam talian melalui Microsoft Forms Platform ke atas 320 responden. Indikator kualiti ditentukan berdasarkan penilaian sikap yang diplotkan pada Matriks Penilaian - Kepercayaan. Berdasarkan penilaian tersebut, enam indikator kualiti telah ditentukan yang menunjukkan responden mempunyai sikap yang negatif terhadap indikator potensi berdasarkan pengalaman mereka di Pantai Kerachut.

Peringkat ketiga proses penyelidikan pula menentukan standard kualiti yang mewakili kapasiti pelawat bagi Pantai Kerachut. Pada peringkat ini, pendekatan visual telah digunakan. Responden diminta menilai gambar yang menunjukkan beberapa tahap keadaan berdasarkan empat dimensi penilaian: kebolehterimaan, keutamaan, kebolehterimaan kepada orang lain dan tindakan pengurusan. Hasil daripada analisa menunjukkan standard kualiti bagi jumlah sampah di Pantai Kerachut adalah antara P.I 2.6 hingga P.I 4.8, atau 5.2% hingga 8.8% sampah terkumpul di kawasan 500m². Di samping itu, standard kualiti untuk bilangan orang di pantai adalah antara 56 hingga 82 orang pada satu-satu masa (PAOT). Mengenai tapak perkhemahan, standard kualiti adalah antara 33 hingga 52 PAOT. Sementara itu, standard kualiti untuk panjang akar yang terdedah di atas

denai adalah antara 165cm hingga 335cm. Standard kualiti untuk panjang permukaan kawasan berlongkang di atas denai adalah 230cm hingga 325cm. Akhir sekali, standard kualiti, bilangan tandas yang tidak boleh digunakan pada satu-satu masa adalah antara 1 hingga 4 tandas. Berdasarkan penemuan ini, pihak berkuasa boleh menggunakan penemuan tersebut dalam pengurusan kapasiti pelawat untuk membantu mengekalkan kualiti sumber semula jadi dan pengalaman pelawat di Taman Negara Pulau Pinang.



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For all the trees stand tall above me,
My shade in the sun, shelter in the rain,
For the trees, I breathe herein,
And my big shady trees.
Beloved Mother and Late Father,
Brothers and sisters,
Teachers, Love, and Friends,
With whom I live for the sun,
And died for the light.
Penang National Park,
The assistance and the romance,
It will not be forgotten.

And finally, happiness struck,
Like the sun long for in the monsoon streak,
Like the comfort and ease in August's breeze,
Like the rain serenades the night dream,
Like the ray of light effervesces in the morning mist,
Like the scent of the grass in the swampy field,
Like the glittering smile from the lady of your dream,
Like when the dusk folds every lousy story,
And dawn unbolts the hope for a new beginning,
Happiness struck, and nothing else was as it seemed.

I certify that a Thesis Examination Committee has met on 30 September 2022 to conduct the final examination of Zamru Ajuhari on his thesis entitled Visitor Capacity of Kerachut Beach, Penang National Park, Malaysia in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the (insert the name of relevant degree).

Members of the Thesis Examination Committee were as follows:

Mohd Hasmadi Ismail, PhD

Professor
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Chairman)

Suhardi Bin Maulan, PhD

Associate Professor
Faculty of Design and Architecture
Universiti Putra Malaysia
(Internal Examiner)

Shazali Johari, PhD

Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Internal Examiner)

Parikshat Singh Manhas, PhD

Professor
Faculty of Business Studies
University of Jammu
India
(External Examiner)

(ZURIATI AHMAD ZUKARNAIN, PhD)

Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Azlizam bin Aziz, PhD

Professor
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Chairman)

Manohar a/l Mariapan, PhD

Associate Professor
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Member)

Sam Shor Nahar Yaakob, PhD

Senior Lecturer
Faculty of Forestry and Environment
Universiti Putra Malaysia
(Member)

Shamsul Abu Bakar, PhD

Senior Lecturer, LAr.
Faculty of Design and Architecture
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

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Signature: _____
Name of Chairman of
Supervisory
Committee: _____

Signature: _____
Name of Member of
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Committee: _____

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Name of Member of
Supervisory
Committee: _____

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LIST OF ABBREVIATIONS

PNP	Penang National Park
UNESCO	United Nation Educational, Scientific, and Cultural Organization
IUCN	International Union for Conservation of Nature
UNEP	United Nations Environment Program
MOTAC	Ministry of Tourism and Culture, Malaysia
KATS	Ministry of Water, Land and Natural Resources, Malaysia
DWNP	Department of Wildlife and National Park, Peninsular Malaysia
FRIM	Forest Research Institute Malaysia
VBN	Value Belief Norm Theory
RPM	Return Potential Model

CHAPTER 1

INTRODUCTION

National Park and its associated designations are protected areas designated for preserving some of the earth's wonders and human history. In Malaysia, the importance of the country's national park could be discussed twofold. Firstly, national parks safeguard the country's invaluable ecological, cultural, aesthetic, artistic and scientific values. National parks and their associated areas (totally protected areas) are responsible for the protection of 13.2% (4,586,273.4ha) of Malaysia's natural environment (Ministry of Water, Land and Natural Resources, Malaysia, 2019). They preserve an estimated 30 endemic species of mammals (Department of Wildlife and National Park, 2017) and 100 endemic species of plants, and an abundance of endangered species of animals and plants for the country (Table 1.1). In a nutshell, these protected areas constitute the core of Malaysia's ecological diversity.

Table 1.1: Endangered species of animals and plants in Malaysia

Animals (Mammals only) ^a	Plants (Dipterocarpaceae only) ^b
Four species of mammals are classified as <i>critically endangered</i> (CR)	52 species of plants are classified as <i>critically endangered</i> (CR)
12 species of mammals classified as (EN)	49 species of plants classified as (EN)
14 species of mammals are classified as (VU)	31 species of plants classified as (VU)
33 species of mammals are classified as <i>near threatened</i> (NT)	Five species of plants are classified as <i>near threatened</i> (NT)
83 species of mammals are classified as <i>least concern</i> (LC)	Nine species of plants are classified as <i>least concern</i> (LC)

(^a Adapted from “Red list of Mammals of Peninsular Malaysia Version 2.0 (pp.5),” by Department of Wildlife and National Park, 2017, Kuala Lumpur. Copyright 2017 by Department of Wildlife and National Park. ^b Adapted from “Malaysia plant Red List. Peninsular Malaysian Dipterocarpaceae,” by Chua, L. S. L., Suhaida, M., Hamidah, M., & Saw, L. G, 2010, Forest Research Institute Malaysia.)

Furthermore, Malaysia's national parks and protected areas embody the country's cultural and heritage diversities (Table 1.2). For example, Mount Kinabalu is sacred to the indigenous Kadazan-Dusun communities in Sabah. In the past, the Kadazan-Dusun communities would bury the deceased facing the mountain so that the deceased's spirit could immediately journey to the mountain as the resting place in the afterlife. Moreover, Lenggong Valley in Perak features the archaeological sites that house the cultural remains of early human history that span over nearly two million years. As of 2021, several protected areas are proposed for such designation; these areas are Bujang Valley Archaeological Site (Kedah), Turtle Island National Park (Sabah), and Niah National Park (Sarawak), Madai-Baturong Forest Reserve (Sabah), and Danum Valley (Sabah).

Table 1.2: World Heritage Site, ASEAN Heritage Park, and Tentative list

UNESCO World Heritage Site (Natural and Cultural) ^a	UNESCO Global Geopark ^b	ASEAN Heritage Park ^c	Tentative list – World Heritage Site ^a
Kinabalu National Park (2000)	Langkawi (2007)	Kinabalu National Park (2010)	Taman Negara National Park (Pahang, Terengganu, and Kelantan) (2014)
Gunung Mulu National Park (2000)		Gunung Mulu National Park (2010)	Forest Research Institute Malaysia (FRIM) Forest Park (Selangor) (2017)
Archaeological Heritage of the Lenggong Valley (2012)		Taman Negara National Park (2010)	Selangor Quartz Ridge (2017)
			Royal Belum State Park (Perak) (2017)
			Sungai Buloh Leprosarium (2019)
			Niah National Park (2021)

Note: ^a Retrieved from <https://whc.unesco.org/en/statesparties/my>. Published 2021 by UNESCOa. ^b Retrieved from <https://en.unesco.org/global-geoparks/list#list>. Published 2021 by UNESCOb. ^c Retrieved from <https://asean.org/asean-declaration-on-heritage-parks/>. Published 2003 by ASEAN.

Secondly, national parks are important as they allow the public to enjoy the experience through recreation. The national parks in the country are exceptional settings for numerous outdoor adventures and recreational opportunities. In addition to allowing visitors to experience the parks, outdoor recreation provides uncountable physical and mental benefits. In 2014 alone, reports show that there was a sum of 1.37 million arrivals to the national parks and state parks in Peninsular Malaysia and Sarawak (Ministry of Tourism and Culture Malaysia, 2016). This report indicates the importance of national parks as the country's recreation opportunities provider (Table 1.3).

Furthermore, national parks via ecotourism/tourism/recreation are essential for the country's economic growth (Puah et al., 2018). The tourism industry acts as the facilitator for national and regional development, and it facilitates the foreign exchange rate, creates employment opportunities, and contributes to social development that would benefit the local community. As of 2019, the tourism industry contributed 15.9% to the Malaysian economy, with a revenue of approximately RM86.10 billion brought in by some 26.10 million tourists or roughly USD795 per tourist (Tourism Malaysia, 2021). Locally, tourism activities have been reported to encourage the business experience of the local communities adjacent to the national park. Aziz et al. (2012) reported that the local community at Taman Negara National Park (Kuala Tahan) experienced significant

growth in their business in 2010 compared to 1993 and received more support financially in starting their business in the park. Other than that, Aziz et al. (2012) reported that many of the locals at Kuala Tahan believed that tourism activities benefited their livelihood in 2010, primarily on the construction of the paved road, which in turn brings other benefits to the area, development facilities and infrastructures and connectivity that connects their area to the rest of the world as compared to 1993.

Table 1.3: Tourist arrivals in main ecotourism destinations in Malaysia

Peninsular Malaysia	Arrivals (2014)	Sarawak	Arrivals (2014)	Sabah	Arrivals (2010)
Taman Negara National Park	112,596 (81,932 in Kuala Tahan)	Tanjung Datu National Park	531	Kinabalu National Park	611,624
Pulau Pinang National Park	125,834	Talang Satang National Park	1,469	Tunku Abdul Rahman National Park	340,092
Wang Kelian State Park	3,862	Gunung Gading National Park	20,879	Turtle Island National Park	13,423
Larut Matang	16,532	Kubah National Park	12,628	Tiga Island National Park	5,426
Royal Belum State Park	15,888	Bako National Park	47,459	Tawau Hills Park	75,740
Endau Rompin National Park	8,341	Semengoh Nature Reserve	92,397	Tun Sakaran Marine Park	9,949
Tanjung Piai National Park	81,160	Maludam National Park	15,776	Crocker Range National Park	20,156
Pulau Kukup National Park	37,443	Batang Ai National Park	15,776	Sipadan National Park	43,475
Gunung Ledang National Park	15,776	Similajau National Park	13,375		
Sultan Iskandar Marine Park	15,776	Niah National Park	25,513		
Pulau Payar Marine Park	122,875	Lambir National Park	17,503		
Terengganu Marine Parks	262,094	Loagan Bunut National Park	879		
Tioman Marine Park	263,071	Gunung Mulu National Park	20,184		
Total	1,081,248		284,369		1,119,885

(Adapted from “National Ecotourism Plan 2016-2025, Volume 2, Technical Report (pp. 120-122),” by Ministry of Tourism and Culture Malaysia, 2016, Putrajaya, Malaysia.)

In addition to supporting the country’s economic growth, national parks through tourism activities could finance conservation. National Park is usually funded by the government through a specific budget for conservation. At the same time, tourism played an essential role in generating revenue in return for protected area financing. Based on Figure 1.1, national parks usually receive funds through three primary sources: government funding,

entrance fee, and any taxes or fees incurred from businesses that could contribute to the conservation of the area.

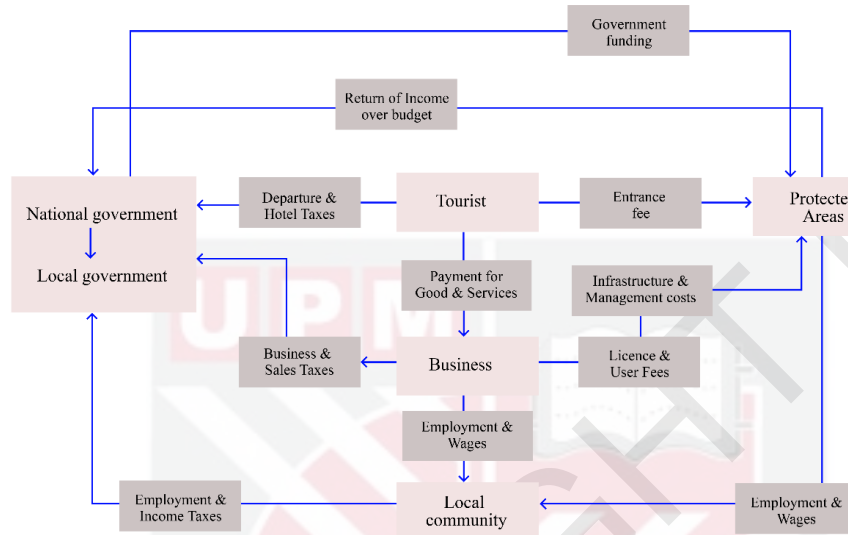


Figure 1.1: Economic model of tourism in protected areas

Note: Reproduced from “*Tourism for Protected Area Financing: Understanding tourism revenues for affective management plans* (pp. 15),” by Font, X., Cochrane, J., and Tapper, R, 2004, Leeds Metropolitan University. Copyright 2004 by Richard Tapper.

Moreover, national parks are important for promoting environmental values. As places with outstanding landscapes, national parks through recreation experience, is a modern means of aesthetic education (Mirzarakhimov, 2020). The recreation experience enhances the visitors' ability to understand the aesthetic values of the national park that are important in the creation of positive attitudes that encourage environmental morals and appreciation towards nature. It promotes environmental awareness and fosters pro-environmental behaviors, as described below (Figure 1.2). The model shows that participation in recreational activities invokes a sense of place attachment that encourage the formation of pro-environmental behaviors (Daryanto & Song, 2021; Ganji et al., 2021; Kastenholz et al., 2020; Kim & Koo, 2020; Sharma & Gupta, 2020).

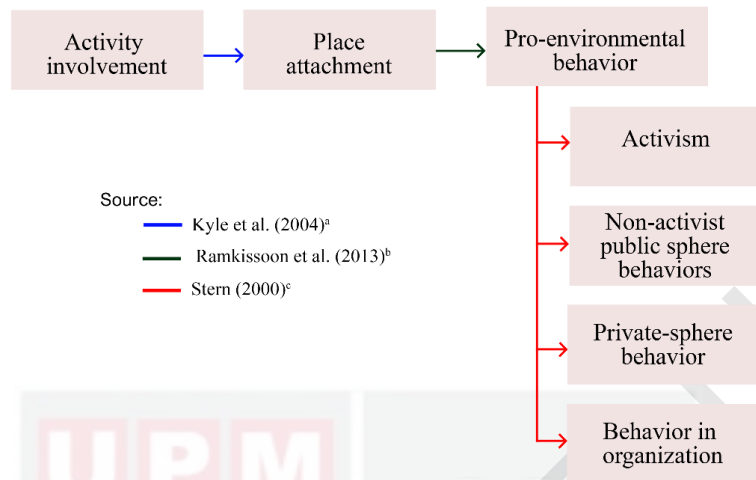


Figure 1.2: Relationship between recreation (activity involvement) and pro-environmental behavior

(^aAdapted from “Effect of activity involvement and place attachment on recreationist’ perceptions of setting density,” by Kyle, G., Graefe, A., Manning, R., & Bacon, J, 2004, *Journal of Leisure Research*, 36(2), 209. Copyright by Taylor & Francis. ^bAdapted from “Place attachment and pro-environmental behavior in national parks: The development of a conceptual framework,” by Ramkissoon, H., Weiler, B., & Smith, L. D. G, 2012, *Journal of Sustainable Tourism*, 20(2), 257–276. Copyright by Taylor & Francis. ^cAdapted from “New environmental theories: toward a coherent theory of environmentally significant behavior,” by Stern, P. C, 2000, *Journal of social issues*, 56(3), 407-424. Copyright 2000 by The Society for the Psychological Studies of Social Issues.)

1.1 Problem statement

Previously known as Pantai Acheh Forest Reserve, Penang National Park (PNP) was declared and gazetted under the National Park act 1980 on April 10, 2003. PNP is located on the north-western part of Penang Island, covering 1181 hectares of forest and 1381 hectares of wetland. This park is managed by the Department of Wildlife and National Park (DWNP), which is the sole department responsible for protecting, managing, and preserving wildlife and national parks in Peninsular Malaysia. In line with the National Park Act 1980, PNP is established to preserve, allow, and encourage education, recreation, and tourism purposes, especially as an ecotourism destination. While the potential of PNP as one of the ecotourism destinations in Malaysia is underlined through several strategic sustainable development initiatives by DWNP as underlined in the park's management plan, detrimental impacts of the recreation activities at PNP are inevitable due to the growth in the number of visitations over the years (Figure 1.3).

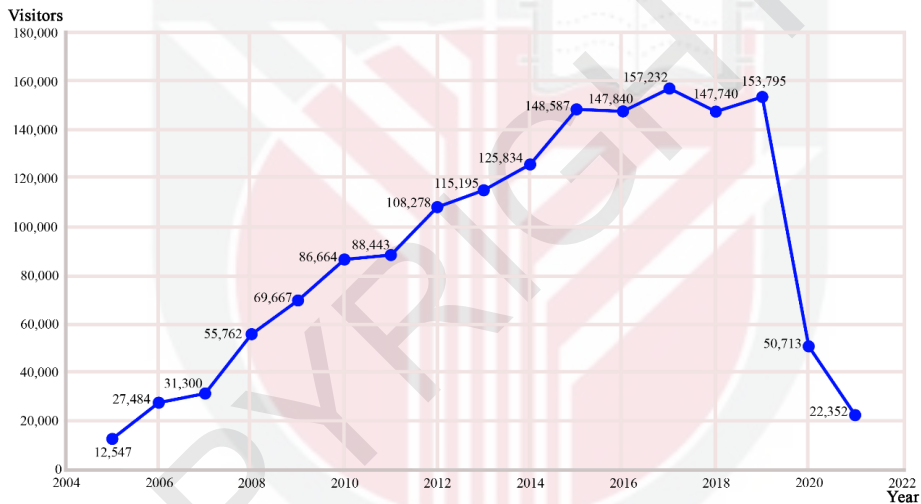


Figure 1.3: Visitor statistics to Penang National Park
(Source: Penang National Park)

The detrimental impacts such as vandalism, short-cutting, noise at the campsite, undesignated trails, wood-burning, trampling impacts, and vegetative clearing and littering were reported in many studies since the park's establishment (Abdullah et al., 2018; Ajuhari, 2016; Ajuhari et al., 2016; Bookhari et al., 2020; Chan et al., 2004; Chan et al., 2003; Hafizal, 2008; Hong & Chan, 2011; Hong & Chan, 2010). Moreover, Kaffashi et al. (2015) reported that the current level of PNP's ecological management is unsatisfactory as perceived by the park's stakeholders. This dissatisfaction was due to ecological disturbances such as human-induced impacts and ineffective waste disposal in the park. Thus, it has been concluded that PNP needs to prioritize on improving its ecological management for a better future of sustainable tourism development at PNP (Kaffashi et al., 2015; Fallah et al., 2014).

Moreover, human-induced impacts also pose several potential threats to the visitors' experience in the park. Although there are limited evidence or studies that have been carried out on the state of the visitors' experience quality at PNP, several studies in the tourism-related field reported that human-induced impacts have the potential to affect visitors' experience quality (Han *et al.*, 2016; Kılıçarslan & Caber, 2018; Li *et al.*, 2016; Reisinger & Turner, 2003; Su *et al.*, 2019) and influenced their experience quality during the visitation (Kao *et al.*, 2008; Kim, 2018; McCool & Lime, 2001; Luque *et al.*, 2018; Suhartanto *et al.*, 2019). As a result, the feeling of dissatisfaction and low experience quality will affect visitors' destination loyalty; thus, affecting the destination image of PNP in the future.

Subsequently, with the current recreation impacts and their potential to continuously degrade the PNP's environment and affect visitors' experience quality, visitor capacity deems as a management tool that could sustainably maintain the integrity of the PNP's resources and its visitors' experience quality. In addition, in their study, Fallah & Ocampo (2021) suggested that PNP needs to specify the visitor capacity for the sustainability of the park's resources. For the time being, the visitor capacity for PNP is limited to the campsite (Table 1.4), and the capacity to address the impact of the recreation activities is not explicitly mentioned in the park's management plan.

Table 1.4: Current visitor capacity at PNP

Campsites	Visitor capacity
Kerachut Beach	80
Teluk Kampi	80
Sungai Tukun	40
Bukit Batu Hitam	20

(Adapted from <https://www.wildlife.gov.my/index.php/en/public/2016-05-10-02-34-43/peta>.)

Therefore, given the extent of the current recreation impacts, this study was intended to assist the policymakers and the park's authority with an empirical and scientific basis for justifying the determination of visitor capacity for PNP. It is important to note that the determination of visitor capacity in this study focuses on Kerachut Beach. Kerachut Beach was chosen as the study site because (1) Kerachut Beach is the most popular attraction that received more visitors than other attractions in PNP, and (2) the substantial cost and the time to carry out such a study for the whole management zones in PNP is high.

1.2 A Scenario of Visitor Capacity Study in Malaysia's perspective (Justification of the study)

National parks and protected areas are usually an area of exceptional scenic beauty, pristine forests, crystal blue waters, and diverse cultures and traditions. Thus, these areas are heavily visited, thus susceptible and prone to human impacts (Hammit et al., 2015; Pickering & Barros, 2015). The concept of carrying capacity is introduced as a management tool for effective visitor management. Given that the implementation of visitor capacity is integral in the management of recreation resources, this study is expected to fill the gap in what is lacking regarding the visitor capacity study in Malaysia.

1.2.1 A lack of attention given to visitor capacity related studies in Malaysia

In the meta-analysis study, Ballantyne & Pickering (2015) found that most of the research on recreation impacts took place in the urban area (39% of 92 publications of trail impact studies) and the temperate broadleaf and mixed forest (20% of 92 publications) while there was only 1% of publication about the impact study in the tropical area. Such findings indicated that there is a lack of research related to human-induced impacts that are conducted in tropical areas such as Malaysia. Also, this lack of attention given to research related to human-induced impacts and visitor capacity in Malaysia could be shown with a search using the three repositories of scientific publications: Google Scholar, Scopus, MyJurnal (Malaysia Citation Centre). By using the keywords such as carrying/visitor capacity, visitors' impact, and impacts indicators, only a total of 23 publications was recorded ranging from the year 2000 to 2021 (Table 1.5), indicating that only a ratio of 1.09 publications related to the recreation impacts and visitor/carrying capacity published over 21 years. In addition, the search also recorded a total of 14 studies (a ratio of .61 publications) that explicitly mentioned visitor/carrying capacity as the central focus of the study.

Table 1.5: Related research in human-induced impacts/carrying capacity in Malaysia

No	Studies	Authors	Repositories/Publishers	Type of publications
1	Physical impact indicators of Gunung (Mount) Tahan Trail, Malaysia.	Sam Shor et al. (2021)	Google Scholar Scopus	Empirical study
2	Assessing Mountain Trail Conditions Taman Negara National Park	Zainal Abidin et al. (2021)	Google Scholar Scopus	Empirical study
3	Stakeholders and visitors' perceptions towards coastal tourism development at Teluk Kemang, Port Dickson, Malaysia	Hanafiah et al. (2021)	Scopus	Empirical study (Qualitative)
4	The use of the Delphi method for identifying sustainability criteria and indicators in Penang National Park	Fallah & Ocampo (2021)	Google Scholar/ Springer	Empirical study
5	Recreation Resource Impacts of Pantai Kerachut Trail in Penang National Park	Bookhari et al. (2020)	Google Scholar	Empirical study
6	A pilot study for sustainable ecotourism at Gunung Stong State Park, Kelantan, using the Visitor Experience and Resource Protection (VERP) management framework	Hassin et al. (2019)	Google Scholar (Institutional Repository Universiti Malaysia Kelantan)	Empirical study
7	Application of Carrying Capacity for Management Practice at Tanjung Piai National Park	Sidi et al. (2018)*	MyJurnal	Empirical study (Qualitative)
8	Carrying Capacity of Tourism Development in Cameron Highlands	Mohamad & Marzuki (2018)*	MyJurnal	Empirical study
9	Challenges to implementing carrying capacity framework at Pulau Perhentian Marine Park	Nasir et al. (2017)*	MyJurnal	Concept/Review publication
10	Establishing the Economic Carrying Capacity of Tourism Development for Perhentian Islands	Jaafar et al. (2016)*	Google Scholar	Empirical study
11	Ecological carrying capacity assessment of the diving site, Mabul Island, Malaysia	Zhang et al. (2016)*	Scopus	Empirical study

Note: *Studies explicitly mentioned carrying/visitor capacity as the central focus of the study

Table 1.5: Continued

No	Studies	Authors	Repositories/Publishers	Type of publications
12	A historical review of the recreational carrying capacity model in island tourism	Badaruddin & Tay (2016)*	MyJurnal/CABI Direct	Concept/Review publication
13	An Assessment of the Carrying Capacity of Sipadan Island Park	Maidin et al. (2016)*	MyJurnal	Empirical study
14	Assessing the social carrying capacity of diving sites on Mabul Island	Zhang & Chung (2015)*	Google Scholar/Springer	Empirical study
15	Significant Indicators in the Assessment of Environmental Tourism Carrying Capacity at Royal Belum State Park	Nayan et al. (2015)*	Google Scholar	Empirical study
16	Social carrying capacity at Kuala Tahan National Park	Ismail et al. (2015)*	Google Scholar	Empirical study
17	Visitor perceptions of the impacts of tourism activities, development, and infrastructure on the environment of the Perhentian Islands	Ramdas & Mohamed (2014)	Google Scholar	Empirical study
18	Social carrying capacity in Cenang Beach, Langkawi Island	Maryam & Azizan (2014)*	MyJurnal	Concept/Review publication
19	Establishing limits of acceptable change (LAC) for anthropogenic development on Mabul Island, Sabah, Malaysia	Soo Ling (2013)*	Google Scholar	Empirical study
20	Social tourism carrying capacity in Kampung Kilim, World Geopark, Langkawi	Kayat & Radzi (2012)*	Scopus	Empirical study
21	Developing criteria and indicators for responsible rural tourism in Malaysia Taman Negara National Park (TNNP).	Siow May et al. (2011)	MyJurnal	Empirical study
22	Visitors' Experience and Resource Protection at National Elephant Conservation Centre, Kuala Gandah	Rahman et al. (2001)*	Google Scholar	Empirical study
23	Ecotourism in Bako National Park, Borneo: Visitors' perspectives on environmental impacts and their management	Chin et al. (2000)	Google Scholar/ Taylor & Francis	Empirical study

Note: *Studies explicitly mentioned carrying/visitor capacity as the central focus of the study

1.2.2 A lack of attention on the visitor capacity study in the form of determining the standard for acceptable condition

In the Malaysian context, while previous studies have proven to be beneficial for the situations in which they were conducted, a lack of attention has been given to the study on the determination of the standard of acceptable conditions (Table 1.6). In the 23 publications reviewed, 73.91% were centralized on identifying indicators, with 30.43% not explicitly mentioning indicators as part of their research objectives. In contrast, merely 8.7% (n=2) of the studies specified the standard for the indicator variables.

Table 1.6: Indicators and Standard of visitor capacity studies in Malaysia

No	Research	Authors	Indicators	Standards
1	Physical impact indicators of Gunung (Mount) Tahan Trail, Malaysia.	Sam Shor et al. (2021)	✓	-
2	Assessing Mountain Trail Conditions Taman Negara National Park	Zainal Abidin et al. (2021)	-	-
3	Stakeholders and visitors' perceptions towards coastal tourism development at Teluk Kemang, Port Dickson, Malaysia	Hanafiah et al. (2021)	-	-
4	The use of the Delphi method for identifying sustainability criteria and indicators in Penang National Park	Fallah & Ocampo (2021)	✓	-
5	Recreation Resource Impacts of Pantai Kerachut Trail in Penang National Park	Bookhari et al., (2020)	-	-
6	A pilot study for sustainable ecotourism at Gunong Stong State Park, Kelantan, using the Visitor Experience and Resource Protection (VERP) management framework	Hassin et al., (2019)	√ (Not explicitly mentioned)	-
7	Application of Carrying Capacity for Management Practice at Tanjung Piai National Park	Sidi et al. (2018)	√ (Not explicitly mentioned)	-
8	Carrying Capacity of Tourism Development in Cameron Highlands	Mohamad & Marzuki (2018)	√ (Not explicitly mentioned)	-

Table 1.6: Continued

No	Research	Authors	Indicators	Standards
9	Challenges to implementing carrying capacity framework at Pulau Perhentian Marine Park	Nasir <i>et al.</i> (2017)	-	-
10	Establishing the Economic Carrying Capacity of Tourism Development for Perhentian Islands	Jaafar <i>et al.</i> (2016)	√	-
11	Ecological carrying capacity assessment of the diving site, Mabul Island, Malaysia	Zhang <i>et al.</i> (2016)	√	√
12	A historical review of the recreational carrying capacity model in island tourism	Badaruddin & Tay (2016)	√	-
13	An Assessment of the Carrying Capacity of Sipadan Island Park	Maidin <i>et al.</i> , (2016)	√ (Not explicitly mentioned)	-
14	Assessing the social carrying capacity of diving sites on Mabul Island	Zhang & Chung (2015)	√	√
15	Significant Indicators in the Assessment of Environmental Tourism Carrying Capacity at Royal Belum State Park	Nayan <i>et al.</i> (2015)	√	-
16	Social carrying capacity at Kuala Tahan National Park	Ismail <i>et al.</i> , (2015)	√	-
17	Visitor perceptions of the impacts of tourism activities, development, and infrastructure on the environment of the Perhentian Islands	Ramdas & Mohamed (2014)	√ (Not explicitly mentioned)	-
18	Social carrying capacity in Cenang Beach, Langkawi Island	Maryam & Azizan (2014)	-	-
19	Establishing limits of acceptable change (LAC) for anthropogenic development on Mabul Island, Sabah, Malaysia	Soo Ling (2013)	√	-
20	Social tourism carrying capacity in Kampung Kilim, World Geopark, Langkawi	Kayat & Radzi (2012)	-	-
21	Developing criteria and indicators for responsible rural tourism in Malaysia Taman Negara National Park (TNNP).	Siow May <i>et al.</i> (2011)	√	-
22	Visitors' Experience and Resource Protection at National Elephant Conservation Centre, Kuala Gandah	Rahman <i>et al.</i> (2001)	√ (Not explicitly mentioned)	-
23	Ecotourism in Bako National Park, Borneo: Visitors' perspectives on environmental impacts and their management	Chin <i>et al.</i> (2000)	√ (Not explicitly mentioned)	-
Percentage			73.91% (30.43% not explicitly mentioned)	8.7%

1.3 Resource Protection, Recreation Experience and Visitor Capacity

As previously discussed, national parks are crucial for resource protection and public enjoyment through recreation experience that encourages education, promotes environmental values, and brings economic growth that benefits the local communities (Figure 1.4).

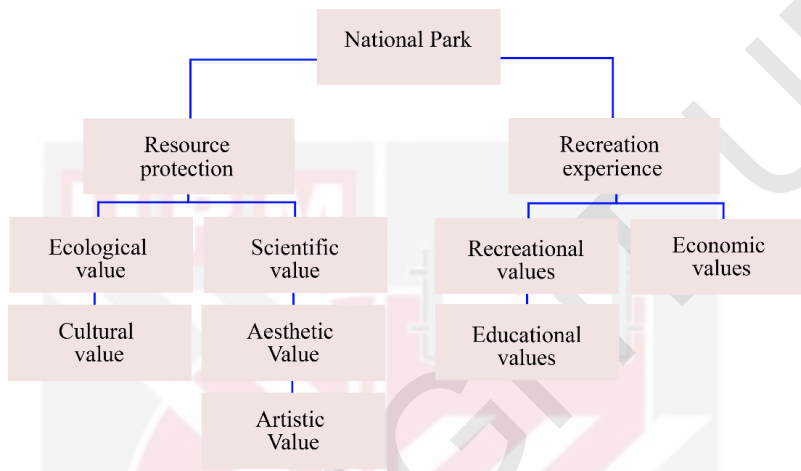


Figure 1.4: The importance of national parks

Therefore, in some parts of the world, especially in the USA, national parks are usually managed with a dual mandate; *to conserve park resources and provide for their use and enjoyment “in such a manner and by such means as will leave them unimpaired” for future generations* (National Park Service Organic Act, 1916). In Malaysia, although such a mandate was not explicitly mentioned, the national park at the federal level is established “...*preservation and protection of wildlife, plant life and objects of geological, archaeological, historical, ethnological and other scientific and scenic interest and through their conservation and utilization to promote the education, health, aesthetic values, and recreation of the people* (National Park Act, 1980). Thus, based on that definition, a national park in Malaysia should be managed to conserve the park resources and to provide the best recreation experience to the public.

However, allowing the park for public use comes with substantial challenges. National Parks have sensitive natural environments that are consistently challenged by depreciative anthropogenic activities such as illegal collection of flora and fauna (Chang, 2010; Kim et al., 2011), disturbance of wildlife (Ballantyne et al., 2011; Chen, 2011), polluting and littering (Brown et al., 2010; Logar, 2010; Rodríguez-Rodríguez, 2012), overcrowding (Dickinson & Robbins, 2008; Poitras & Getz, 2006) tree carving and cutback trails (D’Antonio et al., 2012). Besides depreciative behaviors, the impacts could also be seen on the physical environment, such as undesirable changes to vegetation and plant diversity (Pickering & Hall, 2007; Rawat et al., 2021), soil erosion (Marion et al.,

2018; Martin & Butler, 2021), impact on water quality (Cooke & Xia, 2020) and impact on wildlife resources (Marion et al., 2020). Additionally, recreation activities considerably influence the loss of vegetation cover, loss of fragile species, loss of trees and shrubs, tree trunk damage, the introduction of exotic species, composition change, and altered microclimate (Leung & Marion, 2000). At the same time, the quality of the visitor experience was affected by the recreation impacts such as crowding, conflicting uses, and the aesthetic consequences of resource degradation.

In addressing the importance of reducing the human (visitors)-induced impact, the concept of carrying capacity was introduced. Carrying capacity was first introduced as a concept to capture the need to identify the maximum level of use that an area can sustain. Traditionally used in rangeland and wildlife management (Whittaker et al., 2011), carrying capacity transcends into the recreation perspective as an essential tool in recreation resource management.

In the earlier year of its development, carrying capacity was a conceptual term that was used to represent a "magic number" to be used as the solution to the human-induced impacts and to maintain the integrity of the recreation resources. However, this traditional concept of carrying capacity was considered to have failed to achieve its objective on account that the link between the amount of use and impact is almost non-existent, failed to emphasize the importance of stakeholder involvement, and did not bring together the stability between resource protection and visitor use (McCool & Patterson, 2000; McCool et al., 2007; Newsome et al., 2013; Stankey et al., 1990).

At present, carrying capacity or visitor capacity or capacity (Whittaker et al., 2011) refers to the amount and type of use that is compatible with the management prescription of the area (recreation resource) (Leung et al., 2018; Manning, 2013; Morin et al., 1997; Newsome et al., 2013; Whittaker et al., 2011). It addresses the need to prescribe the acceptable amount of recreation impacts and preserve the quality of recreation experience where it works to achieve the management goals, objectives, and the values of the resources (e.g., national park values). Today, visitor capacity is integral for the management of the protected area and national parks worldwide that depends on the growth of visitation yet needs balancing with such growth and maintaining the integrity of its resources and the quality of visitors' experience.

Newsome et al. (2013) pointed out that the concept of carrying capacity was an old-fashioned framework to base its foundational approach solely on finding the maximum number of visitors that were allowed in one recreational area. Since the change or the impact on the environment is inevitable to occur, current visitor management frameworks such as Limit of Acceptable Change (Stankey et al., 1985), Visitor Activity Management Process (Ashley, 1989), Visitor Impact Management (Graefe et al., 1990), Visitor Experience Resource Protection (Manning, 2001), Tourism Optimization Management Model (Manidis Roberts Consultants, 1997) and Visitor Use Management Framework (IUVMC, 2019) are now shifted towards value-based judgment that is focused on determining the acceptable impact (how much is too much) that emphasized on the determination of indicators and standards represented by the dimensions of carrying capacity as outlined below in Figure 1.5.

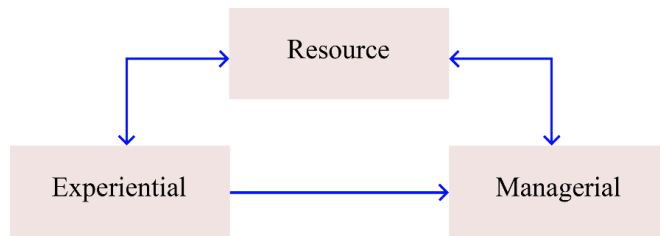


Figure 1.5: Three dimensions of carrying capacity of parks and related areas

Note: Reproduced from "Crowding and carrying capacity in the national park system: Toward a social science research agenda (pp. 27-65)," by Manning, R. E., & Lime, D, 1996, St. Paul: University of Minnesota Agricultural Experiment Station Publication.

In this sense, carrying capacity/visitor capacity/capacity should be governed by (1) the acceptable experiential condition (social) such as the number of encounters, people at one time, and people per view-scape, (2) the acceptable resource condition such as the number of impacts and the extent of impacts that is acceptable, (3) the acceptable extent of development or the acceptable managerial condition (managerial). Therefore, visitor capacity should not be defined by its traditional definition that emphasizes the "maximum number of people for the optimum use" but should be defined by including the indicators of quality and standards of quality associated with the resource, experiential, and managerial condition of the recreation resource.

1.4 Research Framework

Research framework is discussed in Chapter 1 to provide an overview of the research process which is essential in formatting the research question and the development of research objectives. Based on the theoretical foundation of the study, which is discussed comprehensively in Chapter 2, the framework of the research for this study is shown in Figure 1.6

Visitor capacity refers to the amount and type of use compatible with the recreation resource management prescription. It also emphasizes the determination of indicators of quality and standards of quality associated with the resource, experiential, and managerial conditions of the recreation resource. With regards to public enjoyment, Manning (2013) stated that indicators or potential indicators can be determined qualitatively; by asking visitors and stakeholders which park (national park) conditions such as resource conditions, experiential (social conditions), and managerial conditions are of their concern and affect the visitors' experience quality.

Therefore, the potential indicators could be determined based on the stakeholders' concerns and visitors' experience regarding the recreation resources reserve, social and managerial conditions. The potential indicators that meet the criteria (e.g., measurable, manageable, and related to visitor use) are then quantitatively evaluated to determine the indicators of quality. Another critical component of visitor capacity is the standards of quality. Standards of quality are determined by evaluating the indicators of quality by using four types of norms that represent the standards of quality as shown in the following list.

- i. Personal norms: Visitors' beliefs or preference for the indicators of quality (Preferability).
- ii. Descriptive norms: Visitors' beliefs on the acceptable conditions for the indicators of quality (Acceptability).
- iii. Subjective norms/Injunctive norms: Visitors' beliefs on the condition of the indicators of quality that are accepted by other visitors in the study site (Acceptability to others).
- iv. Regulative norms: Visitors' beliefs on the level or the state of indicators of quality condition that require management intervention (Management actions).

Therefore, a program of research was developed to help support formulation of indicators and standards of quality at Kerachut Beach, Penang National Park. The research program was conducted in three stages. Stage I determined the potential indicators of quality for the visitor experience and of stakeholders' concern. In addition, Stage 2 was designed to determine the indicators of quality for the visitor capacity at the study site. At last, Stage 3 was conducted to help formulate the standards of quality for the indicators of quality that were determined in Stage 2. This program of research which was carried out in three different time frames is objectified to formulate the visitor capacity for Kerachut Beach in Penang National Park.

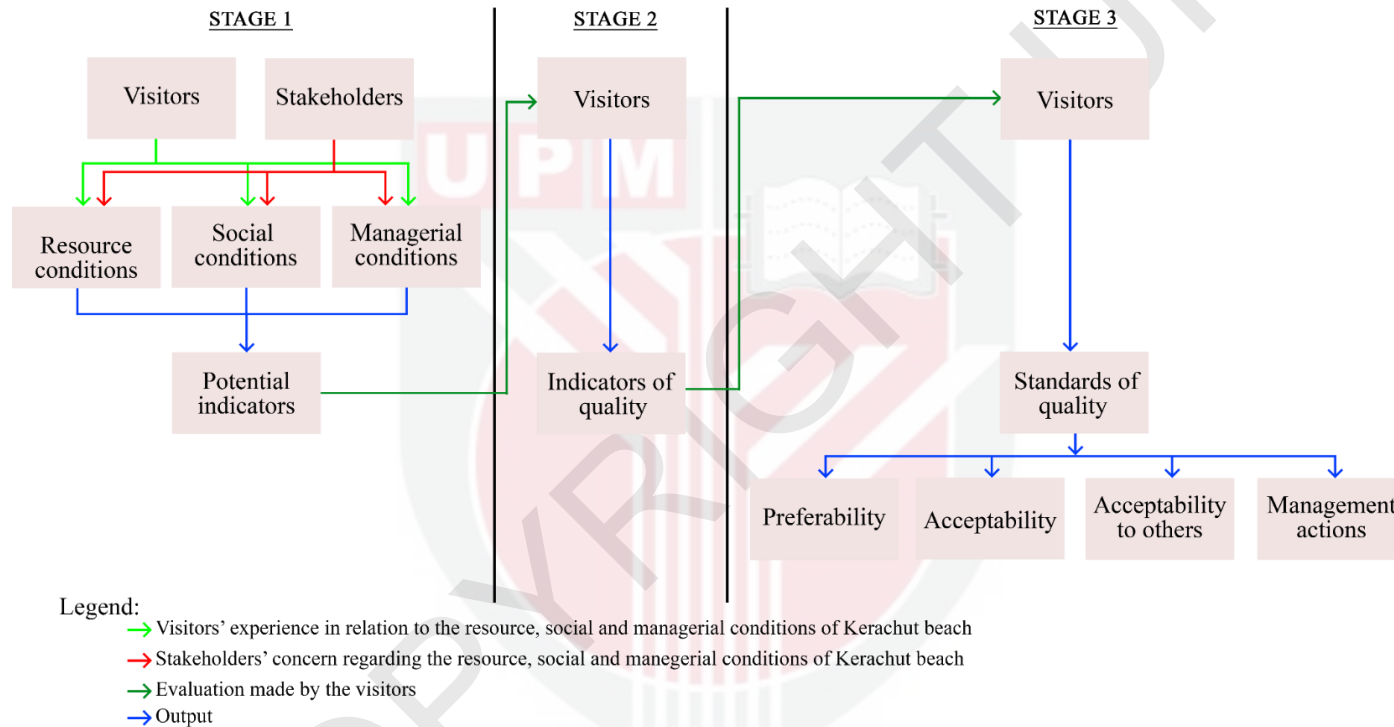


Figure 1.6: Research Framework of the study

1.5 Research Questions

It has been discussed that visitor capacity is an important management tool for Penang National Park that is currently decremented by the impacts of increasing visitation and recreation activities. Therefore, this study aims to assist the policymakers and the park's authority with an empirical and scientific basis for justifying the determination of visitor capacity for Kerachut Beach in Penang National Park. Consequently, to achieve the aims of this study, some research questions must be answered, which are as follows.

1. What are the potential indicators for visitor capacity at Kerachut Beach?
2. What are the indicators of quality that represent the visitor capacity for Kerachut Beach?
3. What are the standards of quality for the indicators of quality that represent the visitor capacity at Kerachut Beach?

1.6 Research objective

The general objective of this study is to determine the visitor capacity at Kerachut Beach, Penang National Park. To achieve the general objective of the study, several specific objectives have been outlined below:

1. To identify the potential indicators for visitor capacity at Kerachut Beach
2. To determine the indicators of quality for visitor capacity at Kerachut Beach
3. To determine the standard of quality for visitor capacity at Kerachut Beach

1.7 Definition and measurement of key terms

- i. Visitor capacity: In this study, visitor capacity is used interchangeably with the carrying capacity. It refers to the amount and type of use compatible with the recreation resource management prescription (Whittaker et al., 2011), represented by the indicators of quality and standard of quality (Manning, 2013). In this study, visitor capacity is defined by the standard of quality of the indicators of quality as measured through four evaluative components: preferability, acceptability, acceptability to others, and management actions.
- ii. Indicators of quality: Indicators are measurable, manageable variables that help define the quality of parks and outdoor recreation areas (Manning, 2013). In this study, indicators of quality help to define the standard of quality for visitor capacity at Kerachut Beach. Indicators of quality are determined based on visitors' attitudes towards the potential indicators.
- iii. Potential indicators: Potential indicators are measurable, manageable variables of concern for Kerachut Beach. They are determined based on visitors' experience and stakeholders' concern for the resource, social and managerial conditions of Kerachut Beach.
- iv. Standards of quality define the minimum acceptable condition of indicator of quality (Manning, 2013). Visitor capacity can be managed through monitoring indicators of quality and implementing management actions to ensure that standards of quality are maintained. In this study, standards of quality are determined based on the visitors' evaluations of four evaluative components that are represented by personal norms (preferability), descriptive norms (acceptability), subjective/injunctive norms (acceptability to others), and regulative norms (management actions).
- v. Norms: Norms refer to what is preferred (personal norms as explained in the Norm Activation Model), accepted (Descriptive norms as explained in The Focus Theory of Normative Conduct), accepted by others (Subjective/injunctive norms as explained in the Theory of Planned Behavior and The Focus Theory of Normative Standard), and permitted (Management actions as explained by the regulative norms)

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