INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 14, Issue 1, (2024) E-ISSN: 2222-6990

Assessment of Marine Tourism Carrying Capacity: A Case Study at Kapas Island Marine Park, Malaysia

Syamimi Mohd Adam
School of Business and Economics, Universiti Putra Malaysia, 43400 Serdang, Selangor

Syamsul Herman Mohammad Afandi
School of Business and Economics, Universiti Putra Malaysia, 43400 Serdang, Selangor
Corresponding Author Email: syamsulhma@upm.edu.my

Siow May Ling, Mohd Johari bin Mohd Yusof
Faculty of Design and Architecture, Universiti Putra Malaysia, 43400 Serdang, Selangor

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v14-i1/18129 DOI:10.6007/IJARBSS/v14-i1/18129

Published Date: 07 January 2024

Abstract
To prohibit marine park tourism destinations from being mistreated, carrying capacity must be appraised and well-organized properly. A crucial fragment of conquering sustainable tourism management and development is the appraisal of the carrying capacity of marine park destinations. The research was conducted at Kapas Island Marine Park (KIMP) in Terengganu, Malaysia. This paper presents physical carrying capacity and real carrying capacity assessment for three selected recreational activities at KIMP. The findings show that hiking at Bukit Singa with a carrying capacity of 22 visitors per day, snorkelling with a carrying capacity of 1368 visitors per day and lastly beach picnic with a carrying capacity of 450 visitors per day. The policy makers might use these real estimations of carrying capacity for recreational activities for providing great tourism experiences among visitors and sustainability of natural resources in the future.
Keywords: Tourism, Carrying Capacity, Marine Park, Kapas Island, Limits

Introduction

Tourism plays a significant role in presenting a country Siow et al (2022) and people from all over the world have been fascinated Malaysia by the emergent reputation of marine park tourism (Arshad et al., 2018). Marine tourism is an emergent phenomenon in has become an inclusive industry worldwide (Adam et al., 2022). The greatest threat to marine tourism is commonly seen as their fast-becoming popularity among tourists. Natural resources and

settings can be degraded by excessive tourist use. An important factor in attaining sustainable tourism management and expansion is the carrying capacity of the marine tourism industry. The question of how many people can be accommodated in marine tourism recreational area are absent in many studies, thus creating a gap in fundamental studies on marine tourism. High demand is placed on coastal resources to meet tourist expectations.

The rapid expansion of anthropogenic activities in the locations of marine parks has been sparked by the increase in marine tourism (Tranter et al., 2022). Visitors' recreational experiences have also been impacted by human activities (Zhou et al., 2022). Tuohy et al., (2022) mentioned that since the marine park is intended to properly manage and conserve, information on the location is crucial. Determining the area's carrying capacity is essential for managing and conserving the environment (Leka et al., 2022).

Wang et al (2023) stated that the concept of carrying capacity is predicated on the concept that the environment has the greatest potential to support the proliferation of the marine tourism industry. Suksmawati et al (2022) justify that the sustainability of the natural resource could be in danger if the number of visitors participating in recreational activities is not restricted. Performing a carrying capacity study can serve to boost the cohesive improvement of the environmental effects of human activities. In addition to calculating the perfect number of components, carrying capacity also emboldens reasonable and sustainable resource consumption to achieve environmental limits (Rodella et al., 2020). Well, management of natural resources for marine tourism is important especially those limited resources found on islands which once depleted, would require irreversible cost to restore to their original state.

The most prevalent explanation of carrying capacity is the number of people that a general population can endure (Liu et al., 2020). The term "carrying capacity" refers to the most visitors that can concurrently visit a tourism destination without jeopardizing the environment's physical, sociocultural or economic dependability or dropping visitor satisfaction levels to unacceptable levels (Adrianto et al., 2021). The idea of carrying capacity emphasizes how crucial it is to continue with development and activities that are both environmentally and socially sustainable

To discover the utmost preferred limits of development or the ultimate practices of tourism resources, it is, therefore, crucial to appraise the carrying capacity of the marine park tourism destinations. Making verdicts about what has to be done, what recreational possibilities should be obtainable, and how to govern recreational practice is also a subdivision of it (Queiroz et al., 2014). Nowadays, Malaysian governments have seriously focused on developing small islands as a tourism destination such as Kapas Island Marine Park (KIMP). The purpose of this study is to estimate the carrying capacity for recreational activities at KIMP.

The Concept of Carrying Capacity

A fundamental technique in tourism is carrying capacity analysis, which recognizes the all-out levels of development, visitor utilization, and overuse of resources (Hassan et al., 2014). World Tourism Organization has defined carrying capacity as “the maximum number of people which could visit a location within a given period, such that local environmental, physical, economic and socio-cultural characteristics are not compromised and without reducing tourist satisfaction” (Sharma & Bisht, 2019).

The maximal ultimate strength of natural, environmental, and socioeconomic components is within the maximum number of visitors as well and maintaining the

satisfaction of visitors during peak seasons of tourism is called carrying capacity. Maintaining a delicate balance between tourism and conservation is frequently the main dilemma in marine park tourism (Adam et al., 2018). To better provide a marine tourism experience, the concept of carrying capacity serves as a cherished outline for inaugurating limitations for part of development. A prominent example is if more than eight or nine divers were visible to them at once, Mabul Island divers would begin to feel unpleasant. This suggests that Mabul Island's diving locations are already being used at levels over its social carrying capacity (Zhang & Chung, 2015).

Method

The research was conducted at KIMP in Terengganu, Malaysia. The location of KIMP is on Peninsular Malaysia's east coast, specifically between latitude 5.2190N and longitude 103.2469E. KIMP is a small island, slightly over 2 km long and 1 km broad, located about 4 km south of Kuala Terengganu in the Marang district. From the Marang jetty, the island is easy to access by speedboat. The island is considered one of the magnificent coral reefs, various fishes, and dunes. KIMP is difficult to visit during the east coast monsoon season, from November until March every year. KIMP is recognised for its magnificent coral reefs, a diverse range of commercial fish species, and white sand (Islam et al., 2017).

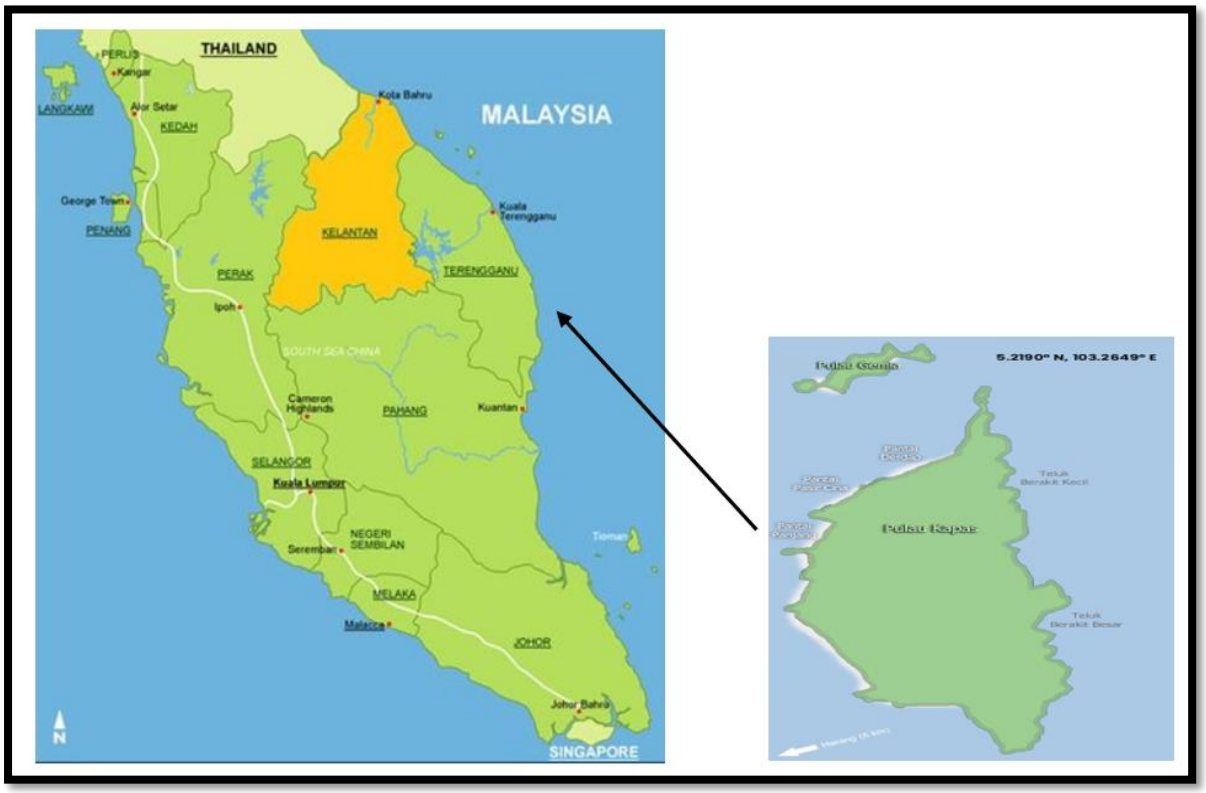

Figure 1. Location of KIMP

Convenient sampling was applied and both domestic and foreign visitors to KIMP were sampled. Data collecting took place during May and June 2022, primarily on weekends and public holidays when it was predicted that more people would visit. A questionnaire was only given to one volunteer participant (who was 18 years old and above) from each group of visitors to minimize redundancy (Abdullah et al., 2023).

A face-to-face interview was conducted to obtain primary data. This method was expected to ensure a high response rate and high-quality data since it allowed the

enumerators to assist the respondents in answering the questions as accurately as possible (Nadirah et al., 2020). The respondents were briefed on the details of the survey by trained enumerators who conducted the interviews. Enumerators first introduced themselves before requesting approval to conduct the survey. Enumerators described the purpose of the survey and displayed the relevant approval letter from authorities after receiving an affirmative answer from the respondents to participate in the survey.

Carrying Capacity Assessment

The maximum number of visitors should be calculated based on the area's physical, ecological, and management circumstances (Bera et al., 2015). This theory was created by Cifuentes (1992), and it has since been used by several other authors, including (Segrado et al., 2008; Zacarias et al., 2011). When using this carrying capacity assessment technique, it is crucial to take into account visitor flows, size area, the ideal space to walk around without being pressured, and the duration of the visits (Bera et al., 2015).

The assessment of carrying capacity consists of different phases and is related by mathematical methods. First, the Physical Carrying Capacity (PCC) is used to determine the space available per visitor. Then, to calculate the Real Carrying Capacity (RCC), the limitations of the PCC factors are examined.

Physical Carrying Capacity

The Physical Carrying Capacity (PCC) is the number of visitors who can practically accommodate a particular setting at a given time.

PCC = A× D× Rf, (1)
where:

A: Available area for use (m2);
D: Tourist density (tourists / m2);
Rf: Rotation factor (number of visits per day).

A is referred by available area for use. This criterion can be determined by the available area can be estimated from the distance of the route there or the entire area that visitors can use for recreational activities. D refers to the amount of space needed for a visitor to conduct activities pleasurably. Lastly, Rf refers to the maximum number of visits permitted within a certain timeframe, typically determined by daily open hours and stated as:

Rf = Accessible time / typical length of stay

Real Carrying Capacity

Real Carrying Capacity (RCC) is the maximum number of visitors allowed after the PCC has been corrected using the correction factors (CF) based on the particular site characteristics. The RCC is determined using the following equation

RCC =PCC x (Cf1x Cf2 xCf3x…… Cfn)

Which are;

PCC= Physical Carrying Capacity (PCC)
CF= Correction factor

Correction Factor

The formula below is used to determine correction factors (CF).:

Cfx=1- (M1/ Mt)
Where:
Cfx = Correction factors of variable x;
M1 = Limiting factor of variable;
Tmx = Total factor of variable x.

Results AND Discussion

- **Hiking at Bukit Singa**

-The measured variables are listed as
-Route length for hiking= 2720 m
-Number of visitors in one group at the most 30
-The typical gap between two people= 1m
-The separation of the two groups= 10m
-The typical duration of a visit 2 hour
-Open times: 7 am until 5 pm (10 hours)

Give x the total number of groups
n x *30* + (n -1) x 10 = 2720
n= 68 visitors/ day

Correcting Factor
Monsoon season (Cf): Temporary closure because monsoon season often occurs from November until February affecting marine park tourism activities. Consequently, this could be considered a limiting factor.
M2: 120 days (September until February).
Mt: 365 days (12 months).
Therefore, CF_1 = M1/ Mt
= 120/365
= 32.87%

Real Carrying Capacity (RCC) of hiking at Bukit Singa

RCC_{hiking} = 68 x 32.87%
= 22 persons (visit /day)

- **Snorkelling**

It is important to take into account elements that affect the satisfaction of visitors when calculating Real Carrying Capacity (RCC), such as the required spacing between two persons and the distance between two groups on a route. Therefore, the following physical characteristics are applied to the Ceballos-Lascurain formula to improve it
- Length of the snorkelling zone= 200 m
- Distance between the waiting area and the snorkelling area: 50m.
- Size of a boat: 5-7m.
- Distance between two operational boats: 5m.
- Space between the two groups in the snorkelling area: 5m.
- Typical gap between two people: 1m.
- Most persons allowed on a boat: 12 visitors including boatman.

- The typical snorkelling Duration: 2 hours
- Open time: 10 am until 6 pm (8 hours).

Let *n* represent the total number of boats. The number of boats is expressed by the following equation from the entrance to the final snorkelling location:

$n \times 3 + (n - 1) \times 1 = 250$

Given the equation above, there are 62 boats.

Then, let *k* represent the maximum number of groups participating in snorkelling (one group is equivalent to one boat).

Since the snorkelling area is 200 m in length and the waiting area is 50 metres from the snorkelling site, the trip is 250 metres long:

$k \times 12 + (k - 1) \times 5 = 250$

$k = 14$ groups

Each tour lasts roughly 1.5 hours, and the open time is 8 hours per day. Thus, there are two visits per day (*Rf* 8/2). Consequently, the maximum daily attendance is:

$PCC = (n + k) \times 12 \times 2$

$= (62 + 14) \times 12 \times 1.5$

$= 1368$ visitors/day

Correcting Factor

• The monsoon season (Cf1): Due to its significant impact on marine tourism activities, this element is perhaps the most significant corrective factor. Heavy rains often occur from November until February affecting snorkeling activities. Consequently, it can be considered as a limiting factor.

M2: 120 days (November until February).

Mt: 365 days (12 months).

Thus, $CF_1 = M1/ Mt$

$= 120/365$

$= 32.87\%$

Effective real carrying capacity (ERCC) of snorkelling

$RCC_{Snorkeling} = 1824 \times 32.87\%$

$= 599$ persons (visitors /day)

- **Beach Picnic**

-Route length for a beachside picnic = 500m
-Number of visitors in one group at the most= 10
-The typical gap between two people= 1m
-The separation of the two groups= 1m
-The typical length of a visit= 4hour
-Open time= 9a.m until 5p.m (8 hours)

Assuming there are *n* groups, for example

$x \times 10 + (x - 1) \times 1 = 500$

x = 45 groups/ day
Each visitor only participates in a picnic activity once each day because the open period is 8 hours in duration and visits last an average of 6 hours, or Rf = 1.
PCC = 45 ×10×1 = 450 (visitors/ day)
Correcting factor;
Intense sunshine (Cf): Without sunshine, fewer people visit beaches for leisure activities, making this one of the most crucial factors for beach tourism activities. Malaysia receives about six hours of direct sunlight per day and April, May and June are the hottest months of the year.

Conclusion
The result revealed that the appropriate value of the carrying capacity for recreational activities in KIMP are followed;

1. Hiking at Bukit Singa with a carrying capacity of 22 visitors per day
2. Snorkelling with a carrying capacity of 599 visitors per day
3. Beach picnic with a carrying capacity of 450 visitors per day

The result revealed that the carrying capacity of the marine tourism industry cannot be avoided, and is intended to facilitate management and authorities in natural protected areas in making decisions. Ibrahim et al., (2023) mentioned that the way people use resources is one of the main contributing factors to biodiversity loss. Through an estimation of the carrying capacity for recreational activities at KIMP, this research suggested that visitors' use must have boundaries, assist conservation, and reduce natural damage.

Contribution of the Study
Carrying capacity is an important element in the management of marine park. Carrying capacity helps to balance the recreational opportunities of visitors and the sustainability of natural resources. In conclusion, if number of visitors above is not restricted, the natural environment can be permanently damaged because nature is irreversible.
Managers can regulate human activities, particularly at KIMP, by defining the maximum number of visitors in advance. Other than that, conducting capacity evaluations can provide a research-based framework for resolving conflicts and effectively allocating funds at marine parks. The findings of the study make a tremendous contribution to the assessment of carrying capacity and recommend real carrying capacity for recreational activities at KIMP for great marine tourism experiences among visitors in the future.

Acknowledgements
This research has been funded by the Fundamental Research Grant Scheme (FRGS), Ministry of Higher Education Malaysia under grant number 55440195. The authors would like to acknowledge the Department of Fisheries Malaysia and Ministry of Agriculture and Food Security for their approval, expertise and assistance in conducting the study. This transdisciplinary research is part of dissertation that has been submitted as a partial fulfilment to meet the requirement for the degree of Doctor of Philosophy at Universiti Putra Malaysia.

References

Abdullah, A., Afandi, S. H. M., Shuib, A., & Mohamad, W. N. W. (2023). Economic Valuation for Recreational Services of The Permanent Forest Estate in Kuala Kubu Bharu: A Travel Cost Analysis. *International Journal of Academic Research in Business and Social Sciences*, 13(6), 359 – 367

Adam, S. M., Shuib, A., Ramachandran, S., & Kunasekaran, P. (2019). Impacts of ecotourism development in Tasik Kenyir on the quality of life as perceived by the local community. *Journal of Sustainability Science and Management*, 14(3), 100-109.

Adam, S. M., Afandi, S. H. M., Mohamad, W. N. W., & Hassan, S. (2022). Mapping Major Trends in Global Research In Marine And Coastal Tourism: A Bibliometric Analysis. *Journal of Sustainability Science and Management*, 17(8), 196-213.

Adrianto, L., Kurniawan, F., Romadhon, A., Bengen, D. G., Sjafrie, N. D. M., Damar, A., & Kleinertz, S. (2021). Assessing social-ecological system carrying capacity for urban small island tourism: The case of Tidung Islands, Jakarta Capital Province, Indonesia. *Ocean & Coastal Management*, 212, 105844.

Arshad, M. I., Iqbal, M. A., & Shahbaz, M. (2018). Pakistan tourism industry and challenges: a review. *Asia Pacific Journal of Tourism Research*, 23(2), 121-132.

Bera, S., Majumdar, D. D., & Paul, A. K. (2015). Estimation of tourism carrying capacity for Nile Island, south Andaman, India. *Journal of Coastal Sciences*, 2(2), 46-53.

Sharma, V. R., & Bisht, K. (2019). Carrying capacity assessment and sustainable tourism management in Agra city, Uttar Pradesh (India). *Geo Journal of Tourism and Geosites*, 25(2), 399-407.

Hassan, S. R., Hassan, M. K., & Islam, M. S. (2014). Tourist-Group consideration in tourism carrying capacity assessment: A new approach for Saint Martin's Island, Bangladesh. *Journal of Economics and Sustainable Development,* 5(19), 150-158.

Ibrahim, M. S. N., Assim, M. I. S. A., Johari, S., Mohammad, S. K. W., Afandi, S. H. M., & Hassan, S. (2023). Public awareness on biodiversity conservation and well-being: case of Gunung Mulu National Park, Sarawak. *GeoJournal*, 88(3), 3471-3496.

Islam, G. M. N., Tai, S. Y., Kusairi, M. N., Ahmad, S., Aswani, F. M. N., Senan, M. K. A. M., & Ahmad, A. (2017). Community perspectives of governance for effective management of marine protected areas in Malaysia. *Ocean & Coastal Management*, 135, 34-42

Leka, A., Lagarias, A., Panagiotopoulou, M., & Stratigea, A. (2022). Development of a Tourism Carrying Capacity Index (TCCI) for sustainable management of coastal areas in Mediterranean islands–Case study Naxos, Greece. *Ocean & Coastal Management*, 216, 105978.

Liu, R., Pu, L., Zhu, M., Huang, S., & Jiang, Y. (2020). Coastal resource-environmental carrying capacity assessment: A comprehensive and trade-off analysis of the case study in Jiangsu coastal zone, eastern China. *Ocean & Coastal Management*, 186, 105092.

Queiroz, R. E., Ventura, M. A., Guerreiro, J. A., & da Cunha, R. T. (2014). Carrying capacity of hiking trails in Natura 2000 sites: a case study from North Atlantic Islands (Azores, Portugal). *Journal of Integrated Coastal Zone Management*, 14(2), 233-242.

Rodella, I., Madau, F., Mazzanti, M., Corbau, C., Carboni, D., Simeoni, U., & Parente, L. (2020). Carrying capacity as tool for beach economic value assessment (case studies of Italian beaches). *Ocean & Coastal Management*, 189, 105130.

Tuohy, P., Cvitanovic, C., & Shellock, R. J. (2022). Understanding visitor awareness and knowledge of marine parks: Insights from the Ningaloo Coast, Australia. *Ocean & Coastal Management*, 227, 106282.

Siow, M. L., Ramachandran, S., Mohammad Afandi, S. H., Baum, T., & Shuib, A. (2022). Policy, government strata and sustainable tourism of a rural destination: An analytical network policy perspective. *Asia-Pacific Journal of Innovation in Hospitality and Tourism*, 11(2), 25–51.

Suksmawati, H., Rahmatin, L. S., & Firdaus, P. (2022). Implementation of Conservation Tourism in Supporting The Protection of The Essential Turtle Ecosystem Area at Taman Kili-Kili Beach Wonocoyo, Panggul.

Wang, Y. C., & Du, Y. W. (2023). Evaluation of resources and environmental carrying capacity of marine ranching in China: An integrated life cycle assessment-emergy analysis. *Science of the Total Environment*, 856, 159102.

Zacarias, D. A., Williams, A. T., & Newton, A. (2011). Recreation carrying capacity estimations to support beach management at Praia de Faro, Portugal. *Applied Geography*, 31(3), 1075-1081.

Zhang, L., & Chung, S. (2015). Assessing the social carrying capacity of diving sites in Mabul Island, Malaysia. *Environmental Management*, 56, 1467-1477.

Zhou, W., Cai, J., & Chen, K. (2022). Connecting Recreational Service to Visitor's Well-Being: A Case Study in Qianjiangyuan National Park. *International Journal of Environmental Research and Public Health,* 19(18), 11366.