DEVELOPMENT OF TOURISM CARRYING CAPACITY INDICATORS FOR TOURISM IN MARINE NATIONAL PARKS

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ABSTRACT

This research was developed to develop the tourism carrying capacity indicators suitable for tourism in marine national parks in Thailand. the population and sample group of which were the stakeholders related to the tourism activities within the marine national parks, including national park officers, local operators, people living in the surrounding communities, and tourists with travelling experience in marine national parks, 456 persons in total. The suitableness evaluation of ecological carrying capacity indicators for tourism in marine national parks showed that 23 of 34 indicators were qualified. The suitableness evaluation of facility carrying capacity indicators for tourism in marine national parks showed that 25 of 30 indicators were qualified and the suitableness evaluation of facility carrying capacity indicators for tourism in marine national parks showed that all 17 indicators. The results can be applied to the sustainability management of marine national park tourism.

Keywords: Tourism Carrying Capacity Indicators, Marine National Park**.**

INTRODUCTION

Tourism activities generate economic wealth to the countries across the globe, including Thailand which unceasingly benefits from such activities during the past years in terms of reputation, revenue and global recognition (Suveatwatanakul & Sukpatch, 2021). The number of tourists in each area in Thailand steadily increases; the number went from 159,197,021 persons/time in 2014 to 205,120,684 persons/time in 2018, equal to 28.84% increment (Ministry of Tourism and Sports, 2019), resulting in huge revenue generation from 1,874.249 billion baht in 2017 to 2,947.479 billion baht in 2018 or 57.26% increment (Tourism Authority of Thailand, 2019). This also reflects the number of tourists in each attraction, including national parks, which increased from 12,605,854 persons/time to 20,792,834 persons/time, equal to 39.37%, resulting in revenue generation from 102,740,312 baht in 2014 to 2,702,657,746 baht in 2018 (Department of National Parks, 2019).

Although the growing number of tourists contributes to the revenue generation of national parks, it causes the significant damage and loss of natural resources in the area, especially in the national parks. The government announced the temporary close of many national parks, some longer than expected due to the deterioration of the area as a result of the inordinately high number of visiting tourists, causing the conflict between the local operators and security personnel as constantly reported in the news.

A widely discussed concept for determining the number of tourists allowed in the area is the tourism carrying capacity which creates the balance between nature conservation and revenue generation, leading to the sustainable development of the area. This study, therefore, has the key objective to develop the tourism carrying capacity indicators suitable for tourism in marine national parks in Thailand in order to sustainably utilize and conserve the nature which can be further developed and referred to by other Thai and foreign researchers in the future.

Research Objectives

To develop the tourism carrying capacity indicators suitable for tourism in marine national parks.

LITERATURE REVIEW

The study of relevant documents and researches concluded the meaning of tourism carrying capacity as the maximum number of visiting tourists that an area can accommodate without deteriorating the natural resources within (Aguilar et al., 2021; Bertocchi et al., 2020; Hu et al., 2021; Ye et al., 2020). This study of tourism carrying capacity aims to study the indicators related to the effects caused by the tourism activities on the ecosystem, natural resources and environment in order to evaluate the tourism carrying capacity. The general characteristics of tourism carrying capacity are subject to the geography, size of area, type of activity, experience or character of the visiting tourists, and density level acceptable for the recreational activities of the visiting tourists, all of which are varied to each area.

The tourism carrying capacity indicators under this study include (Aguilar et al., 2021; Amerta et al., 2018; Choi & Sirakaya, 2006; de Sousa et al., 2014; Han, 2018; Hongyun, 2016; Hu et al., 2021; Anindika et al., 2020; Mansfeld & Jonas, 2006; McCool, 1996; Meshkini et al., 2013; Salerno et al., 2013; Sha, 2020; Shi et al., 2015; Wang, 2018; Zhongbin, 2018):

1. **Ecological carrying capacity**: The maximum number of species that an ecosystem can accommodate the quality living within while maintaining the system output level, adaptability and replacement. This is the study of maximum capacity that an ecosystem or environmental system can support without deteriorating or causing permanent damage to such system.
2. **Facility carrying capacity**: The maximum number of visiting tourists that the facility in an area can accommodate. It is used to evaluate the carrying capacity of an area in terms of buildings and operations within.
3. **Psychological carrying capacity**: It is used to evaluate the carrying capacity of an area in terms of feeling and experience of visiting tourists, and density level.

METHODOLOGY

This study employed the quantitative research, the population and sample group of which were the stakeholders related to the tourism activities within the marine national parks, including national park officers, local operators, people living in the surrounding communities, and tourists with travelling experience in marine national parks.

Selected Tools

This survey research used the questionnaire created and developed following the objective of the research to collect data. Having assessed by 3 specialists using content validity

method, the test was then modified and adjusted to cover all aspects of the content in proper language level. Its reliability was also pre-tested by a group of 30 persons who were not the members of the sample group in order to calculate the reliability (De Costa et al., 2019; Tonioli, 2018).

RESEARCH FINDINGS

After studying the indicators on other relevant researches and theories, the tourism carrying capacity indicators for tourism in marine national parks produced the results as follows:

Table 1
RESULTS OF SUITABLENESS EVALUATION OF ECOLOGICAL CARRYING CAPACITY INDICATORS FOR TOURISM IN MARINE NATIONAL PARKS

Ecological Carrying Capacity Indicator	Binomial (p)	Result
A1 Cleanness of Seawater	0.91 (0.00*)	Suitable
A2 Average Oxygen in Seawater	0.78 (0.01*)	Suitable
A3 Cleanness of Natural Freshwater	0.87 (0.00*)	Suitable
A4 Salinity of Seawater	0.65 (0.21)	Unsuitable
A5 Average Oxygen in Air	0.87 (0.00*)	Suitable
A6 Sand Erosion Rate	0.87 (0.00*)	Suitable
A7 Particulate Matter Concentration (PM 2.5)	0.74 (0.04*)	Suitable
A8 Average Area Temperature	0.61 (0.41)	Unsuitable
A9 Average Area Humidity	0.52 (1.00)	Unsuitable
A10 Area Size	0.74 (0.04*)	Suitable
A11 Number of Trees	0.70 (0.09)	Unsuitable
A12 Tree Species	0.61 (0.41)	Unsuitable
A13 Tree Density	0.65 (0.21)	Unsuitable
A14 Restricted Wood Species	0.52 (1.00)	Unsuitable
A15 Number of Restricted Wood Species	0.61 (0.51)	Unsuitable
A16 Tree Damage	0.57 (0.68)	Unsuitable
A17 Number of Marine Plants	0.91 (0.00*)	Suitable
A18 Marine Plant Species	0.83 (0.00*)	Suitable
A19 Marine Plant Density	0.87 (0.00*)	Suitable
A20 Marine Plant Damage	0.83 (0.00*)	Suitable
A21 Number of Corals	0.96 (0.00*)	Suitable
A22 Coral Species	0.87 (0.00*)	Suitable
A23 Coral Density	0.96 (0.00*)	Suitable
A24 Coral Damage	0.91 (0.00*)	Suitable
A25 Number of Marine Animals	1.00 (0.00*)	Suitable
A26 Marine Animal Species	0.96 (0.00*)	Suitable
A27 Marine Animal Density	1.00 (0.00*)	Suitable
A28 Marine Animal Birth Rate	0.83 (0.00*)	Suitable
A29 Marine Animal Death Rate	0.61 (0.41)	Unsuitable
A30 Reserved Marine Animal Species	0.83 (0.00*)	Suitable
A31 Number of Reserved Marine Animals	0.87 (0.00*)	Suitable
A32 Size of Conservation Area for Wildlife/Wood	0.83 (0.00*)	Suitable
A33 Size of Conservation Area for Marine Animals and Marine Plants	1.00 (0.00*)	Suitable
A34 Damage on Other Nature Elements Apart from Marine Animals and Marine Plants	0.65 (0.21)	Unsuitable

Note: * $p<0.05$

Indicator Evaluation

The data collected by the questionnaires was analyzed using the following steps:

1. **Step 1:** The answers provided in the questionnaire were converted to score. 1-3 meant that the indicator was unsuitable for the further evaluation. 4-5 meant that the indicator was suitable for the further evaluation.
2. **Step 2:** The binomial test was employed to test the converted scores to indicate the suitableness of the indicators and selected only the qualified indicators. 65 indicators from 3 categories were qualified and suitable.

The suitableness evaluation of ecological carrying capacity indicators for tourism in marine national parks showed that 23 of 34 indicators were qualified as presented in Table 1. The unqualified indicators were salinity of seawater, average area temperature, average area humidity, number of trees, tree species, tree density, restricted wood species, number of restricted wood species, tree damage, marine animal death rate, and damage on other nature elements apart from marine animals and marine plants.

Table 2 RESULTS OF SUITABLENESS EVALUATION OF FACILITY CARRYING CAPACITY INDICATORS FOR TOURISM IN MARINE NATIONAL PARK		
Facility Carrying Capacity Indicator	**Binomial (p)**	**Result**
B1 Number of Visiting Tourists at Any Given Time	0.91 (0.00*)	Suitable
B2 Number of Visiting Tourists throughout the Year	0.78 (0.01*)	Suitable
B3 Waste Management Efficiency	1.00 (0.00*)	Suitable
B4 Number of Garbage Bins	0.96 (0.00*)	Suitable
B5 Amount of Clean Water for Usage by Visiting Tourists	1.00 (0.00*)	Suitable
B6 Sewage Management Efficiency	1.00 (0.00*)	Suitable
B7 Noise Level from Tourism Activities	0.78 (0.01*)	Suitable
B8 Size of Parking Area	0.87 (0.00*)	Suitable
B9 Number of Visiting Tourists Moving through Area	0.78 (0.01*)	Suitable
B10 Number of Restrooms	1.00 (0.00*)	Suitable
B11 Number of Accommodations within Area	0.96 (0.00*)	Suitable
B12 Number of Accommodations Surrounding Area	0.91 (0.00*)	Suitable
B13 Size of Camping Area	0.87 (0.00*)	Suitable
B14 Size of Recreational Activity Area (e.g. Diving)	0.96 (0.00*)	Suitable
B15 Size of Relaxing Area for Visiting Tourists	0.83 (0.00*)	Suitable
B16 Size of Tourist Service Center	0.83 (0.00*)	Suitable
B17 Number of Officers in Charge of Tourism Activities	0.96 (0.00*)	Suitable
B18 Number of Tourism Activities	0.91 (0.00*)	Suitable
B19 Average Number of Overnight Visiting Tourists within Area	0.78 (0.01*)	Suitable
B20 Average Number of Non-Overnight Visiting Tourists within Area	0.74 (0.04*)	Suitable
B21 Number of Shops within Area	0.61 (0.41)	Unsuitable
B22 Number of Restaurants within Area	0.91 (0.00*)	Suitable
B23 Number of Alcoholic Beverages and Tobacco Found within Area	0.61 (0.41)	Unsuitable
B24 Number of Alcoholic Beverages and Tobacco for Sale within Area	0.57 (0.68)	Unsuitable
B25 Number of Quarrel Cases within Area	0.61 (0.41)	Unsuitable
B26 Number of Narcotic Cases within Area	0.52 (1.00)	Unsuitable
B27 Profession Change Rate of Locals to Tourism-Related Professions	0.74 (0.04*)	Suitable
B28 Number of Tourism-Related Local Operators within Area	0.87 (0.00*)	Suitable
B29 Revenue Generated from Tourism of National Parks	0.87 (0.00*)	Suitable
B30 Revenue Generated from Tourism of Surrounding Communities	0.96 (0.00*)	Suitable

Note: * $p < 0.05$

The suitableness evaluation of facility carrying capacity indicators for tourism in marine national parks showed that 25 of 30 indicators were qualified as presented in Table 2. The unqualified indicators were number of shops within area, number of alcoholic beverages and tobacco found within area, number of alcoholic beverages and tobacco for sale within area, number of quarrel cases within area, and number of narcotic cases within area.

Table 3 RESULTS OF SUITABLENESS EVALUATION OF PSYCHOLOGICAL CARRYING CAPACITY INDICATORS FOR TOURISM IN MARINE NATIONAL PARKS		
Psychological Carrying Capacity Indicator	Binomial (p)	Result
C1 Feeling of All Stakeholders Towards Waste Odor	0.96 (0.00*)	Suitable
C2 Feeling of All Stakeholders Towards Air Ventilation	0.91 (0.00*)	Suitable
C3 Feeling of All Stakeholders Towards Restroom Cleanness	1.00 (0.00*)	Suitable
C4 Discomfort Level of Visiting Tourists	0.96 (0.00*)	Suitable
C5 Safety Level of Visiting Tourists	1.00 (0.00*)	Suitable
C6 Satisfaction Level of Visiting Tourists	0.96 (0.00*)	Suitable
C7 Revisiting Desire of Visiting Tourists	0.87 (0.00*)	Suitable
C8 Satisfaction Level of Surrounding Communities towards Tourism Activities within Area	0.91 (0.00*)	Suitable
C9 Satisfaction Level of Surrounding Communities towards Revenue Generated from Tourism	0.87 (0.00*)	Suitable
C10 Feeling of Surrounding Communities Towards Negative Effects Created by Tourism Activities within Area	0.91 (0.00*)	Suitable
C11 Discomfort Level of Surrounding Communities	0.87 (0.00*)	Suitable
C12 Safety Level of Surrounding Communities	0.96 (0.00*)	Suitable
C13 Dispute Level between Visiting Tourists and Local Residents	0.78 (0.01*)	Suitable
C14 Dispute Level between National Park Officers and Local Residents	0.83 (0.00*)	Suitable
C15 Dispute Level of Local Operators	0.83 (0.00*)	Suitable
C16 Dispute Level between Local Operators and Visiting Tourists	0.83 (0.00*)	Suitable
C17 Dispute Level between National Park Officers and Local Operators	0.74 (0.04*)	Suitable

Note: * $p<0.05$

The suitableness evaluation of facility carrying capacity indicators for tourism in marine national parks showed that all 17 indicators were qualified as presented in Table 3.

CONCLUSION

This study has the key objective to develop the tourism carrying capacity indicators suitable for tourism in marine national parks. The stakeholders were asked for the opinion on the indicators gathered from the relevant theories and researches in order to develop the suitable indicators in accordance with the objective of this study. It can be concluded that 65 indicators from 3 categories were suitable, comprising 23 ecological carrying capacity indicators, 25 facility carrying capacity indicators, and 17 psychological carrying capacity indicators. The results can be applied to the sustainability management of marine national park tourism.

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