TOURISM CARRYING CAPACITY IN MARINE PROTECTED AREA: A CASE STUDY OF TUNKU ABDUL RAHMAN PARK, KOTA KINABALU, SABAH.

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DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, equations, summaries and references, which have been duly acknowledged.

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ABSTRACT

Tunku Abdul Rahman Park is a popular tourist location; thus, the presence of too many tourists may leave a long-term negative impact on its ecology and sustainability. In determining the Carrying Capacity, a few factors were taken into account, such as the briefing effectiveness and tourists behaviour (Chapter 3), tourists knowledge and support (Chapter 4), changes of coral cover through Movement Control Order (Chapter 5), management capacity, socio-physical and climate limiting factors (Chapter 6). Briefing scores was found to be only focused on marketing to gain more revenue from the tourists. The lack of responsibility among tourist guides was later proof by tourists behaviour in term of Coral Contact Rate with 1.76 contacts per 10 minutes of snorkelling time, where 72.29% of the contacts were intentional. T-test results showed that the reef of Mamutik island experienced a significantly higher Coral Contact Rate ($p<0.05$) than Manukan as Mamutik has a shallower reef area, restricting movements of snorkelers. Results also proved that Coral Contact Rate was significantly higher ($p<0.05$) duringstronger currents than weak currents. Kruskal-Wallis test shows that tourists knowledge and support of Marine Protected Area overall were highly dependent ($p<0.05$) on education level. Very low knowledge was observed in Marine Protected Area knowledge, with only 37% of respondents and only 29% knows that Tunku Abdul Rahman Park is a Marine Protected Area. Most tourists were well-aware that corals, turtles and sharks are endangered species. However, in concern of corals, very few respondents (26%) know that it is an animal and can be leached by sunscreen (35%). Despite the low knowledge, tourists show slight support of the Marine Protected Area, where the Likert-scale of 5 questions resulted in a mean score of 2.36 ± 0.99. A notable higher disagreement was observed on the restriction of snorkelling activity during low tide due to the lack of knowledge on Coral Contact Rate's effect in the shallow reef area. In July 2020 (4 months afterthe Movement Control Order), the final coral cover survey proved the benefit of theResting Period, where an increase of 3.16% was compensated from the 96% of revenue drop. Applying the Rotation Resting Period concept will grant the opportunity for Tunku Abdul Rahman Park to still collect revenue while keeping the coral ecosystem healthy. With all the essential data collected, the Carrying Capacityformulas of Land-based and Ocean-based were calculated for each island. Since thetourist's arrival shows fluctuation throughout the year, this study considered three tourism seasons; Regular Season, High Season and Festive Season. Manukanisland, which offers the largest Land and Ocean-based area, recorded the highest number of Carrying Capacity with 1,464 and 822 tourists, respectively. The Land- based Carrying Capacity of Mamutik (990) and Sapi (997) are almost similar in number as their size is nearly the same. However, the Ocean-based Carrying Capacity of Sapi (458) is lower than Mamutik (587) as Sapi island has the highest limitation in terms of fragile coral cover. Finally, a series of recommendations basedon the result of the study were listed to improve Tunku Abdul Rahman Park's management in preserving and conserving the ecosystem of the islands. Further research and monitoring are needed, whether the new management's implementation based on the Carrying Capacity of this study helps the environment.

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ABSTRAK

KAJIAN HAD DAYA TAMPUNG PELANCONG SECARA EKOLOGI BERASASKAN IMPAK PELANCONGAN DI TAMAN PERLINDUNGAN MARIN: KAJIAN KES DI TAMAN TUNKU ABDUL RAHMAN, KOTA KINABALU, SABAH.

Taman Tunku Abdul Rahman adalah lokasi pelancongan yang popular; kehadiran pelancong yang tinggi boleh meninggalkan kesan negatif jangka panjang terhadap ekologi dan kelestariannya. Dalam penentuan Had Daya Tampung, beberapa faktor dipertimbangkan, seperti keberkesanan taklimat dan tingkah laku pelancong (Bab 3), pengetahuan dan sokongan pelancong (Bab 4), kadar perubahan kadar litupan karang semasa Perintah Kawalan Pergerakan (Bab 5), keupayaan pengurusan, faktor pembatas sosio-fizikal dan iklim (Bab 6). Skor taklimat pemandu pelancong didapati hanya tertumpu kepada pemasaran untuk mendapatkan lebih banyakpendapatan dari para pelancong. Kurangnya tanggungjawab pemandu pelancong kemudian dibuktikan oleh tingkah laku pelancong dari segi Kadar Sentuhan Karang dengan 1.76 untuk setiap 10 minit sewaktu aktiviti snorkel, di mana 72.29% sentuhan itu disengajakan. Hasil T-test menunjukkan bahawa terumbu pulau Mamutik merekod Kadar Sentuhan Karang ($p<0.05$) yang jauh lebih tinggi daripadaManukan kerana Mamutik memiliki kawasan terumbu yang lebih cetek, sehingga menghadkan pergerakan aktiviti snorkel. Hasil kajian juga membuktikan bahawa Kadar Sentuhan Karang lebih tinggi ($p<0.05$) semasa arus lebih kuat berbanding arus lemah. Ujian Kruskal-Wallis menunjukkan bahawa pengetahuan dan sokongan pelancong terhadap Taman Perlindungan Marin secara keseluruhan sangat bergantung ($p<0.05$) kepada taraf pendidikan. Pengetahuan yang rendah direkod dalam pengetahuan Taman Perlindungan Marin, dengan hanya 37% responden danhanya 29% mengetahui bahawa Taman Tunku Abdul Rahman adalah Taman Perlindungan Marin. Sebilangan besar pelancong menyedari bahawa karang, penyu dan ikan yu adalah spesies terancam. Namun, mengenai batu karang, hanya sedikitresponden (26%) yang mengetahui bahawa ia adalah binatang dan terhakis oleh krim pelindung matahari (35%). Namun demikian, pelancong menunjukkan sokongan terhadap Taman Perlindungan Marin, di mana skala 5 soalan Likert-scale menghasilkan skor rata-rata 2,36 ± 0,99. Ketidaksepakatan yang lebih tinggi diperhatikan mengenai had aktiviti snorkel semasa air surut kerana kurangnya pengetahuan mengenai kesan Kadar Sentuhan Karang di kawasan terumbu karang cetek. Pada bulan Julai 2020 (4 bulan setelah Perintah Kawalan Pergerakan), tinjauan litupan karang terakhir membuktikan manfaat dari Tempoh Rehat, di manapeningkatan sebanyak 3.16% direkod walaupun dengan penurunan pendapatan 96%. Menerapkan konsep Tempoh Rehat bergilir akan memberi peluang kepada Taman Tunku Abdul Rahman untuk terus menjana pendapatan sambil memastikan ekosistem karang tetap sihat. Dengan semua data penting yang direkod, formula Had Daya Tampung untuk kawasan Daratan dan Lautan dikira untuk setiap pulau. Oleh kerana kedatangan pelancong menunjukkan turun naik sepanjang tahun, kajian ini memfokus kepada tiga musim pelancongan; Musim Biasa, Musim Tinggi dan Musim Perayaan. Pulau Manukan, yang menawarkan kawasan Daratan dan Lautan terbesar, mencatat jumlah Had Daya Tampung tertinggi dengan masing- masing 1,464 dan 822 pelancong. Had Daya Tampung kawasan Daratan pulau Mamutik (990) dan Sapi (997) hampir sama jumlahnya kerana ukurannya hampir sama. Walau bagaimanapun, Had Daya Tampung pulau Sapi (458) berdasarkan

luas kawasan Lautan lebih rendah daripada Mamutik (587) kerana pulau Sapi memiliki habitat tertinggi dari segi litupan karang rapuh. Akhirnya cadangan berdasarkan hasil kajian disenaraikan untuk meningkatkan keupayaan pengurusan Taman Tunku Abdul Rahman dalam memelihara dan memulihara ekosistemnya. Penyelidikan dan pemantauan lebih lanjut diperlukan agar keupayaan pengurusan pelancong berteraskan Had Daya Tampung hasil kajian ini dapat ditingkatkan.

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LIST OF ABBREVIATION

ABNJ	-	Areas Outside National Jurisdiction
ADB	-	Asian Development Bank
AIMS	-	Australian Institute of Marine Science
APEC	-	Asian-Pacific Economic Cooperation
BGI	-	Blue-Green Infrastructure
cm	-	Centimeter
COESTGA	-	Code of Ethics of Sabah Tourist Guide Association
CTI-CFF	-	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security Initiative
CUZ	-	Community Use Zone
EEZ	-	Exclusive Economic Zones
GDP	-	Gross Domestic Product
GRT	-	Gross Registered Tonnage
GVATI	-	Gross Value Added of Tourism Industries
HABs	-	Harmful Algal Blooms
ha	-	Hectares
IUCN	-	International Union for Conservation of Nature
IUU	-	Illegal, Unreported and Unregulated
km	-	Kilometer
km²	-	Kilometer Square
LAC	-	Limits of Acceptable Change
m	-	Meter
m²	-	Meter Square
MCO	-	Movement Control Order
MCS	-	Marine Conservation Society
MECC	-	Marine Ecological Carrying Capacity
mm	-	Millimetre
MOTAC	-	Ministry of Tourism And Culture
MPA	-	Marine Protected Area
MTPB	-	Malaysia Tourism Promotion Board
NEP	-	National Ecotourism Policy

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NERACOOS	-	North-Eastern Regional Association Coastal Ocean Observing System
nm	-	Nautical Miles
OECD	-	Organization For Economic Cooperation And Development
PAST	-	Paleontological Statistics Software Package For Education And Data Analysis
PATA	-	Pacific Asia Travel Association
SDBEC	-	Sustainable Development On Biodiversity And Ecosystems Conservation
SDGs	-	Sustainable Development Goals
SEPU	-	State Economic Planning Unit
SIMCA	-	Sugud Islands Marine Conservation Area
SPSS	-	Statistical Package For The Social Sciences
SSME	-	Sulu Sulawesi Marine Ecoregion
STGA	-	Sabah Tourist Guide Association
STP	-	Student Tourism Programme
TARP	-	Tunku Abdul Rahman Park
TIHPA	-	Turtle Islands Heritage Protected Area
UN	-	United Nation
UNEP	-	United Nations Environment Programme
UNEP-WCMC	-	United Nations Environment Programme World Conservation Monitoring Centre
UNGA	-	United Nation General Assembly
UNWTO	-	United Nations World Tourism Organization
WDPA	-	World Database On Protected Areas
UNWHO	-	United Nation World Health Organization
WWF	-	World Wildlife Fund
φ	-	Cramers's V Values
°C	-	Degree Celsius
%	-	Percentage

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CHAPTER 1

INTRODUCTION

1.1 Background

Tourism is the fastest growing industry in the world with an estimated 1.2 billion people travelling overseas in 2012 and predicted to rise to 1.8 billion by 2020 (UNWTO). The travel and tourism industry is currently worth $2 trillion and provides one in ten jobs worldwide. It generates 7% of global GDP, contributing more than 10% of GDP for 73 countries around the world (World Travel & Tourism Council). With many people flocking to the country, Malaysia has certainly become one of the most popular tourist destinations in Asia. According to Othman et al. (2018), in Malaysia, the tourism industry can be categorised as one of the most important industries after it has grown to be the second largest contributor to the country's GDP after oil and gas. The industry contributes approximately 10% of Malaysia's GDP, or about RM120 billion annually. In addition, the industry employs about 2.2 million people directly and indirectly.

Despite the massive growth of tourism, the industry is still plagued by several problems. The two biggest issues are sustainability and security. Sustainability is the concept of ensuring that resources are not depleted and that the environment is not affected by human activities. It is a way of life that ensures sustainability in every aspect of life. Tourism is one of the industries that can be sustainable if it is practiced in the right way. However, the tourism industry is faced not only with challenges in the form of competitors, but also in the form of threats to its very existence, such as overcrowding, which led to a new term called 'overtourism.' In a report published in 2017, the World Tourism Organization (UNWTO) warned that this situation is threatening the sector's future that unless action is taken, tourism will be greatly affected. Overtourism and tourismphobia emerged and impacting the identity of a

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destination, redevelopment, and introduction of stress and degradation to ecological assets.

Hence, limiting the number of tourists in an area can alleviate the issue of overtourism. There are several concepts within the sustainable debate that are being used to propose a sustainable number of tourists in an area such as Limits of Acceptable Change (LAC), Visitor Impact Management (VIM), Carrying Capacity (CC), etc. The concept of carrying capacity is rooted in agricultural practice and is being used to determine the most optimum number of livestock according to its availability of natural resources.

The simplicity of the concept then evolved and applied in various fields such as ecology and tourism, creating different connotations following its respective use. Several instances of ecological carrying capacity such as soil carrying capacity, water carrying capacity, forest carrying capacity and environmental carrying capacity can be found. Though differences exist, the basic connotations of the concept are to find equilibrium in the number of users to the availability of resources (e.g. soil, water, forest and environmental).

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When tourism carrying capacity and environmental carrying capacity are combined, it will create environmental tourism carrying capacity which is described as the maximum number of tourism activities that a location can endure without lessening its physical, economic, and sociocultural environment along with setting a limit of a suitable reduction of the visitor satisfaction value, as mentioned by Nayan *et al.* (2015). Environmental Tourism Carrying Capacity is regarded as a multifaceted concept that involves many multidimensional components in ensuring tourism management and development that are improved. In this study, since there was no definite framework on the carrying capacity of environmental tourism before, all indicators selected to measure the carrying capacity are correlated with establishing a proper model of the carrying capacity of environmental tourism. From the developed model, three dimensions embodied the role of Environmental Tourism Carrying Capacity, which comprised biophysical environment, sociology, and tourism facility management. These three attributes, which were derived from different backgrounds, were then combined to find the most appropriate Environmental Tourism Carrying Capacity number. Even though numerous studies are sceptical of

the use of carrying capacity, many believe that its simplicity and ease of use are its assets, allowing it to be adopted by all stakeholders, particularly local communities.

Overtourism is a developing problem in Malaysia, as shown at the World Heritage Sites of Melaka and George Town (Penang), where inhabitants are fleeing the old town to avoid the rush of visitors (Chong et al., 2021). This is due in part to the global introduction of low-cost travel and lodging (Johnes and Mapjabil, 2020), which has resulted in an increase in visitor numbers. In Sabah's state, tourist arrivals had peaked in 2019, where the state registered its highest-ever tourism receipt of RM 8.3 billion, which is a 5.3% increase from the previous year (Chan, 2020). In the perspective of international tourists, the state's tourism image was mostly built on its natural attractions, which included cultural diversity, coastal activities, and marine attractions such as islands, which earn up to USD 20 million per year (Teh et al., 2018; Zain et al., 2015). Tourists are most satisfied with the vicinity of natural wonders, culture, and people even in the capital, Kota Kinabalu (Johnes and Mapjabil, 2020; Simon et al., 2020). However, the state's tourism expansion must be addressed for improved management, particularly in its marine attractions, in order to reduce visitor effect on Sabah's natural assets. As a result, utilising Tunku Abdul Rahman Park (TARP) as a research site, this study focuses on the ecological carrying capacity based on the influence of tourism on marine protected areas.

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TARP was named after Malaysia's first prime minister, Tunku Abdul Rahman. It was gazetted in 1974, being the first MPA in Sabah (Hashim et al., 2020). The MPA covers about 50 km² of the area, surrounded by coral reefs and the sea and receiving 500,000 tourists in 2018 and 2019 alone (Nasrulhakim et al., 2021). The main objective of the MPA is to protect the flora, fauna, and marine ecosystems such as the coral reefs within the area from destruction. TARP comprises of five islands; Manukan, Gaya, Mamutik, Sapi, and Sulug island that offers numerous marine activities such as diving, snorkelling and accommodations.

1.2 Problem Statement

Marine ecosystem especially in marine protected area is an attraction for tourists, especially in Sabah where nature-based tourism is favoured by many. However,