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Marine Parks and Sustainability of Fisheries Resources: View of the Pulau Tioman's Residents

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ABSTRACT

Pulau Tioman is among the 42 islands in Malaysia that are designated as Marine Parks. The primary objective of establishing the Marine Park is to enhance the nation's fisheries resources through the effective management, preservation, and conservation of biodiversity and marine ecosystems within these designated areas. Nevertheless, the extent to which local populations embrace the construction of the Marine Park and its efficacy in guaranteeing the long-term viability of fishing resources remains uncertain. Consequently, this study was undertaken to gather data to address the subject using a quantitative methodology. Data collection was conducted using a survey that used specific questions to be administered to inhabitants residing in seven settlements on Pulau Tioman. The study's findings indicate that the residents of Pulau Tioman rely heavily on fishing resources, with a majority of them engaging in fishing activities to obtain sustenance. The residents of Pulau Tioman have a moderate level of acceptability towards establishing the Marine Park. However, they recognize the significance of the Marine Park in guaranteeing the long-term viability of fishing resources. According to the study, there is a substantial correlation between the degree of public acceptability of marine parks and the significance and efficacy of marine park management. As a result, initiatives to raise public understanding of and confidence in marine park administration ought to be maintained and occasionally enhanced.

Keywords: Marine park**,** Fisheries resources, Pulau Tioman, Marine ecosystems.

1. INTRODUCTION

Marine Protected Areas (MPAs) are defined regions in the ocean or other marine environments declared and controlled. The formation of the Marine Protection Area (MPA) aims to safeguard and conserve diverse marine habitats and marine life, including biodiversity and the integrity of ecosystems, from various human activities and threats. Empirical research indicates that Marine Protected Areas (MPAs) have the potential to effectively preserve and rehabilitate fish populations [1, 2]. This can indirectly enhance fishing resources by ensuring sufficient stocks to meet the demands of local communities, thus contributing to population growth and maintaining sustainable local economies [3]. Hence, the MPA also plays a crucial function in enhancing and bestowing advantages upon the socio-economic populace while simultaneously safeguarding cultural values [4].

Marine Parks have a significant role in protecting and connecting ecosystems regionally and enhancing resilience to climate change. However, these advantages may only be acquired if the Marine Park is situated in an appropriate and well-protected location and successfully

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administered [5, 6]. While Marine Parks are widely recognized as a successful approach to biodiversity protection and sustainability, they often include a complex interplay between the sustainability goals and the local people's socio-economic interests. If a marine park excessively prioritizes biodiversity concerns, it will neglect the requirements of the population that heavily relies on marine resources as their major source of livelihood [7, 8]. Conversely, excessive measures used to safeguard the local population's economic interests can also hinder the achievement of the biodiversity sustainability objective. This can lead to the depletion of marine resources and the proliferation of invasive activities in Marine Parks [9]. There is also criticism that the formation of Marine Park has adverse effects on the socio-economic, cultural, and political aspects of the local populace [10]. In their study, Mizrahi et al. (2018)[11] conducted a comprehensive analysis of multiple research on Marine Parks. They identified population poverty as a significant socio-economic concern. Therefore, it is imperative to tackle this difficulty in the management of a Marine Park in order to effectively accomplish the objectives of sustainability and provide advantages to the local population.

In recent decades, there has been an increasing focus on the investigation of Marine Parks, particularly in order to address controversies around the efficacy and consequences of establishing such protected areas. Nevertheless, further data and empirical investigations are required to fully comprehend the impact associated with the Marine Park [12]. Commonly emphasized research areas include the effects of Marine Parks on marine conservation, socio-economic factors, tourism, and management issues. Nevertheless, the issue of the level of local community approval towards the Marine Park following its establishment has not yet been emphasized. This matter is crucial to guarantee the ongoing backing of the establishment of Marine Parks, especially from local people residing there. Furthermore, the investigation of the efficacy of Marine Parks in guaranteeing the long-term viability of fishery resources deserves significant scrutiny. This is due to the fact that the establishment of Marine Parks is intricately linked to the matter of ensuring a reliable food supply for the nation and the global community as a whole. This study seeks to investigate the concerns about Marine Parks in Malaysia that have been previously mentioned.

1.1 Marine Park Area

Marine Parks, also known as Marine Protected Areas, are designated coastal and marine regions that are subject to specific rules and regulations. The primary purpose of these measures is to effectively manage, conserve, and safeguard the resources and biodiversity of marine life. According to O'Leary et al. (2019) [3], there are around 13,000 marine protected areas worldwide as of 2018. The subject of discussion is the marine park located in Malaysia.

The Division of Marine Parks and Resource Management, which operates under the Department of Fishing, oversees the regulation of the sea. In this country, Marine Park refers to a designated region of marine waters that extends up to two nautical miles from the lowest low tide level. However, there are exceptions for Pulau Kapas in Terengganu, Pulau Kuraman, Pulau Rusukan Besar, and Pulau Rusukan Kecil in Labuan, which are zoned up to one nautical mile from the lowest low tide mark. The inaugural Marine Protected Area established in Malaysia was Tunku Abdul Rahman Park in 1974, which was located in Sabah.

One of the criteria used to identify Marine Protected Areas (MPAs) is considering anthropogenic hazards, preserving biodiversity, and protecting endangered species. Rantau Abang was designated a Prohibited Fishing Area under the Fisheries Act of 1985 to safeguard turtle populations and nesting grounds, particularly for the endangered Giant Leatherback turtles. Due to numerous regulations and statutes safeguarding this Marine Protected Area, local and international tourists are allowed to relish and admire the exceptional natural heritage that remains pristine and stunning.

The MPA Agenda commenced in 1983. According to the Strategic Plan 2016-2020 of the Malaysian Marine Parks Department, a total of forty-two (42) islands in Malaysia have been officially designated as Marine Parks. The Marine Park, which is under the jurisdiction of the Department of Fisheries, spans an area of 2,486.13 km2, equivalent to 0.51% of the overall coastal regions (excluding Sabah and Sarawak). The National Biodiversity target for Malaysia by 2025 is to have 10% of the overall coastal area designated as Marine Parks, as stated in the NRE Strategic Plan 2016-2020. In addition to the presence of 42 Marine Parks on the Peninsula, Malaysia additionally imposes seven (7) Fishing Prohibited Areas in Peninsular Malaysia. There are three marine parks in Sarawak and eight marine parks in Sabah.

Pulau Tioman was designated as a Marine Park in 1994 according to the Fisheries Act of 1985 (Amended 1991). The Pulau Tioman Marine Park spans approximately 25,115 hectares [13]. The waters surrounding Pulau Tioman have been shown to have a total of 183 coral species, along with 233 species of coral fish, 3 species of seaweed, and 53 species of seagrass [14, 15, 16, 17]. Pulau Tioman is renowned as a prominent tourist destination in Malaysia, and it has seen significant development through numerous projects and tourism initiatives along its coastline. This location has evolved from a little fishing village into a renowned tourist destination.

1.2 Acceptance of the Establishment of Marine Park

The management of Marine Parks greatly relies on the approval of the residents [18]. Effective reception will foster strong collaboration among residents and the management team of various parties to ensure the long-term preservation and viability of the Marine Park ecosystem. Public support is crucial for mobilizing and cultivating conservation initiatives that necessitate a shift in attitude and behaviour [19].

The value-belief-norm theory (VBN) posits that individuals are more inclined to engage in certain behaviors or accept certain ideas based on their personal values, beliefs, and norms [20]. The socio-economic factors, sustainability of fishery resources, and the effectiveness of Marine Park management are all likely to impact the public's acceptance of the designation of Pulau Tioman as a Marine Park island.

Initially, the people faced challenges in accepting the establishment of the Marine Park since specific sections were designated as no-fishing zones. This is of utmost significance, particularly for coastal fishermen and people who rely on marine resources to sustain their daily livelihood. Several initiatives are being implemented to enhance the locals' acceptance, one of which is elucidating the significance of the Marine Park. Additionally, attempts are being made to promote socio-economic development among the community through alternative economic sectors such as tourism, agriculture, and services. Many Marine Parks are evolving into popular tourist attractions due to their allure of natural beauty and exceptional biodiversity. With the growth of the tourism sector, new economic prospects arise for the local population, who have previously relied on marine resources such as fishing.

However, the rapid pace of tourism activities leads to numerous disputes in the Marine Park [21]. When a Marine Park experiences a higher number of tourists than its capacity allows over a specific period, it leads to several negative consequences, including heightened water consumption, increased sewage waste, and accumulation of leftover debris. Nevertheless, most Marine Park management teams choose to disregard the prescribed restrictions for tourist entry, except for restricted zone areas where the Marine Park management team has complete discretion over restricting visitor access [22]. Moreover, the exertion of political influence and the involvement of interest groups frequently contribute to promoting tourism in the Marine Park region, which often poses a significant challenge in effectively preserving the area's natural sustainability [21].

These concerns generate diverse attitudes among the people regarding the establishment of a marine park, which will impact the population's acceptance and response to the management and implementation of marine parks and conservation efforts. This study seeks to gather the perspectives of individuals residing on Pulau Tioman and those engaged in fishing activities on the island regarding the significance of the Marine Park in ensuring the long-term viability of fisheries resources. The study will focus on three objectives: 1) determining the extent of the residents' reliance on marine resources in Pulau Tioman, 2) examining the perspectives of the people regarding the sustainability of fishing resources on Pulau Tioman. 3) Determine the relevant relationships and assess the impact of Marine Park on the level of acceptance among Pulau Tioman locals over its establishment.

2. Methodology

This study uses a quantitative methodology to accomplish the stated research objective. Data collection is conducted by a questionnaire survey, which can be administered either in person or online using a platform such as Google Forms. The survey method is selected due to its ability to provide a thorough overview of an issue or problem, accurate data collecting, utilization of a large sample size, efficient collection of information directly from respondents in a short period of time, and the ability to make general statements about a study population [23].

2.1 Study location, population, and sampling

Pulau Tioman is an island situated in the state of Pahang on the eastern coast of Peninsular Malaysia. It is designated as a Marine Park. The island is located 32 km away from Mersing in Johor and 80 km from Kuala Rompin in Pahang. The island has a land size of approximately 133.6 square kilometres or 13,360 hectares.

Pulau Tioman consists of eight settlements, specifically Kampung Tekek, Kampung Juara, Kampung Genting, Kampung Air Batang, Kampung Salang, Kampung Mukut, Kampung Paya, and Tanjung Gemok. The majority of the island is enveloped by a tropical rainforest characterized by undulating terrain, inland woodlands, and tiny stretches of level land along the shoreline.

The study's population comprises individuals who reside in Pulau Tioman. The population of Pulau Tioman in 2020 is estimated to be around 3,000 individuals. This study employs stratified random sampling, with a total of 460 respondents who completed the survey (Table 1). The following data represents the quantity of survey replies obtained based on the respondents' residence location.

Table 1: Total response.

Village name	Total Response
Kg. Tekek	89
Kg. Juara	80
Kg. Genting	76
Kg. Air Batang	72
Kg. Salang	66
Kg. Mukut	42
Kg. Paya	35
Total	460

2.2 Research instrument

To achieve the study's goals, a questionnaire was created collaboratively by conducting focus group talks with agencies involved in the management of Marine Park, as well as key stakeholders with a strong connection to the issue of sustainable fishing resources. The questionnaire is segmented into two primary sections. The initial section of the study is to gather data on the socio-demographic characteristics of the respondents, including their gender, ethnicity, age, level of education, location of residence, occupation type, and income level. The second phase of the study seeks to determine the extent to which the residents of Pulau Tioman rely on marine resources, their perception of the significance of Marine Parks, and the sustainability of fisheries resources. Additionally, it aims to gather information regarding the residents' willingness to support the establishment of the Marine Park.

The study examines the population's reliance on marine resources specifically to obtain seafood. Regarding surveys on the sustainability of fishery resources, residents are requested to provide their opinions on the correlation between the establishment of tukun and unjam and the rise in revenue from fish catches. Additionally, they are asked to assess whether the presence of coral reef regions serves as the primary source of fish supply in Pulau Tioman waters. To determine the correlation between the significance and efficacy of Marine Parks and the acceptance of the population, participants were requested to express their level of agreement on a scale of 1 to 5 in response to the statements shown in Table 2.

Table 2: Items to measure the level of importance and effectiveness of the Marine Park and the level of acceptance of the people towards the Marine Park.

Criteria	Item
Level of Importance of Marine Park Functions (Scale 1-5)	▪ Conserving the coral reef ecosystem in Pulau Tioman Marine Park ▪ Monitor aquatic ecosystems and fisheries resources. ▪ Carrying out rehabilitation activities (release of seeds into public waters, coral restoration, etc.) ▪ Carry out tukun and unjam management for the conservation of fishery resources. ▪ Deliver fishery resource management advisory services. ▪ Increase public awareness through collaboration with NGOs, resort operators, corporate bodies & GLCs, etc. ▪ Enforcing the Fisheries Act 1985 (arrest, investigation, and prosecution)
Effectiveness on the Sustainability of Fisheries Resources (Scale 1-5)	▪ Marine Parks protect reefs and corals ▪ Marine Park increases the number of fish. ▪ Fishermen's source of income increased with the establishment of Pulau Tioman Marine Park.
Acceptance of the Establishment of Marine Park (Scale 1-5)	▪ I support the establishment of Marine Park. ▪ There should be more gazetted Marine Parks in Pahang waters. ▪ There are economic benefits for Tioman Island from the establishment of the Marine Park. ▪ I support the addition of a new Marine Park in Pahang waters if the marine resources on Tioman Island increase and improve.

This field research activity is conducted as a study because it enables researchers to gather substantial information from a sizable group of participants within a short period. This study employed two online and face-to-face methodologies to encompass a broad geographical area of seven Pulau Tioman communities. A pilot study was undertaken to validate and assess the instrument's dependability for data collection in this investigation.

The feedback obtained from the pilot study was utilized to enhance and consolidate additional components present in the constructed instrument. Data collection operations were conducted in August 2021, adhering to the Standard Operating Procedures (SOP) for face-to-face data collection during the COVID-19 pandemic.

The acquired data was subsequently analyzed using SPSS Windows Version 27, which stands for Statistical Package for Social Science Version 27. Before doing the analysis, data cleaning is necessary to prevent any errors during data entry into the SPSS program. This is crucial since any mistakes that arise can potentially impact the accuracy of the analysis results [24]. Subsequently, data analysis is conducted employing descriptive statistics to elucidate the profile and characteristics of the respondents and the variables under investigation in this study. Inferential statistics are utilized to analyze the correlation between the significance and efficacy of building a Marine Park and the level of acceptability among the residents of Pulau Tioman.

2.3 Validity and Reliability Tests

The validity and reliability of the research instrument employed in the study have been established by administering the following tests. Initially, a content validity test is performed using factor analysis and assessing the Kaiser Meyer Olkin (KMO) value to verify that the research instrument adequately encompasses the evaluation criteria and aligns with the study's objectives. The test findings yielded KMO values ranging from 0.629 to 0.930 for all assessed criteria, showing that the instrument utilized is valid at an acceptable level. Secondly, a reliability test is conducted to ascertain the consistency with which the measures employed measure the same phenomenon.

The instrument's reliability for this study was assessed using Cronbach's Alpha, which yielded scores ranging from 0.727 to 0.955. Hence, it may be inferred that the research instrument is valid and dependable.

3. FINDINGS AND DISCUSSION

The survey collected information and data from 460 respondents with diverse backgrounds. The study respondents were 64.1% males and 35.9% females, who were divided into three age groups: 25-34 years (47.2%), 35-44 years (37%), and 45 years and above (15%). The study revealed that the predominant ethnic group among the respondents is Malay. Tioman Island is inhabited by several ethnic groups, including Chinese, Indians, indigenous people, and foreigners.

The study found that over 70% of the respondents had completed secondary or higher school. Among them, 33% belonged to the highly educated group, which means they had at least a diploma. The survey revealed that a significant proportion of participants, specifically 56.74%, were engaged in the tourism industry. However, this figure experienced a sharp decline to 15.43% during the outbreak of the COVID-19 epidemic. While some individuals are employed in the public sector, retail, and agriculture. Out of all the respondents, 37 individuals, which accounts for 8% of the total, work as fishers.

3.1 The Dependency of the Inhabitants of Pulau Tioman on Fishing Resources

Out of the total respondents, only 8% are employed as fishermen, which amounts to 314 individuals. However, a significant majority of the respondents, specifically 68.26%, acknowledge their participation in fishing activities and seafood gathering. The primary objective of fishing and harvesting seafood is to obtain sustenance. Merely 38.21% of participants engage in fishing and catch fisheries to generate income. This demonstrates Pulau Tioman's inhabitants' reliance on the comparatively abundant fishery resources. Figure 1 displays the distribution of respondents engaged in fishing activities based on their place of residence. Kampung Tekek has the most significant number of inhabitants, followed by Kampung Juara and Kampung Salang, which have recorded more than 50 individuals. While the population of other communities was fewer than 50 individuals.

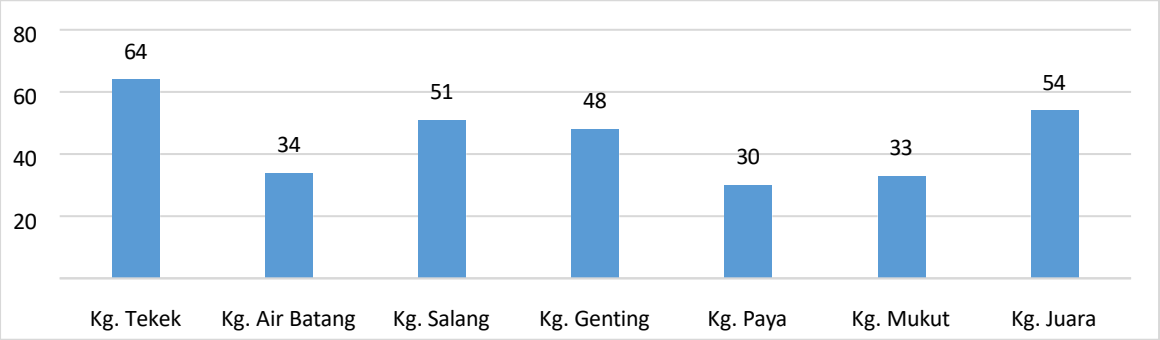

Figure 1: Distribution of respondents who carry out fishing activities by living location.

Next, the main areas that are the focus of fishing activities are shown in Figure 2. These designated regions are situated beyond the boundaries of the Marine Park, specifically at least two nautical miles away from the lowest low tide mark. Area G is where fishing activities are predominantly concentrated, with Areas A, B, F, D, and E following suit.

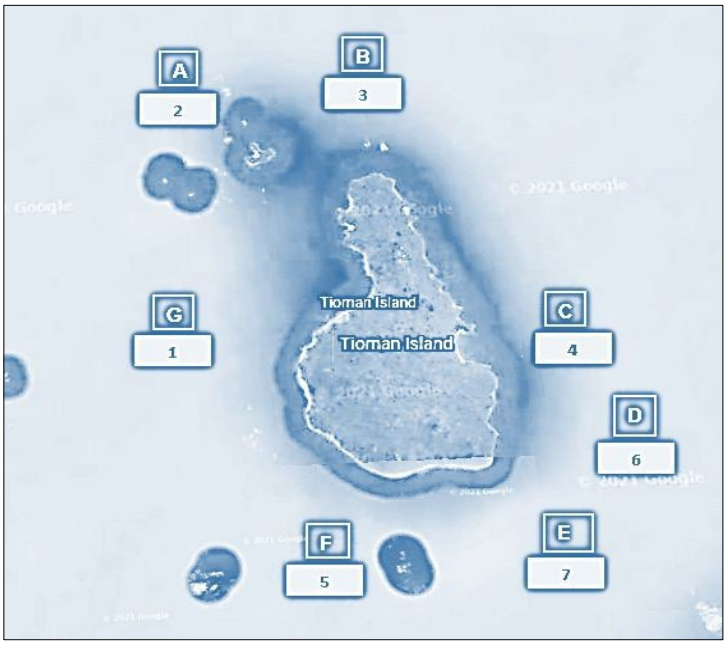

Figure 2: Fishing and seafood activity areas.

3.2 Sustainability of Fisheries Resources

In order to obtain more precise data regarding the sustainability of fishery resources, a sample size of 37 fishermen was chosen as respondents. The results are illustrated in Figure 3. The data indicates that 89.2% of respondents believe that the consistent provision of fish resources in Pulau Tioman and surrounding areas is due to the abundant coral reefs in the Pulau Tioman Marine Park area. Approximately eighty-three percent of respondents agreed that utilizing tukun and unjam in the vicinity of Pulau Tioman aided in expanding their capture. Nevertheless, some participants (43.2%) agreed that the fish resources in the Pulau Tioman Marine Park's peripheral waters remain abundant. In contrast, the prevailing viewpoint among the majority is that the fish resources have diminished compared to several years ago.

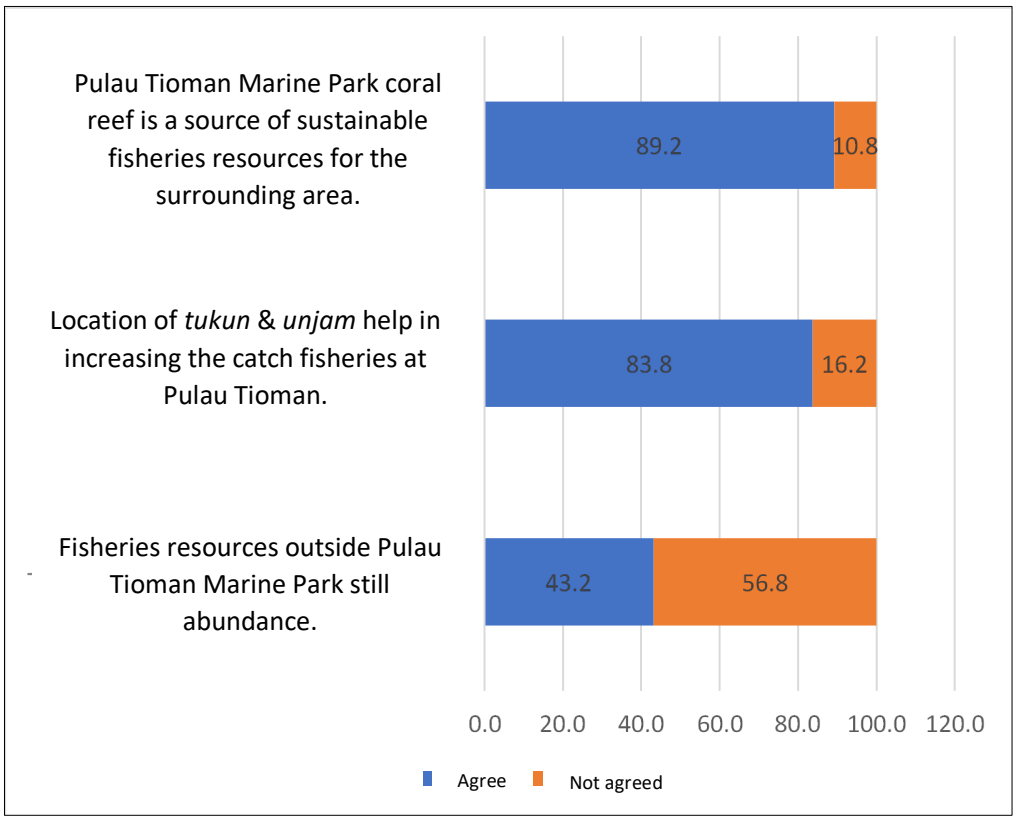

Figure 3: Fisherman's view on the sustainability of fishery resources.

In connection with this discovery, noticeable variations exist in perspectives regarding resource extraction. However, this demonstrates the need for formal evidence containing more information regarding the current state of fisheries resources beyond the waters of Pulau Tioman Marine Park, as opposed to relying solely on a perception survey. Determine whether the respondent's perception of this statement is affected by variables such as the capture location and fishing technique. Mascia et al. (2010) [25] discovered in a prior investigation that while fishery resources in Marine Park are generally stable or growing, the quantity of fish caught differs depending on the type of capture equipment, with traditional methods resulting in a 15% reduction in fish capture compared to other capture methods. In addition, managing marine park resources is closely related to enforcing park regulations in the sea to prevent the occurrence of prohibited activities [26]. So long as this is ensured, the marine park area's fishery resources should be conserved and expanded.

3.3 The Effect of the Importance and Effectiveness of Marine Parks on Resident Acceptance

Descriptive analysis was performed to acquire the means of values ranging from one to five. The mean scores for the three variables, ranging from three to four, are presented in Table 3. This indicates that the populace agreed with the statements associated with all three variables. The mean score for the importance of Marine Park was the highest, with population acceptance and effectiveness of Marine Park following suit. A relatively low mean score for the effectiveness of Marine Park indicates that there is scope for enhancement that warrants consideration to augment the Marine Park's function. According to a 2018 survey by Pendleton et al. [12], concerns regarding enforcement and compliance frequently arise concerning the effectiveness of the Marine Park administration. The significance of integrated management is underscored by the close collaboration among the holder of the interest, the administration of the Marine Park, and the local community. In their study, Kaplan et al. (2015) [27] demonstrated that implementing an incentive-based approach effectively promoted compliance and enforcement within the marine parks of the Caribbean Islands. Therefore, a multitude of strategies can be contemplated to enhance certain facets of the efficiency of Pulau Tioman Marine Park.

Table 3: Descriptive analysis.

Variables	Mean score
The importance of Marine Park	3.8342
The effectiveness of Marine Park	3.3478
Community acceptance	3.4745

The results of the correlation test are presented in Table 4. According to the test results, significant relationships exist among the three variables. Following the principles proposed by LaMorti (2021) [28], a correlation coefficient ranging from 0.2 to 0.4 signifies a weak relationship; from 0.4 to 0.6, a moderate relationship; and from 0.6 to 1.0, an extremely powerful relationship. Consequently, it can be deduced that a robust correlation exists between the effectiveness of Marine Park and the level of approval exhibited by the population.

While the correlation between the acceptance population and the importance of marine parks is limited, it is statistically significant. Overall, this discovery is consistent with the contention put forth by Gall and Rodwell (2016)[18], which suggests that acceptance of the community towards Marine Park is intricately linked to the ongoing communication and participation of interested parties. By doing so, transparent information can be communicated concerning the community's potential benefits and ramifications associated with establishing Marine Park, thereby enhancing their confidence and fostering continued support.

Table 4: Correlation test.

	The importance of Marine Park	The effectiveness of Marine Park	Community acceptance
The importance of Marine Park	1	0.327**	0.335**
The effectiveness of Marine Park	0.327**	1	0.722**
Community acceptance	0.335**	0.722**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Following this, the level of relationship between two independent variables, namely the Importance and Effectiveness of Marine Parks, and the dependent variable, Resident Acceptance, was determined using a multiple regression analysis. The results of the regression tests are summarized in Table 5.

Table 5: Multiple regression analysis.

Variables	Unstd. Coefficients	Std. Coefficients	t-value	Sig.	VIF
(Constant)	1.053	0.109	9.656	0.000	
The importance of Marine Park	0.058	0.111	3.269	0.001	1.119
The effectiveness of Marine Park	0.657	0.686	20.254	0.000	1.119

R = 0.729; R^2 = 0.532; Adjusted R^2 = 0.530; F=259.809; Sig.=0.00; Durbin-Watson = 2.07

Predictors: (*Constant*), The effectiveness of Marine Park, The importance of Marine Park

Dependent Variable: Community Acceptance.

The findings from the multiple regression analysis indicate a strong positive correlation (R-value = 0.729) between the dependent and independent variables. The R^2 value of 0.532 indicates that the independent variable explains 53.2 percent of the variation in the dependent variable. The adjusted R^2 value of 0.530 indicates that the variation of sample results from the population in multiple regression is not significantly different, indicating that the results are generalizable. The coefficients of both variables yielded significant values, but they fell short of the acceptable level of significance, which is set at 0.05 with a 95% confidence interval [29]. This indicates that the effectiveness and importance of marine parks both have a substantial influence on resident acceptance.

4. CONCLUSION

According to the results of a survey of Pulau Tioman Marine Park's residents, reliance on fishery resources is substantial. Most of them obtain their food from catch fisheries. A minority of individuals profit from fishing.

It can be concluded from the fishermen's responses that they recognize the significance of establishing marine park areas to safeguard coral reefs, which serve as fish reproductive grounds and habitats. Furthermore, they acknowledge that the government's initiatives to develop tukun and unjam zones beyond the marine park have effectively augmented their capture. However, a concerning development is that most fishermen believe that fish resources are diminishing compared to the past. This may result from external fishermen's incursion, climate change-induced devastation and, threats to coral reefs, and additional factors that necessitate further investigation.

Based on the resident's understanding of the significance of the Pulau Tioman Marine Park's establishment, it can be inferred that the respondents acknowledge the importance of its existence to preserve and maintain the ecosystem surrounding its waters through effective management, public education, and enforcement. In conclusion, residents' acceptance of the Marine Park establishment is significantly impacted by their recognition of its significance and its effectiveness in preserving the sustainability of fishing resources in the waters surrounding Pulau Tioman.

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