PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 23 ISSUE 1 (2025), Page 261 – 272

ASSESSMENT OF THE IMPACTS OF COASTAL DEVELOPMENT AND CLIMATE CHANGE ON FISHING COMMUNITIES IN KUALA TERENGGANU, MALAYSIA

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Abstract

Fishing communities face numerous challenges affected by rapid coastal development and climate change. These issues have threatened the sustainability and livelihoods of their community. The objective of this study was to investigate the impacts of coastal development and climate change on fishing communities in Kuala Terengganu. This research was carried out with 125 members of fishing communities in Kuala Terengganu's coastal areas. The data were collected through questionnaires and analysed using XLSTAT software. The findings from this study showed that the type of climate change did not affect the impacts of climate change towards the fishing community. Moreover, the level of social functionality of the fishing community in Kuala Terengganu remains unaffected by the ongoing development. In conclusion, fishing communities in Kuala Terengganu have successfully managed to preserve their social functionality and resilience despite the challenges posed by coastal development and climate change. Thus, to ensure the long-term resilience and prosperity of these communities in the midst of continuous environmental changes, it is essential to implement sustainable planning and adaptation measures.

Keywords: Climate Change, Coastal, Community Development, Fishing

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INTRODUCTION

Climate change and coastal developments have a major impact on the socioeconomic status of coastal fishermen in various regions around the world (Hashim et al., 2019). Whilst coastal development can lead to habitat damage, pollution, and restricted access to traditional fishing grounds, climate change contributes to rising sea levels, shifts in fish populations, and an increase in extreme weather events (Domit et al., 2022). The majority of residents living in coastal areas are employed in maritime or sea product-related industries (Fadzli, et al., 2023). Coastal fishermen are highly dependent on natural resources, especially the sea, as their primary source of livelihood.

Peninsular Malaysia consists of coastal areas, with the coastline extending approximately 4800 kilometres (Azali, 2022). Terengganu, a state located in the most coastal areas of Malaysia has a high population of fishermen (Bagheri et al.,2021). Nowadays, development around coastal areas has grown rapidly. In Kuala Terengganu, coastal development includes the development of infrastructures for tourism, urban growth, and the establishment of commercial entities (Ismail et al., 2023).

Many studies have highlighted that the increasing rate of coastal development is potentially influencing the community's social, economic, environmental, and infrastructure accessibility conditions (Zakaria et. al., 2022). Moreover, climate change also affects the coastal ecosystem, leading to changes in the habitat of various fish species and other marine organisms (Baharudin, Ali & Idros, 2023). Comprehensive policies are required to prevent negative consequences while promoting sustainable development in coastal regions to mitigate the impacts.

The objective of this paper was to examine the impacts of coastal development and climate change on fishing communities. This research aimed to discover the impacts of climate change and coastal developments in relation to the Sustainable Development Goals (SDGs), specifically Goal 13 on climate action and Goal 11 on sustainable cities and communities. The findings provide insightful information on how these global issues impact local communities, as well as offer suggestions on promoting sustainable development in coastal areas.

LITERATURE REVIEW

Fishing Communities in Kuala Terengganu

Fishermen are individuals or groups whose profession involves catching fish, shellfish, squid, shrimp, and various other types of aquatic animals in bodies of water such as seas, rivers and lakes. Coastal fishermen are traditional fishers who use small boats to fish within a range of up to five nautical miles from shore (Sembok et al., 2020). According to research by Abdullah et al. (2022), urban

residents living in coastal areas have also started engaging in fishing, alongside the villagers who have traditionally dominated this activity in Terengganu.

In 2019, Malaysia's fishing community contributed to a 12% increment in the nation's agricultural industry towards the sustainability of Malaysia's Gross National Product via their fisheries-based products (Department of National Statistics, 2020). According to the Malaysian Department of Fisheries, in 2022, there were 8526 registered fishermen in Terengganu state, with only 878 in the Kuala Terengganu district (The Department of Fisheries Malaysia, 2023). The Department of Fisheries Malaysia, under the Fisheries Development Authority of Malaysia (LKIM), is responsible for assisting and monitoring the welfare and affairs of the fishermen.

Nevertheless, despite changing demographics and environmental challenges, Kuala Terengganu's fishing communities continue to play a vital role in Malaysia's economy and cultural landscape. Sustainable management and continuous assistance are necessary to maintain the prosperity and resilience of fishermen in the face of evolving environmental and economic conditions.

Climate Change

Climate change refers to long-term changes in the Earth's average weather, including air temperature, rainfall patterns, wind and several other climate factors. Weather variations could negatively affect our daily activities and the functioning of the Earth's natural system. The Intergovernmental Panel on Climate Change (IPCC) estimates, based on the observed scenarios, that there is more than a 50% chance that the global temperature will rise by 1.5 degrees Celsius or more between 2021 and 2040 (Boehm & Schumer, 2023). As for the high-emission trajectory, the world may surpass the threshold between 2018 and 2037, or perhaps sooner (Ismail et al., 2024).

Fishing communities were among the groups that would be affected by climate change as they highly depend on marine resources. As mentioned by Islam et al. (2020), fishermen rely on the surrounding conditions such as sea temperature and rainfall patterns to determine the availability of fish resources. As a result, the fishing community's catch-related issues have worsened due to unpredictable climate change, which has severely damaged and depleted marine resources. Fishermen also face the issue of having to sell their catches to the general public at extremely low prices, often more than 50% below the average price due to the impacts of climate change (Putri, Rosyadi, & Rahmawati, 2022). This highlights the urgent need for international cooperation and adaptive methods to mitigate these effects and protect marine ecosystems, safeguarding the fishing communities' livelihoods and resilience.

Coastal Development and Social Functionality

Coastal development refers to the construction of infrastructure, the expansion of urban areas, and the establishment of commercial entities along coastlines to accommodate growing population demands and foster economic growth (Tien et al., 2020). The development of coastal areas is closely linked to fishing communities and has a range of effects, both beneficial and adverse. Some of the benefits include significant economic activity in coastal regions, which serve as hubs for tourism, recreation, farming, fishing, and residential real estate which often features some of the highest property values in the nation (Hamid et al., 2023). On the other hand, the adverse impacts include the degradation of the nearby marine and coastal environments, as well as the socio-cultural aspects, infrastructure accessibility, and the fishing sector (Zakaria et al., 2022).

The term "social functionality" refers to a social group's or community's ability to interact effectively and maintain social cohesion (Yadav, 2024). It involves several aspects such as interpersonal relationships, teamwork, and the ability to adapt to the demands and expectations within the community (Rosni, 2017). Understanding social functionality is essential for evaluating the roles and purposes that behaviours, actions and institutions serve, besides acknowledging their importance in establishing and maintaining social order and unity (Wandi et al., 2021). Coastal development can have a substantial impact on social functionality by altering the dynamics of the community, access to resources, and cultural practices. Changes in infrastructure, economic activity, and population density can affect the local population's traditional lifestyles, social cohesiveness, and community resilience (Dehghani et al., 2022). To address these challenges, proper management of coastal development is essential to strike a balance between the well-being of the local communities, environmental preservation, and economic progress (Huy, 2022).

RESEARCH METHODOLOGY

This study was conducted specifically in the coastal area of Kuala Terengganu, Terengganu. Data were collected using convenience sampling and quantitative methods, incorporating direct interviews and survey questionnaires. The questionnaires were distributed randomly among 125 individuals from the fishing communities residing in the Kuala Terengganu coastal areas. Figure 1 illustrates the location of Kuala Terengganu, the designated study area.

The questionnaires consist of three sections. The demographic section included items on the respondents' gender, race, religion, age, marital status, education level, working experience, income, and number of dependents. All questions were presented in Malay. Responses were measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

For statistical analysis, the collected data were entered into an Excel file and analysed using XLSTAT software. Descriptive analysis was utilised to analyse and present the respondents' demographic data. The arithmetic mean was used to determine the average response level based on the five-point Likert scale was determined. Regression analysis was also performed to evaluate the degree of association and relationships in accordance with the study's objectives.

Figure 1 Location of the study area, Kuala Terengganu (mark with yellow colour).
Source: Map of Terengganu

ANALYSIS AND DISCUSSION

Table 1 shows the demographic background of 125 respondents from Kuala Terengganu. The ages of the respondents ranged from 15 to 70 years old. Since the respondents varied widely in terms of their backgrounds and characteristics,

the random sampling conducted was representative of the population of fishing communities in Kuala Terengganu.

Table 1: Socio-demographic profile of respondents

Socio-demographic		**Percentage (%)**
Gender	Woman	**0**
	Man	**100**
Race	Malay	**100**
	Chinese	0
	Indian	0
Religion	Islam	**100**
	Others	0
Age	Below 18	2.4
	18 - 25	16.7
	26 – 35	23.0
	36 – 45	18.3
	46 – 55	**27.0**
	55 and above	12.6
Marital Status	Single	30.2
	Married	**67.5**
	Widow	2.3
Education Level	No formal education	4.0
	Primary school	19.8
	Secondary school	**70.6**
	Diploma/STPM	5.6
	Degree	0
Working Experience	<10 years	**42.9**
	10 – 19 years	34.9
	20 – 29 years	15.2
	> 30 years	7.1
Income	< RM500	4.8
	RM500 – RM1000	**69.8**
	RM1000 – RM2000	22.2
	> RM2000	3.2
Number of Dependents	None	37.3
	1 – 3 people	**37.3**
	4 – 6 people	19.0
	> 7 people	6.4

From the table above, the predominant gender, race and religion among the fishing communities in Kuala Terengganu are male, Malay and Islam, respectively. Most of the respondents were aged between 46 to 55 years old (27.0%), followed by respondents aged between 26 to 35 years old (23.0%) and the least respondents were those below 18 years old (2.4%). Around 67.5% of the respondents were married, 30.2% were single and 2.3% were widows.

In terms of education level, 70.6% of the respondents studied until secondary school, 19.8% up to primary school, 5.6% were diploma/STPM holders and the remaining 4.0% had no formal education. Moreover, the majority of the respondents have working experience below 10 years (42.9%), 34.9% with 10 - 19 years followed by 15.2% with 20 - 29 years and the minority of the respondents have working experience more than 30 years (7.1%). Among the 125 respondents, 69.8% of respondents' incomes were RM 500 – RM 1000, 22.2% with incomes of RM 1000 – RM 2000, 4.8% had incomes below RM 500 and 3.2% had incomes of RM 2000 and above. The number of dependents for none and 1-3 people were at 37.3%, meanwhile for 4 - 6 people were at 19.0% and more than 7 people were 6.4%.

The Relationship of Types of Climate Change and Its Effects on the Fishing Community in Kuala Terengganu.

Table 2 describes the regression analysis statistics for the types of climate change and their effects on the fishing communities in Kuala Terengganu. The independent variables for this research were the types of climate change and the dependent variables were the effects on fishing communities in Kuala Terengganu. The table below displays the mean value of 2.768 for independent variables and 2.751 for dependent variables.

Table 2: Regression Analysis Statistics

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Independent Variable	125	0	125	1.000	4.000	2.768	0.496
Dependent Variable	125	0	125	2.133	3.400	2.751	0.283

In addition, the regression of variables is shown in Table 3. The dependency between the independent and dependent variables is influenced by the R^2 value. In the table below, the R^2 value is 0.023, representing 2%. This indicates that the effects of climate change in Kuala Terengganu were only influenced by this 2% types of climate change. Hence, it could be considered that types of climate change (independent variables) did not influence the impacts of climate change (dependent variable) on the fishing community in Kuala Terengganu.

Table 3: Regression of Variable

Observations	125
Sum of weights	125
DF	123
R^2	**0.023**
Adjusted R^2	0.007
MSE	0.203
RMSE	0.450
MAPE	11.837
DW	1.655

Moreover, Table 4 demonstrates the analysis of variance. In this study, the difference between one variable is determined using an analysis of variance. The table below shows the P-value was 0.241, hence, there is no relation between the types of climate change (independent variables) and impacts of climate change (dependent variables) on Kuala Terengganu's fishing community.

Table 4: Analysis of Variance

Source	DF	Sum of squares	Mean squares	F	Pr > F	p-values signification codes
Model	2.000	0.584	0.292	1.438	**0.241**	°
Error	123.000	24.958	0.203			
Corrected Total	125.000	25.541				

Computed against model Y=Mean(Y)

Signification codes: 0 < *** < 0.001 < ** < 0.01 < * < 0.05 < . < 0.1 < ° < 1

The Relationship Between the Levels of Social Functionality of the Fishing Community Against Coastal Development in Kuala Terengganu.

Table 5 determines the regression analysis statistics for levels of social functionality of the fishing communities against coastal development in Kuala Terengganu. The independent variable for this study is the level of social functionality of the fishing communities, while the dependent variable is the impact of coastal development. From the table below, the mean for both variables were 2.534 and 2.660 with standard deviations of 0.342 and 0.341, respectively

Table 5: Regression Analysis Statistics

Variable	Observations	Obs. with missing data	Obs. without missing data	Minimum	Maximum	Mean	Std. deviation
Independent Variables	125	0	125	1.867	3.600	2.534	0.342
Dependent Variables	125	0	125	1.733	3.667	2.660	0.314

Moreover, Table 6 presents the value of R^2 that was calculated using XLSTAT software. The R^2 value indicates to which extent the independent variable influences the dependent variable. The R^2 value in the table below was 0.238, equivalent to 24% of the level of social functionality affecting the impact of coastal development around Kuala Terengganu. Since the value of R^2 was less than 50%, thus, it reflects that coastal development did not have significant impacts on the level of social functionality of fishing communities around Kuala Terengganu.

Table 6: Regression of Variable

Observations	125
Sum of weights	125
DF	123
R^2	**0.238**
Adjusted R^2	0.231
MSE	0.090
RMSE	0.300
MAPE	8.951
DW	1.654

Besides, an analysis of variances was employed to determine the differences between each research variable. Table 7 displays a P-value of <0.0001, indicating that the results are statistically significant.

Table :7 Analysis of Variance

Source	DF	Sum of squares	Mean squares	F	Pr > F	p-values signification codes
Model	1.000	3.456	3.456	38.339	**<0.0001**	***
Error	123.000	11.086	0.090			
Corrected Total	124.000	14.542				

Computed against model Y=Mean(Y)
Signification codes: 0 < *** < 0.001 < ** < 0.01 < * < 0.05 < . < 0.1 < ° < 1

CONCLUSION

In conclusion, the results of the analysis describe that the observed effects on the fishing communities in Kuala Terengganu were not significantly impacted by climate change. Moreover, it was found that the fishing communities in Kuala Terengganu have an excellent level of social functionality. This research encourages ecologically friendly fishing and farming methods, developing climate-resilient infrastructure, and promoting sustainable spatial planning. Education and raising public awareness are also crucial for enhancing flexibility and lessening the effects of climate change. Sustainable coastal management must prioritise community well-being and environmental stewardship to ensure the resilience of fishing communities. By promoting sustainable practices and adaptive resilience, the livelihoods and cultural heritage of Kuala Terengganu's fishing communities can be preserved.

ACKNOWLEDMENT

We would like to extend our heartfelt gratitude to the Ministry of Higher Education (MOHE) of Malaysia for the funding of this research under the Fundamental Research Grant Scheme (FRGS) (FRGS/1/2023/WAB08/UNISZA/02/1).

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Received: 30th June 2024. Accepted: 25th October 2024

