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Sustainable Livelihood Strategies of Fishing Communities in Marine Protected Area (MPA), Sabah, Malaysia

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Abstract

Marine Protected Areas (MPA) are an important management tool adopted by most the nations for conservation of marine and fisheries to save marine ecosystems that are in danger of being overexploited. Malaysia is no exception as coastal regions of Malaysia is prospective for fisheries and many others development activities. The MPAs have an immense impact on people's livelihood. This study aims to understand the livelihoods of the fishing community in MPAs, Marudu Bay, Sabah, Malaysia. It is guided by the Sustainable Livelihoods Framework (SLF) to analyze the indicators of sustainable livelihood capitals and strategies of the MPAs fishing communities. This study uses a qualitative approach. In-depth interviews with five informants were chosen for the data collection using the purposive sampling technique. According to the findings, the informant's human capital, such as education, health, leadership, skills, and training, has not yet reached a level that could offer a reasonable standard of living and livelihood for the research site's population. Residents of the study sites do not have many options for increasing their household income level. In many locations, fishing is a less appealing occupation. The study provided recommendations and strategies on how to further develop and sustain the livelihood of the fisheries community in MPAs, Sabah.

Keywords: sustainable livelihood strategies, marine protected area, sustainable livelihood framework, fishing community, Malaysia

1. Introduction

Environmental changes such as climate changes, loss of biodiversity, rapid deforestation, and increased pollution cause significant changes to ocean ecosystems and increase the vulnerability of human communities that depend upon the ocean (Fletcher, 2009). Reviving the normal environmental atmosphere and save the planet, international organizations, policymakers, and scientists are urged to preserve and protect the Marine Protected Areas (MPAs) (Moran, 2010). MPAs are a type of marine protected area that is widely utilised to safeguard marine biodiversity in places where human exploitation of marine resources is a danger. It was created to safeguard marine species and habitats, restore fisheries stocks, conserve marine biodiversity, manage tourism activities, and reduce conflict among users of the different resources available (Nursey-Bray & Rist, 2009; Rodriguez-Martinez, 2008; Alder et al., 2002; Alder, Sloan, & Uktolseya, 1994).

At the same time, the number of MPAs has steadily expanded around the world over time. According to a recently released estimate, MPAs cover 1.17 percent of the world's ocean. (Toropova et al., 2010). MPAs play a vital role in sustainable development through the protection and maintenance of biodiversity and of natural and associated cultural resources (Scherl et al., 2004). The area of protection has increased by 150% since 2003. This estimate represents 5880 MPAs on this planet covering 4.2 million km^2 of the ocean surface (Hoyt, 2012 in Nair, 2016). There are over 50 gazetted MPAs in Malaysia, the first of which was established in 1974 in Sabah, a state in East Malaysia. Sabah has a 1440 km long coastline with views of the South China Sea on the west and the Celebes Sea and the Sulu Sea on the east, all of which are bordered by the Philippines (Nair, 2016).

MPAs are a popular conservation strategy, but their impacts on human welfare are poorly understood (Mascia, Claus, and Naidoo, 2010). Most MPAs place a strong focus on environmental protection, with community interaction viewed as a secondary priority in park management (Nair & Ramachandran, 2016). Communities are frequently compelled or compensated to leave the MPA. There is also very little research on how the establishment of MPAs affects the livelihood of communities living within the park, or if communities were involved in the planning and implementation stages of MPAs (Voyer, Gladstone, & Goodall, 2012).

High human reliance on marine resources in developing countries is a challenge for implementing MPAs, which specifically seek to limit or restrict fishing in selected areas (Teh, Teh & Jumin, 2013). Indeed, theories on the ecological effects of marine protected areas are based on the condition that no fishing takes place within MPA borders (Ward et al., 2001). Therefore, it can be summarized that while plenty of thought has been given to the potential costs and benefits of MPAs, understanding of their actual impact on peoples' lives is still very limited. Evidence shows that these rural communities are often the last to be provided with development opportunities or social services and be effectively involved in decision-making processes that affect natural resources (Franks 2003; McNeely 2004). Beyond their importance for biodiversity conservation, the effects (both positive and negative) of protected areas on local people got little attention (Kisi, 2013). The present study aims to understand the livelihoods of the fishing community in Marine Protected Areas in Marudu Bay, Sabah.

2. Definition of MPA

The formal definition for MPA was developed at the 4th World Wilderness Congress, and adopted by International Union for the Conservation of Nature (IUCN) at its 17th General Assembly in 1988 as ‘‘any area of intertidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Humphreys and Clark, 2019: 5; Nair, 2016; Gubbay, 1995). IUCN defines Marine Protected Area is “A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (Dudley, 2008: 8).

3. A Brief Overview of the Global Movements of Marine Protected Area (MPA)

The concept of MPAs is not new. Although the loss of biodiversity and pollution of the marine environment has long been recognised, several attempts have been made in this century by development practitioners, international agencies, policymakers, and public and private organisations to stop the loss of the marine environment and conserve biodiversity and the ocean. It was acknowledged that the first World Congress on National Parks was held in 1962, by The International Union for the Conservation of Nature (IUCN), in Seattle, Washington (Humphreys & Clark, 2019). The conference is mainly geared towards improving international understanding of national parks and encouraging the national park movement on a worldwide scale. Followed by 1976 Conference on Scientific Research in the National Parks was held on November 9-12, 1976, in New Orleans, Louisiana. A key event in

the modern global impetus for marine protected areas (MPAs) was the third United Nations Conference on the Law of the Sea (UNCLOS) which ran from 1976 to 1982 (Humphreys and Clark, 2019). Some other, in June 1992, the United Nations Conference on Environment and Development (UNCED) which called as the "Earth Summit" also called Agenda 21 (Agenda for the 21 Century) where a total of 118 heads of government met in Rio de Janeiro (Roberts, 2006; Morse & McNamara, 2013). This was a highly successful step taken by the world leaders on the agreement as a global marine protected area target of 10% was established. In addition, since the 2010 target for restoration under the convention, states agreed to target 11 (Aichi Biodiversity Targets), an established target for restoration of protected areas, which also called the Aichi target 11 on protected areas (Telesetsky et al., 2016: 229).

4. The MPA in Sustainable Development Goals (SDGs)

Protecting the ocean, nature and habitats are the centers of the many well-known organization's goals as there are global targets in place for the conservation and sustainable use of the ocean, most notably within the Aichi Biodiversity Targets and Sustainable Development Goals (SDGs). For instance, in September 2015, all the member countries of the United Nations agreed on Sustainable Development Goals 2030 which consisted of a total of 17 goals and 165 targets for the future world. These goals are interconnected and dependent upon partnerships between countries, businesses, NGOs, and citizens. SDGs goal number 14 'Life Below Water' is focused on the ocean, with the overall goal to 'conserve and sustainably use the oceans, seas and marine resources for (UN, Online) (Humphreys, J., & Clark, R. eds. 2019). From the SDGs Goal 14 'Life Below Water,' a few key targets and milestones are discussed below:

> 14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
>
> 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience and taking action for their restoration in order to achieve healthy and productive oceans
>
> 14.5 By 2020, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information
>
> 14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture, and tourism
>
> 14.a. Increase scientific knowledge, develop research capacity, and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular, small island developing States and least developed countries

14.b. Provide access for small scale artisanal fishers to marine resources and markets

Mainly the targets are the proportion of the ocean covered by marine protected areas, which is used as a measure of protection and sustainable use (Humphreys & Clark, 2019). Fig. 1 indicates the worldwide distribution of marine protected areas. It shows that by January 2019, over 14, 000 marine protected areas had been designated globally, covering over 27 million km^2. This represents 7.44% of the global ocean or just over 17.4% of coastal and marine areas within national jurisdiction and 1.18% of areas beyond national jurisdiction. This figure shows that the status of marine protected areas has accelerated rapidly since 2006 when only just over only 1% of the global ocean was protected.

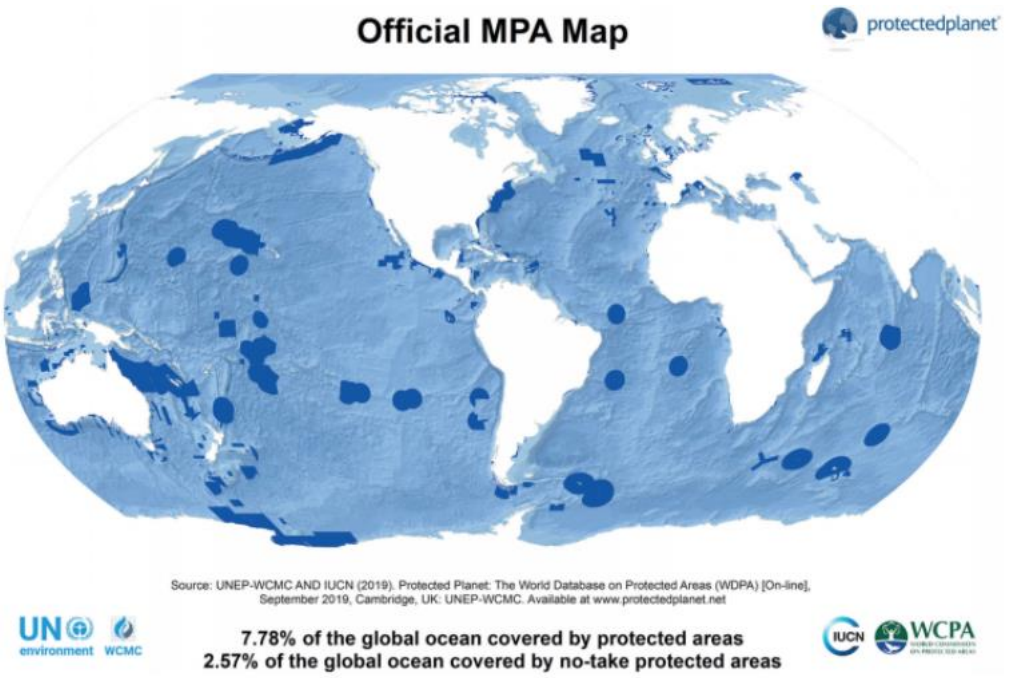

FIG. 1 Official map showing global distribution of marine protected areas (UNEP-WCMC and IUCN, 2019).

Source: Humphreys, J., & Clark, R. (Eds.). (2019). Page XX

5. The Status of MPAs in Malaysia

When it was recognised that Malaysia's marine fishery resources were dwindling in the 1980s, the idea of creating MPAs arose. This was followed by the Malaysian marine parks gazetting began in 1994, and became law in 1985 upon reviewing the Fisheries Act 1963. The goal behind the creation of marine protected areas is to protect marine resources and habitats while also serving as a management tool to promote sustainability in the fisheries. The primary goal of the establishment of marine parks is "to provide an area for the protection and conservation of marine resources and habitats, and to function as a management tool, aiding the drive towards sustainability in the fishing industry" (Department of Fisheries, 1996). According to the report, Malaysia has a coastline of 9,323 kilometers and a coral reef area of around 3,600 kilometers (Nair & Ramachandran, 2016). The majority of the Fisheries Prohibited Areas (FBAs) in Peninsular Malaysia were designated as Marine Parks in 1994. As

a result, Peninsular Malaysia now has a huge number of maritime parks. Malaysia has approximately 50 MPAs, the first of which was formed in 1974 in Sabah, East Malaysia. Sabah has a 1,440-kilometer-long coastline, with views of the South China Sea on the west and the Celebes and Sulu Seas on the east. The Coral Triangle Initiative (CTI), which includes Indonesia, Papua New Guinea, the Philippines, the Solomon Islands, and Timor Leste, includes MPAs in Sabah. The CTI spans approximately 5.7 million km2 and is home to 76% of all known coral species (Clifton, 2009). As these places are vulnerable to overfishing, damaging fishing methods, and the effects of climate change, the CTI's mission is to encourage adequate planning and management to address these challenges. As a result, the governments in charge of these resources must act quickly to manage and protect them responsibly.

The management of MPAs in Malaysia is shown in table 1 below, which was compiled from the websites of the several bodies named in the first column. In Peninsular Malaysia, it is supervised by a federal agency. In Sabah and Sarawak, it is handled by a state-level agency.

Table 1. Number of Marine protected areas and management body in Malaysia by region

Management Body	*Region*	*Gazettes*	*Number of MPAs*
Sabah Parks	Sabah	Sabah Parks Enactment 1984	5
Department of Marine Park Malaysia	Peninsular	Marine Order 1994 of the Fisheries Act	42
Sarawak Forestry Corporation	Sarawak	The National Park and Nature Reserve Ordinance 1998	3

Table 2 indicates a list of MPAs in Sabah. Tun Mustapha Park (TMP) is the largest marine park in Malaysia. TMP is the first multiple-use park where conservation, sustainable resource use, and development co-occur within one management framework (Jumin et al., 2018). It is located in the northern region of Sabah. Prior to gazettement, the region had no effective formal natural resource management plans, and laws regulating its resource use were not fully enforced. To address this, the Sabah Government approved the intention to gazette TMP in 2003, with the gazettement finalized in May 2016 (Jumin et al., 2018). TMP is home to over 187,000 people living in three administrative districts (Kudat, Pitas, Kota Marudu), almost half of which depend on marine resources for their livelihood and wellbeing (Department of Statistics Malaysia, 2010; PE Research, 96 2011). For subsistence and livelihood, a substantial number of TMP communities rely on fisheries. Fishing is a primary economic activity in the region, contributing 22% of total marine fisheries production in Sabah in 2008 (PE Research, 2011).

Table 2. The list of marine protected areas in Sabah

MPA	Gazette Year	Size
Tunku Abdul Rahman Park	1974	Five islands: 49 km^2
Turtle Island Park	1977	Three islands: 17.4 km^2
Pulau Tiga Park	1978	Three islands: 158 km^2
Tun Sakaran Marine Park	2004	Eight islands: 350 km^2
Sipadan Island Park	2009	One island: approximately 13.5 hectares
Tun Mustafa Park	19th May 2016*	Fifty islands: 10, 000 km^2

Source: Nair & Ramachandran (2016) & *Sabah Parks 2020 (accessed on April 7, 2020)

6. Literature Review

Sustainable Livelihood

The term "livelihoods" has grown in popularity as a way of describing the economic activities that poor people engage in their communities (Adato and Meinzen-Dick 2003). Chambers and Conway (1992) elucidated that "A livelihood is environmentally sustainable when one is able to maintain or enhances the local and global assets on which livelihoods depend, and has a net beneficial effect on other livelihoods". Definition of sustainable livelihood was also found negative expression by Carswell (1997:10), according to him that sustainable livelihood definition are often "unclear, inconsistent and relatively narrow" and this could add to "conceptual muddle". The Sustainable Livelihood Framework (SLF) has been gained huge recognition by scientists in studying people's livelihoods to eliminate poverty by analyzing the causes and relationships between the different aspects of people ś livelihood (Chambers & Conway 1992). The first thing that scholars come across while assessing or evaluating a rural community's standard of living in the society's livelihoods. Furthermore, the "Sustainable Livelihood Framework" is a recognised approach for measuring a community's sustainable livelihood. The study of MPAs and their effects on local communities is not new. According to studies, MPA management and conservation benefits can result in favorable outcomes for local populations, including local fisheries (Gell and Roberts, 2003; Halpern, Lester, and Kellner, 2009), tourism livelihood (Agardy, 1993), and climate and environmental threat mitigation (MacKinnon, Dudley, and Sandwith, 2011). MPAs, on the other hand, have been chastised for having harmful social, economic, cultural, and political consequences for local people and communities (Bennett and Dearden, 2014).

Conceptualizing the Sustainable Livelihood Framework

The notion of sustainable livelihood was discussed first in the 1992 Earth Summit held in Rio (Morse & McNamara, 2013). The summit also promoted Agenda 21 (Agenda for the 21st Century) which was the first initiative taken by the world community to come up with a concept of sustainable livelihood. Its core aim was stated that everyone must have the "opportunity to earn a sustainable livelihood" (Morse & McNamara, 2013: 22). In 1992, Robert Chambers and Gordon Conway proposed the following composite definition of sustainable rural livelihood that is applied most commonly at the household level: "A

livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term" (Adapted from Chambers and Conway (1992) & IDS Discussion Paper 296. Brighton: IDS; in Ibrahim et al., 2017).

In 1997, The UK's Department for International Development's (DFID) emphasis on sustainable livelihoods which was set out 1997 White Paper on international development as follows:

> "Refocus our international development efforts on the elimination of poverty and encouragement of economic growth which benefits the poor. We will do this through support for international sustainable development targets and policies that create sustainable livelihoods for poor people, promote human development and conserve the environment".
>
> *(DFID, 1997: Summary, page 6; in Stephen Morse, Nora McNamara, 2013, page 22)*

Sustainable Livelihood Framework (SLF) is one of the most widely used in development practice. The term livelihood refers to a means of earning a living by an individual or household. It is a combination of the individual or household's assets (capitals), including activities and resources, and access to these, mediated by institutions and social relations (Masud et al., 2016). Similarly, Chambers and Conway (1992) noted that the SLF consists of various capitals or assets, strategies, activities, and other factors commonly required for living. The sustainable livelihoods framework presents the main factors that affect people's livelihoods and typical relationships between these. In general, the SLF framework contains five sections (as shown in figure 2) that are rendered dynamic due to both external interventions and the activities of the rural residents (Bennett and Dearden, 2014). These five sections are (1) vulnerability context; (2) livelihood assets; (3) transforming structures and processes; (4) livelihood strategies; and (5) livelihood outcomes (DFID 2000). SLF first seeks to identify the important assets or capitals (physical, natural, human, financial, and social capital) related to people's livelihood. Then, it seeks to assess the vulnerability context such as shock, trends, and seasonality, or climate change. Finally, it seeks to identify the livelihood strategy and outcomes.

The SLA framework has been suggested as a tool for analysing the effects of protected areas on livelihood outcomes and capitals/assets, as well as the role of protected area policies, institutions, and processes (i.e., management and governance) in generating these outcomes, with the ultimate goal of improving conservation practice (Masud et al., 2016; Igoe, 2006). Masud et al. (2016) did a study on the community's standard of life in Marine Park Areas (MPAs) in Peninsular Malaysia, which revealed the challenges of livelihood sustainability and environmental issues in MPAs. The major findings of their study indicate that the social and physical assets of the societies within Marine Park Island improved the economic

development, but they continue to lack human capital and financial and environmental assets. In a study on livelihood assets and sustainable livelihoods among Malaysia's vulnerable groups, Ibrahim et al. (2017) discovered that physical, natural, and social assets are all significantly associated with the accomplishment of sustainable livelihoods.

It has been noticed that the socio-economic conditions of local communities within marine protected areas in Malaysia are typically low. This is because they have fewer resources and inadequate capacities. They also face many obstacles in managing their societies and gaining access to the services they require (Cabanban and Nais, 2003; Kari et al. 2011; in Masud, 2016). The focus of this study is to investigate fishers' livelihoods across the two districts in Sabah Malaysia guided by SLF.

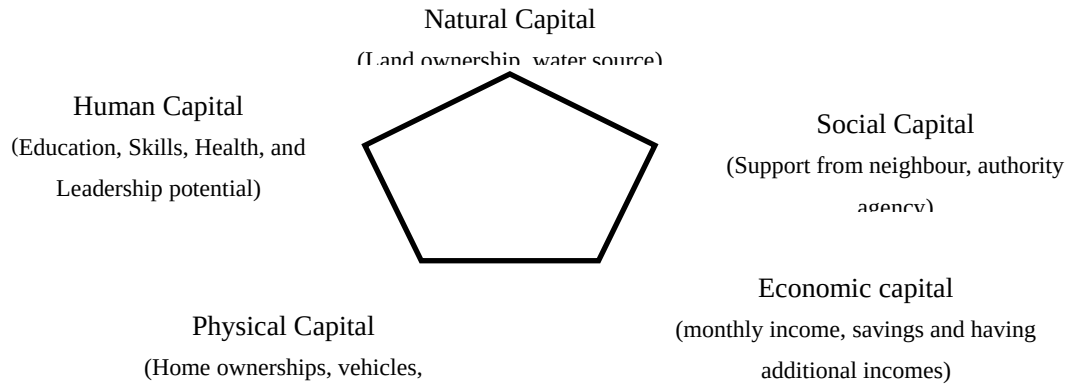

Figure 2. Sustainable Livelihood Framework (SLF) adopted from (Stephen Morse, Nora McNamara Springer Science & Business Media, 13 Feb 2013: page 19; Masud et al., 2016; Krantz, 2001)

7. Methodology

This study was carried out based on qualitative approach. Open-ended interviews as method of collecting data from the two districts in Marudu Bay, Sabah, Malaysia purposively chosen.

Data Collection and Sampling

This research is guided by a non-probability sampling procedure such as purposive sampling technique to select the informants and research sites purposively. The data were collected face-to-face between October and February 2020. Interviews were conducted using interview guide questions. The informant's identity of this study will keep confidential and anonymous. Based on location and ethnic groups informants' information is presented in Table 3. Purposive sampling was used to select five informants for the in-depth interviews. Surely, the study cannot describe the whole community based on only five in-depth interviews which were conducted for the first phase of the study to understand the livelihood of people and the authors plan to conduct the broader research on the phenomenon using quantitative methods. Three researchers and one research assistant were present during the data collection. Each interview took between 75 to 90 minutes.

Table 3. Informants' information based on location and ethnic groups

Name of Village	Majority Ethnic Group	District
Kanibongan Village	-Tambanua (Orang Sungai)* -Murut -Ubian	Pitas
Limau-Limauan Village	Suluk* & Bajau*	Kudat
Perapat Laut Village	Bajau Bedaan*	Kudat

Informants

The five informants in this study were selected for the in-depth interviews as follows.

Informant 1:

A 42 years old part-time fisherman. His highest level of educational qualification is secondary school. He is holding a position as head of the village for the Kanibongan Village.

Informant 2:

A 50-year-old full-time fisherman with the educational attainment of primary school.

Informant 3:

A 42-year-old man. He is a fisherman while he also working in the rubber garden to do some extra income. He has completed secondary school and the only skill he has is *Trawl Net Fishing.*

Informant 4:

A 46-year-old full-time fisherman with primary school education.

Informant 5:

A 48-year-old fisherman. Since childhood, he was engaged in fishing activity and till now his main source of income as a fisherman. He also works as a wage labourer. He enters primary school up to year 6 at a local school.

Research Questions Design and construction:

The main objective of this study is to understand the livelihoods of fishing communities in MPA Marudu Bay, Sabah, Malaysia. Data was collected from the households. The open-ended questionnaire covers various variables related to the SLF assessment framework from previous studies (Masud et al., 2016; Krantz, 2001). SLF is an assessment framework in order to investigate the livelihoods of people in rural and marine areas and their impact on poverty elimination. SLF is the core of the assessment of the different livelihood resources that people use for constructive their livelihoods such as capitals or assets that are deemed to underpin livelihood at the level of the individual, household, village, or group. These capitals are classified as human capital, social capital, physical capital, natural capital, and financial capital (Stephen et al., 2013:19). Each capital or asset consists of various components to measure, as follows in Table 4:

Table 4. Research instrument Design and Distribution of Livelihood Resources Considered in SLF Capitals

Themes: Livelihood Capitals (Assets)	Measurement Components as Livelihood Resources (Adopted from previous studies (Masud et al., 2016; Krantz, 2001).	Interview guide questions
Human capital	We examine informant s' acquired skills and training, education, occupation, health state, and leadership potential to determine their human capital.	● What is your educational level? ● What kind of work you do? ● What skills do you have? ● Does fishing cause health problems? ● Have you ever attended a course provided by the MPA authority?
Social capital	Social capital refers to the social relationships, networks, trust, and group membership that people rely on when pursuing various livelihood choices that necessitate coordinated efforts.	● Do you get any help from your neighbors or MPA authority? ● How do you get the capital to venture into the fisheries sector? ● Do you borrow any loan from any party?
Natural Capital	Natural capital refers to the informants' ownership status of land and other natural resources, which provide resource flows and services that are valuable for their livelihoods.	● Do you have any land to produce livelihoods? ● Is there any of your family members involved in fishing activities? ● Did you get help from the government? (boats and subsidies) ● Did you make any loan from any party?

Physical Capital	The physical capital of informants is determined by looking at their ownership of productive assets such as household assets and livestock, tools such as fishing gear and other fishing and processing equipment, boats, houses, bicycles, cars, and motorcycles.	• What level of homeownership do you currently have? • Do you own any vehicles? • Do you have a boat or a ship? • Does your home have electricity? • Do you feel the current fishing boats and equipment are adequate for catching fish? • Does a lack of fishing equipment or facilities make it difficult for you to carry out fishing activities? • Does your residence have a clean water channel? • Are the infrastructure provided by the government enough?
Economic /Financial Capital	Economic capital refers to a person's financial assets, such as cash, savings, and other income assets, which are necessary for pursuing any livelihood strategy.	• How much is your monthly income? • Do you have savings? • Are you satisfied with the income you earn? • Do you have side income? • Do you use any technology in the fisheries sector?
Livelihood strategies:	We focus on activities that generate additional income mainly the occupational pattern of the informants and opportunities in MPAs areas.	• Do you have additional income? • Other activities beside marine resource • Do you have an agricultural plot? • What are other activities that support your family? • Do you have other family members work in other areas?

Source: SLF assets/capitals components are adopted from Masud et al., (2016) and Krantz, (2001).

Study Area:

The study sites cover mainly two districts include Kudat and Pitas, in Marudu Bay, Sabah, Malaysia (as shown in figure 3). Three communities were selected using the purposive sampling technique. These villages are: Kanibongan Village, Limau-Limauan Village, and Perapat Laut Village.

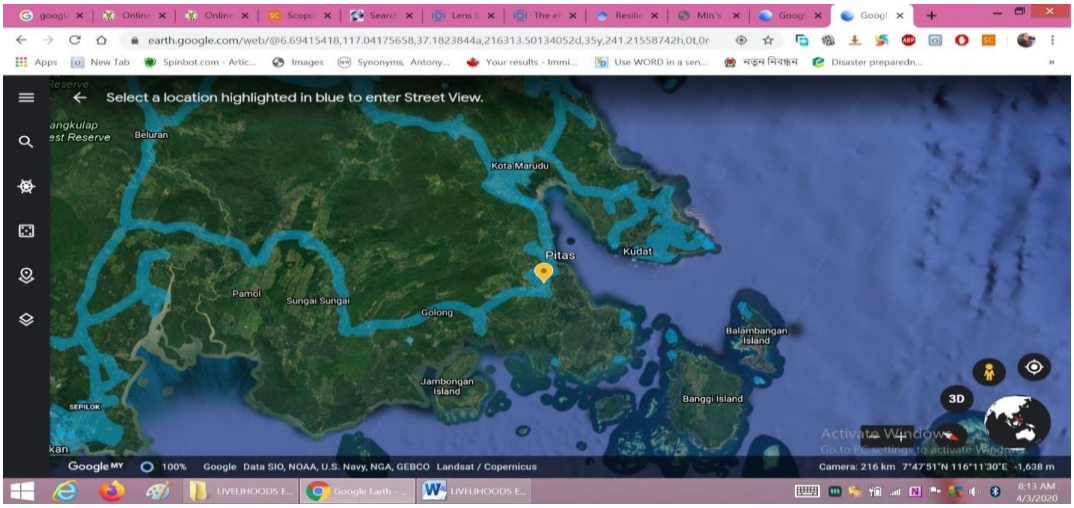

Figure 3. Satellite image of Pitas and Kudat (Source: Google map)

Data Analysis:

The collected data were transcribed, coded based on themes (there are five themes includes human capital, social capital, natural capital, physical capital and economic capital) and then compared. The data were analyzed for open, codes that described each informants's experiences. The counts for each theme represent the individual informant's discussion of that theme. The audiotaped interviews were transcribed verbatim. The Malay Language transcripts were translated to English.

8. Results

Human capital:

The human capital resources were determined in this study is informants' probation of education, skills, health, and leadership in the MPA fishing community. Informant's highest level of education found to be primary and secondary level school. It was found that fishing become a less attractive livelihoods activity in these areas. One man commented,

> *"The majority of our village fishermen are diversifying their sources of income and are no longer solely reliant on fishing as a primary source of income. I only go fishing when I have the time and it is weather dependent."*

We have asked them if they acquired skills and training. The majority of them had no formal training and skills. A 42 years old informant stated:

> *"I am using the traditional method to catch fish and the only skills I know is Memukat (one way to catch fish using the net). I had attended training programs organized by the government organization."*

Another informant stated:

> *"Since at my young age, I am involved in a fishing activity which is my only livelihood source of income and my family depend on this. I use the traditional method to catch fish and the skill I got is Trawl Net Fishing".*

A 46-year-old full-time fisherman stated:

> *"I am fully dependent on fishing as this is my only source of income. I have used my skills to catch fish. I can make Sangkar (a type of tool like a box with various shapes to catch fish which put under the water), Bagang (floated structure on the sea to catch fish) and Memukat (net fishing)."*

In terms of health, all believe that working as a fisherman is harmful to one's health and that fishing operations are sometimes hampered because of health issues. In terms of leadership capabilities, most of the informants possess no leadership qualities, except informant 1.

Social Capital

Social capital refers to the individual's relationships within the community and social support he/she gets from society. We asked each of the five informants if they had received any form of social support. The majority of interviewees stated that they raised their own funds and started their fishing business without the assistance of others. In terms of aid from the government and local authority, two of them have received help such as boats and other subsidies. One informant received loan from AIM (Amnah Ikhtiar Malaysia). An informant stated:

> *"I do receive help from the government like a boat and other assistance. I also got the house under PPRT (Housing Assistant Programme). I do not have any loan to pay".*

Another informant stated:

> *"I am included in the e-Kasih list, so I have received the boat and trawl from the government. So far, that's all the aid I have received".*

Natural Capital:

Natural capital was assessed by observing informants' status of land ownership, employment status of their family members, and other natural resources. Out of five, majority informants reported that they had owned a piece of land, except one. All of them mentioned that their family members also involved in this fishing occupation. It was found that in Perapat Laut Village does not have a source of clean water. The villagers depend on rainwater and buy gallons of water in Sikuati Village.

Physical Capital:

Physical capitals were measured based on status of homeownerships, vehicles (car/motor bike), boats and availability of the adequate infrastructure for living in MPA. Two informants out of five reported that they owned houses. Two informants reported that they are staying with their law's houses. One informant reported that he builds the house, but the land is state-owned land. In terms of owning vehicles (boats/car/bike), three of the informants reported that they have owned vehicles and boats. Two informants reported that they do not own boats.

All five informants reported that the infrastructure such as electricity supply is available in all three villages *(*Kanibongan Village, Perapat Laut Village, Limau-Limauan Village*).* In terms

of water supply, Perapat Laut Village and Limau-Limauan Village do not have a water supply. From the Limau-Limauan Village, one informant shared:

> *"Previously, the Water Department and the District Office provided water assistance. However, because of a quarrel between the people, the relief had to be halted".*

Four informants stated that they had sufficient fishing equipment, while one stated that he does not have sufficient fishing equipment. The majority of informants also believe that a shortage of fishing equipment will make it impossible to carry out fishing activities. The fishermen are occasionally helped by government personnel. An informant from Perapat Laut Village is stated that:

> *"I received government assistance including boat and net. I also received house under PPRT (Housing Assistance Program). The villagers also received a lot of help from the government".*

Economic Capital:

Economic capital is another main component of the Sustainable Livelihood Framework. We assessed the fishermen's economic capital based on their monthly income, savings, and having additional incomes. Data found that all five informants earned monthly income RM800, RM400-RM600, RM3000, RM600, and RM500 respectively. It was found that informants three earned higher than others. He is a 42-year-old full-time fisherman, and he also does *bagang* (to catch the small fish – anchovies – 'fish village'), earning a total of RM3000 monthly. He also received a loan from a Malaysian trust for a capital - Amanah Ikhtiar Malaysia (AIM). On the issue of MPA, he replied:

> *"We strongly disagree with the MPA because if they do the MPA, where do we get money? MPA will limit the area for fishing".*

The majority of the informants (four out of five) said they were satisfied with their monthly income. One informant commented:

> *"I am not satisfied with the level of income I earned from the fishing but at the end, we must thank Allah whatever we get".*

He is not satisfied with the monthly income he earned from fishing. In order to assess informants' economic capitals, we asked them about their additional sources of income, if there were any. It was found that two informants s have been working rubber plantations in addition to fishing in MPA areas, while another two informants work on a farm owned by their relatives. And, only one informant work as a daily labourer. It showed that, despite fishing being the primary source of income in MPA regions, informants had other forms of income to support their families.

An informant stated:

> *"I myself have been a fisherman for a long time. My father is also a fisherman. Indeed, our life is depending on fishing activity. To me, Sabah Parks is also good. Because right now, the sea is prone to bad things. Only the current income is a little*

difficult, it's a bit difficult, I can't catch fish in the area where I used to fish".

Livelihood Strategies

This section focused on all income-generating activities as livelihood strategies by the informants. The informants had to do other tasks to meet their daily needs, therefore the informants' livelihood plan was quite straightforward. Some worked in the construction industry, while others worked as rubber tappers. One informant's monthly income is more than the rest since he runs a small business. Fishing was only a secondary source of income for a few of the informants. This demonstrates that they are engaged in other economic activities.

9. Discussion

The primary goal of this study is to learn more about MPA livelihoods in Sabah, Malaysia. The Sustainable Livelihood Framework (SLF), a well-known approach to evaluating community poverty and livelihood, is used to lead this research. Human capital, social capital, natural capital, physical capital, and economic capital are the five standards of living indicators or assets/capitals that make up the index of the SLF. Based on the findings, we came to the conclusion that the lives and standard of living in MPA regions in this research site had not improved. To meet their necessities and sustain their livelihoods, the majority of the population is turning to different economic activities other than fishing. This finding differs from Masud et al. (2016), which could be due to the fact that their study sites are primarily well-known tourist destinations and marine park locations, providing the community and people with more possibilities and jobs to improve their living conditions. However, according to current research, MPA sites are not tourist destinations, and locals do not have access to a variety of job options. Another issue is a lack of human capital, as the majority of informants have only completed primary and secondary school.

They lack the necessary skills and training.

For a community to established trust and support from institutions and the community, social capital is critical. Though a few of them received government aid and subsidies, such as fishing boats and nets, others found alternative means to solve their economic problems or establish their businesses. The importance of economic capital in community development cannot be overstated. Except for one informant, the findings suggest that the informant's overall monthly income is below RM800. It shows that the person is lacking in physical and natural capitals; indeed, the informant stated that they do not have access to water.

10. Conclusion

Through the conservation and management of biodiversity, natural and cultural resources, the Marine Protected Area plays an important role in sustainable development. It has a significant impact on the community and livelihood. This study's goal is to gain a better understanding of the livelihood of rural communities in marine protected zones in Marudu Bay, Sabah, Malaysia. Three villages were identified as research sites in the MPAs zone. The Sustainable Livelihood Framework (SLF), a well-known framework for assessing or evaluating community livelihoods, guides this research. This framework has five assets or capitals,

which are regarded as stocks of different types of capital that can be used to generate livelihoods directly or indirectly.

In the MPAs sites, five open-ended in-depth interviews were completed. According to the study findings, informants' human capital, such as education, health, leadership, skills, and training, has not reached a suitable level that might provide a quality of living and livelihood for the population of the research sites. In many locations, fishing is a less appealing occupation. Those who work in the fishing industry typically employ very old traditional methods to catch fish. Residents lack natural and physical capital such as water resources and the capacity to finance a house, boat, and net. Based on the findings, we advocate that various sustainable livelihood projects be implemented in Sabah's Marine Protected Areas. These places require extra assistance, as well as social and economic initiatives and training to help the community improve their skills. Policymakers should pay special attention to citizens' educational and health needs.

Next, the fishing community of the study sites do not have many options for increasing their household's income level; as a result, policymakers should pay more attention to current study sites in order to create new livelihood opportunities for the poor; in particular, tourism should be invested in so that local residents can be employed and their economic situation improved. Because the fishing community is losing interest in the areas, the administration should authorize intensive fishing activity based on zone and time to safeguard the lives of fishermen and people. Again, we must say that the study cannot describe the whole community based on only five in-depth interviews, as this was the first phase of study for the broader research in a quantitative manner.

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Conflict of Interest

The authors declare no conflict of interest with respect to the authorship, research, and/or publication of this article.

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