

Modeling of Sustainable Marine Resources: Case Study Sampan Tribe in Riau Island, Indonesia

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Abstract. Currently, massive practice in fisheries caught and lack of marine ecosystem is not the only news in Indonesia but also in most other countries. Those practices are based on compliance with the growing food needs due to the growth of the world's population. The Riau Island, known as the Sampan Tribe, has been practicing methods and maintaining a sustainable marine ecosystem from generation to generation for decades. The focus of this research is on the Sampan tribe and the practice of sustainable marine resources. To understand the interactions and activities, culture, values by the Sampan tribe to maintain harmony with the sea and marine ecosystems. It shapes modeling of sustainable marine resources. To gain the best of modeling the Sampan tribe using qualitative method. The researchers did the deep interview with the key of informant from sampan tribe in the land, observation the three areas which was Berakit Bintan, Kampung Tua Batam, and Belakang Padang Batam. To support the data, the researcher did a literature study related to the sea, sampan tribe, and coastal ecosystem. The Sampan tribe consists of three practices, namely the practice of fishing gear, marine ecosystem sustainability practice, and the practice of prohibiting the catching marine animals. They believe that maintaining the sustainability of the marine ecosystem will have an impact on fish survival. It followed by a ban on catching several types of marine animals such as dugongs, turtles, dolphins, and whales. In fishing, the Sampan tribe protects the spawning fish, and the size of the fish is not caught. Their practices are in line with the government policies regarding the catching of fish, fishing gear, and protected marine animals. To conclude, the Sampan tribe is one of the drivers for supporting sustainable marine resources with practices and it is believed to be able to save the sea and existence as a Sampan tribe.

Keywords: Sampan tribe, sustainable fishing practice, sustainable marine resources model, Riau Island

1. Introduction

For us, people in the Berakit are not the sea tribe, but we would love it if people call us the sampan tribe due to we live in the boat. Currently, we have the permanent house to consider education for children and health. However, the sea is a part of our and can't be separated. We have to save the sea according to the mandate of our parents. Tintin – the Sampan tribe boy in Berakit.

Riau Island consists of 2.407 islands and 30% the small island without the name and population. The total area of Riau island is 8.201,72 km² consisting of 96% ocean and 4 percent of the land. Geographically, Riau island has the potential to grow and thrive coral reefs (278 815,41 Ha), seagrass, mangrove (57 670,65 Ha), and other marine species. However, industry development and tourism influence on sustainability of the marine ecosystem. It impacts on coral cover conditions, seagrass, mangrove, and the decline of marine biodiversity as well.

Indonesia has 2.399.981 Ha of coral reef ecosystem with live coral cover. It can be separated four categories condition such as excellent (1.333,38 km²), good (6.844,66 km²), fair (9.378,08 7.666,91 km²) and poor (7.666,91 km²). Whereas total mangrove areas in Indonesia are 3.616.445,19 ha [1]. Those data show that the condition of live coral cover included in the poor

category. That condition is still quite large compared to the combination of excellent and good categories. The damage is caused by fishing activities using methods and tools that tend to damage the marine ecology. Massive fishing is driven by the fulfillment of food needs due to an uncontrolled increase in the population [2].

Based on the data from Cental Bureau of Statistic Indonesia claim that population growth in Indonesia in 2010 amounted to 238,518.8 thousand people, an increase quite significantly to 272,248.5 thousand people in 2021 [1]. The growth of population has a negative impact following by increasing the consumption patterns. The condition also poses a threat to marine biodiversity [3]. The compliance of the food needs of the community will be carried out massively by exploiting existing biological resources without thinking about sustainability.

In specific, the findings were strengthened by research in which did by [4]. Related inventory of damage to the coastal and marine ecosystems of the Riau Islands conducted in the waters of Berakit Village, Bintan Regency, and Pasir Island, Batam City. The result of the study depicts that temperature supports water quality conditions in both areas, while salinity and pH are not yet supported.

Bintan regency has seagrass (981,65 Ha) and coral reef (4291,73 Ha) as a potency. Cover seagrass in

Berakit beach has the area of around 36,55% (Indonesia Institute of Science), and according to this percentage, seagrass into poor category. The percentage of live coral cover on Berakit Beach is 42.87% (in the type of fair condition). These conditions will directly affect marine ecosystems, mainly marine aquatic flora and fauna.

Like coral reefs, a seagrass is a place for multiple other aquatic flora and fauna with various purposes and interests [5]. Seaweed, shellfish, cucumber shrimp, and fish can be found in seagrass. There are several types of fish, for example, that live in seagrass throughout their lives, including for spawning, but several other species choose to live from a juvenile to adulthood. Then go to spawn elsewhere. Some only stay until youngsters, and some decide to stay only for a moment. Green turtles (*Chelonia mydas*) and dugongs are two animals that often live in seagrass beds. These two animals are very dependent on seagrass, because it is a food source for green turtles and dugongs [5].

Of massive fishing practices that destroy the continuity of marine ecology is different from the behavior of the sea nomads in Berakit and Batam. The difference with sea nomads who migrated and lived on boats. There are about 25 families who have lived in Berakit for a long time since the arrival of their parents who decided to settle on land (Berakit). Even though they have long lived on land, they still hold fast to the crucial values of harmony with the sea. The sampan tribe that has settled on the mainland also found on Belakang Padang island, Batam. The number of families from the Sampan tribe who have settled on Pulau Belakang island Padang is 30 families approximately. In their view, it is crucial to preserve the sea and its ecosystem because it is what sustains their life.

These values were practiced by saving the area around Berakit as a conservation area for coral reefs, seagrass, and mangroves. Thus providing an opportunity for flora and fauna to breed freely without breaking the chain. The practice of Maintaining the sustainability of marine ecology has been carried out for age, sticking to the present age. They realize that the sea is their source of livelihood. This practice contrasts to the method of massive fishing that is almost uncontrolled to meet food needs.

Based on these empirical conditions, this study aims to develop a model of sustainable marine resources based on local knowledge and local wisdom or awareness related to fishing practicing and the coastal ecosystem of the Sampan Tribe in Riau Island.

1.1 Sampan Tribe in Riau Island

From the published research about the sampan tribe in Riau island was only two research namely Lenhart (1995, 1997) and Chao (2003). There is no recent research outside of these two studies. The Orang Laut or Sampan Tribe of the Riau Islands are one of several minor ethnic groups found scattered throughout Southeast Asia through different cultural influences. The Sampan tribe, known as sea nomads or sea gypsies, descended from a Proto-Malay population that probably immigrated before 1000 M [6]. They have their own language, more precisely speaking various dialects of the Sea Tribe, which are closely related to Riau Malay

[6–8]. Their way of life are well adapted to marine ecological zones, mangrove swamps, and adjacent coastal areas. Some of them still live a nomadic life at sea, while others have a permanent houses, built mainly by the government. Furthermore, some Sampan tribes still return seasonally to their boat-dwelling way of life. The Sea Tribe consider themselves to be the original Malays. Sampan tribes are recognized by many Malays as native Malays of Riau. However, their status as natives is not enough to be accepted as pure Malays. This because they are considered 'unreligious', speak the harsh language, do not have a good code of ethics, and have a less refined physical appearance [7]

According to historical sources, most of the ancestors of the Orang Laut are now an integral part of the population of the Malacca-Johor kingdom and the Riau-Lingga Sultanate and included in the lower layers of nobles (*orang kerahan*) [6,7]. One of their duties is to supply marine products such as sea cucumbers, pearls, seaweed, and bird nests to local authorities for international trade, especially with China [8]

The Sampan tribe navigates the archipelago by following the tides and currents of the sea, winds, fishing grounds, sun positions, moon, and stars, about which they have extraordinary knowledge. These patterns are adopted until today. It is surprising why they can know which areas are abundant in fish. At the same time, they are not equipped with the latest and adequate technology or information. Based on interviews with several people from the Sampan tribe, they know the information from 'nature whisper.' Most of the Sampan tribe do the same thing, and they can meet in the same location simultaneously. There are ten areas that are fishing destinations for the Sampan tribe such as Berakit island, Mapur island, Belakang Padang island, Ngenang island, Bertam island, Gara island, Buru island, Tudjuh archipelgo, Tanjung kub, and Berang island and it can be seen in figure 1.



Figure 1. Fishing destination of Sampan Tribe
Source: The Author

For the Orang Laut, including those who have settled on land (Berakit), make a living from fishing and collecting marine products (sea cucumbers) for subsistence and small-scale trade with Chinese middleman (*tauke*). In addition, there are also seasonal

workers as mangrove loggers and workers in charcoal kilns. But this work by the Sea Tribe living in Berakit has long been abandoned because it impacts environmental damage and air pollution. It appears that there are three charcoal-burning stoves have not been used for a long time. For those who are still living on the boat, they are still bartering some of their products to fulfill their daily needs (such as oil, matches, rice, etc.) without using money. Preserving of coral reefs, seagrass, and mangroves is essential for the Berakit Sea tribe; they argue that this is a protection from abrasion or erosion, waves or strong winds, seawater intrusion, habitat for various types of fauna, as a place to find food, spawn and breed multiple kinds of fish and shrimp. In addition, other co-benefits, especially mangrove forests, are controlling malaria disease, maintaining water quality, absorbing CO₂, and producing relatively high O₂ compared to different forest types.

2. Methods

This study of modeling sustainable marine resources case study of Sampan tribe uses qualitative descriptive as a method to gain the result of this study. The authors did interviews, observation, and literature studies. For the first step, the researcher did a literature study related to the sampan tribe, coastal ecosystem, and sustainable marine. Those themes were chosen based on the essential part of this study. The author, classification or making the list of questions. Furthermore, observation did in different location such as in Berakit, Belakang Padang island, and Kampung Tua. In addition, the observation also did to the important coastal ecosystem, namely mangrove, seagrass, and coral reef in Berakit. The statement was used to see the current condition of mangroves, coral reefs, and seagrass.

3. Results

This study of modeling sustainable marine resources case study of Sampan tribe that highlight on three-part essential things such as the fishing practice, marine ecosystem sustainability, and prohibiting catching marine animals, see Table 1.

| No | Sampan tribe activities | Value |
|----|-------------------------------------|--|
| 1 | Fishing practice | Sustainable marine resources: traditional catching tools |
| 2 | Marine ecosystem sustainability | Sustainable marine resources: protecting three coastal ecosystem |
| 3 | Prohibiting catching marine animals | Sustainable marine resources: don't catch spawning fish and small fish |

Table 1. Sampan Tribe Activities Related Sustainable Marine Resources

The analysis from the in-depth interview and observation gain the three highlights in this study. Following those highlights, it will get the best modeling of sustainable marine resources through the sampan tribe. Tintin, as a sampan tribe descent, said that the sampan tribe still uses the traditional catching tools in

their daily activities such as lines, spear, flashlight, scoop, and bubu. Following the fishing gear used by the sampan tribe in daily activities consist of fishing lines and bubu. Like Tintin, the sampan tribe in Belakang Padang fisheries as well, still uses the traditional fishing mechanisms. He said that the tools of fishing practice can never be changed to maintain sustainability marine resources. In addition, the Sampan tribe, they don't have particular target to catch the fish between fishing gear and kind of fish. As long as the fishing does not violate the beliefs that they have. Furthermore, the Sampan tribe does not practice fishing using pukets and nets. In practice, the Sampan tribe does not practice bombing to get fish in the waters of the Riau island.

The Sampan tribe protects the marine ecosystem not only from the tools and methods of fishing, but by maintaining the sustainability of three important marine ecosystems are mangroves, seagrass, and coral reefs. The sampan tribe cut down mangrove trees but they did not cut down trees massively. This means the Sampan tribe knows and understands that mangroves are one of the critical habitats for fish breeding. The Sampan tribe community does the same with coral reef and seagrass. In their fishing practice, the sampan tribe do not damage the seagrass and coral reefs. They do the disposal of plastic waste on coral reefs and seagrass. When swimming, they do not damage the coral reefs and seagrass ecosystem, do not trample on coral reefs and seagrass. The actions have the purpose of treating coral reefs and seagrass as essential habitat for the survival of fish. Their actions help to treat coral reefs and seagrass as essential habitats for the survival of fish. Sampan tribe has conservation areas or protected areas such as Sumpat Island, Malang Bedaun Island, Pengdang, and Perimpat Island.

Another important thing for the sustainability of fish in the waters of the Riau island is that the sampans do not catch spawning fish and do not catch small fish. The Sampan tribe knows the characteristics of spawning fish. The people of the Sampan tribe know that fish lay eggs from certain seasons. For example, during the Chinese days season, they know that generally, dingkis or bruised fish lay eggs. If the Sampan tribe catches the fish that lay their eggs, they will return them to the sea. The same thing was practiced with small fish. The Sampan catch fish weighing 3-4 ounces. If the weight of the fish they catch does not match that size, they will return the fish to the sea. For example, the Sampan tribe is catching gamat with a specific extent, which is 3-4 inc.

4. Discussion

Sampan tribe is a tribe that lives on Riau island. In which their activities catch the fish. Sampan tribe in Riau island use traditional catching tools. It means the sustainability of marine resources and not harming the environment. Their belief relates to their behavior and relationship with the sea. One of the traditional tools used by the sampan tribe is the fishing trap. According to [9], that fishing trap is one of the traditional fishing gear to support sustainable marine resources. The practice of fishing is also familiar among fishermen, such as fishermen in Muara Angke. All fishermen in

Muara Angke use fishing traps as fishing gear due to easier maintenance [10]. In line with this, fishing using fishing lines was practiced by fishers in Muara Angke and Kalibaru to shoot by fishermen in Muara Kamal. It describes that the fishing practice by the Sampan tribe is carried out by fishermen in other areas. The practice of catching using traditional fishing gear has been inherited by the descendants of the Sampan tribe who work as fishermen and live on land. They believe that by raising fish with conventional tools, they can maintain the marine ecosystem and the catch sufficient for their daily needs. The practices have carried out their reasons according to the characteristics of the local culture. The fishing gear used has a target of fish.

The Sampan tribe has now developed to catch gamat using spears and tangguk. Fishing gear and the practice of catching fish through fishing lines have advantages in producing a lot of fish compared to other fishing gear. On the other hand, it also pays attention to sustainable fisheries resources [11]. Fishing lines are used by fishermen to catch fish like skipjack, and Purse seine was used to catch fish like pelagic [12]. Gillnet is also used to catch the fish, and based on [13] that that tools like bawal putih, and layur. The Sampan tribe, they don't have particular target to catch the fish between fishing gear and kind of fish. As long as the fishing does not violate the beliefs that they have. In addition, the Sampan tribe does not practice fishing using pukets and nets. In practice, the Sampan tribe does not practice bombing to get fish in the waters of the Riau island. It was different from fishing practice in Liukang Tupabiri, Pakeng Regency, and illegal fishing practices have been existed since 1975, such as bombing, trawl, and poison [14].

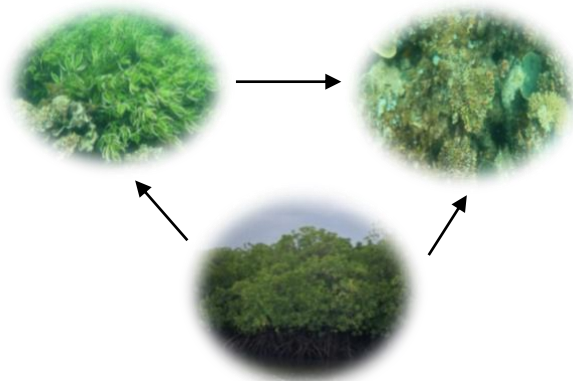


Figure 2: Coastal Ecosystem in Berakit
Source: The Author

In practice, until now, the Sampan tribe who live on land still preserves the coastal habitat. Their concern for the coastal ecosystem can be seen in the replanting of mangroves around the waters of Panglong village and stopping the operation of charcoal houses that use mangrove wood as the primary source for charcoal. On the other island like Belakang Padang, the active role of the Sampan tribe community can be seen by being one of the mangrove police. This means that they are trusted to protect mangroves and can take policies if people cut and damage mangroves on the island. In contrast to the condition of the mangroves in Panglong waters, which

are dense and currently it has developed into one of the tourist attractions in Panglong village. The figure 2 depict that the condition of mangrove, seagrass and coral reef in Berakit sea.

Mangrove planting is an essential activity given the many benefits, consider to the direct use and indirect use value of mangrove. Both of use-value give many benefits to the community and environment, such as fish, household equipment, to control erosion and supply feed for the other species [15]. So far, the Sampan tribe has not gained training about mangrove planting. They learn mangrove planting techniques by self-taught and from their ancestor. The Sampan tribe believes that the sustainability of mangrove can improve productivity marine resources. It's one of the reason to protect mangroves. While Sampan tribe used mangrove wood to make kujang. They have know to see the kind of mangrove wood that can be used and not disturbing the sustainability of mangrove. One of te causes of decline seagrass population is socio-economic, human activities. Declining seagrass will impact coastal protection, fisheries, and carbon sequestration [16]. When there is no socialization or project related to saving seagrass with the Sampan tribe. But this community understands to protect seagrass during their activities in the sea. Those actions relate to their belief that the sea is home for them.

The condition of mangrove, coral reefs, and seagrass in the Berakit sea are in good condition. One of the sampan Tribe in Belakang Padang island state currently coral reefs condition in Belakang Padang sea has been poor condition. The impact is, the amount of fish in Belakang Padang drastically decreased. This condition started in 2014. Coral reef's damage was not caused by Sampan tribe activities. However, factories and the oil spilled to the sea. Before the phenomenon, the Sampan tribe in Belakang Padang had an income of around Rp 3.000.000 in a day. Too sad, the condition is changing a lot nowadays, they only get around Rp 300.000 a day are uncertain. Consequently, fishers or Sampan tribe in Belakang Padang are difficult to catch the fish in their area. Sampan tribe in Belakang Padang moves to Berakit sea for looking the fish. They will spend 2-3 days to catch the fish.

The practice of catching fish by considering these sizes to maintain the continuity of the breeding of fish and marine animals. This was done to get good results and can be sell. The moving of the sampan's residence to the mainland does not change the practice of protecting marine animals and continuing to have a profession as a fisherman. The displacement of the Sampan tribe did not only occur on the islands of Bintan and Batam but also the Bajo tribe in Sulawesi moving around the sea using the boat, but along the way, they settled in the land [17]. Despite their life in the ground and having a permanent house, they are fishermen and have the place close to the sea. Furthermore, the essential thing don't catch fish undersize or juvenile fish.

In current practice in North Andhra Pradesh, India, it is estimated that fishers catch juvenile fish or fish under the size of maturation around 57,03% [18]. Where this practice is not carried out by the Sampan tribe

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