# Rupat Island as a mariculture center on the east coast of Sumatra: A suitability analysis

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**Abstract**. Rupat Island is located in Bengkalis Regency, Riau Province, Indonesia, and it is directly adjacent to Sumatra and Dumai City. In the last 20 years, this island has been expected to become a mariculture center. The current research aimed to analyze some factors that determine the program. The study was conducted from January to December 2023 by using a survey method. Primary data were collected through parameter measurements in the field, field observations, and interviews with some respondents, including mariculture entrepreneurs (5), local community leaders (5), fisheries and maritime service officials (3), residents (30), transportation entrepreneurs (3), and fisheries entrepreneurs (5). Secondary data was obtained from reports and scientific publications. Analyzed parameters included water quality, wind, current, waves, sediment, coastal abrasion, and social-economic factors. Currently, the island has been utilized for the cultivation of vanamei shrimp (*Litopenaeus vannamei*), and white snapper (*Lates calcarifer*). The observed water quality parameters were: salinity (23 to 30‰), pH (6.30-6.50), temperature (2.97-33.9°C), brightness (0.94-1.15 m), and dissolved oxygen (5.30-7.75 mg $L^{-1}$). The other observed parameters were: wind speed (0.50-3.60 m $s^{-1}$), the current speed is relatively high (0.70-0.80 m $s^{-1}$), low and high tide difference (1.0-1.5 m), and wave height (0.175-0.250 m). The parameters are appropriate for the mariculture industry. However, for floating net cages at sea and for cultivating seaweed, the current speed, wave height, and wind speed could be a serious problem. Sediment samples consisted of sand, mud, gravelly mud, and sandy mud. The average coastline abrasion rate is more than 2 m $year^{-1}$ and classified as a high-threat category. The abrasion can be a serious problem for mangrove and mariculture areas. Although the surrounding community has a positive response, the business infrastructure is deficient. The access to this area is relatively difficult, namely by crossing the Rupat Strait on a ferry boat in 2 hours. The harvest has been completely absorbed and marketed to several cities in Sumatra. The government policy is very supportive. However, there are obstacles in terms of regulatory aspects from the Ministry of Environment and Forestry, regarding the protection of mangrove forests.
**Key Words**: white snapper, vannamei shrimp, feasibility study, mariculture center, coastline abrasion.

**Introduction**. Rupat Island is the outermost island of Indonesia that borders directly with Malaysia. This island has become the center of attention in recent years. There are two big agendas that the Indonesian government wants to carry out, namely marine ecotourism and mariculture centers. Coastal ecotourism on Rupat Island has produced a Keynesian Income Multiplier value of 1.03. This shows an increase in the income of workers and business owners in the marine ecotourism area on this island (Mashur et al 2021; Suroyo & Putra 2022; Warningsih 2023). The Mariculture Center, a cultivation center of marine organisms in their natural environment, has been launched by the Riau Provincial Government, Indonesia on Rupat Island, since the island is relatively large, the population density is still low and the location is on the east coast of Sumatra Island (Akbar et al 2022; Ningrum et al 2022). Rupat Island is directly opposite to the Malacca Strait, the busiest shipping strait in the world, it is located about 40 miles from the port city of Port Klang, Malaysia a and it is connected to the mainland of Sumatra Island since the operation of the Dumai-Rupat Island ferry. These conditions cause the flow of goods and services in and out of this island to be relatively smooth.

Rupat Island has experienced very rapid development, marked by various activities such as plantations, agriculture, animal husbandry, and rapidly growing ecotourism activities (Tanjung et al 2023). This development is followed up by the regional government

through the Regional Medium Term Development Plan. So far, the Riau Provincial Government has opened additional land there covering an area of 10 ha from the planned 200 ha. Several private companies, for example PT. Marindo Utama Lestari and PT. Tambak Libu Segara have started the production, with an additional area of around 40 ha. Apart from vannamei shrimp (*Lithopanaeus vannamei*), white snapper (*Lates calcarifer*) is also cultivated. Trials for planting of seaweed *Eucheuma cottonii* have also been carried out (Akbar et al 2022; Nursyirwani et al 2022).

Despite this, until now Rupat Island has never really become the projected Mariculture Center. Several reasons may be mentioned, for example: the distance to marketing centers, the limited access to capital, information and cultural technology, the non-availability of business infrastructure and so on. This research aimed to analyze several factors that determine the success of Rupat Island as a mariculture center, including physical-oceanographic characteristics, chemical-biological parameters, and social-economic factors.

## Material and Method

***Research location***. This investigation was carried out between January and December 2023 on the island of Rupat, which is located in the Bengkalis Regency of the Riau Province in Indonesia.

***Research methodology***. This research was carried out using a survey method. Primary data was collected through parameter measurements in the field using appropriate equipment and systems. Apart from that, field observations and interviews were also carried out with a number of respondents nominated purposively, such as: mariculture entrepreneurs (5), local community leaders (5), fisheries and maritime service officials (3), residents (30), transportation entrepreneurs (3), fisheries entrepreneurs (5) and others. Meanwhile, secondary data was obtained from reports and scientific publications from related parties. In order to ascertain the suitability of Rupat Island as a mariculture center on the east coast of Sumatra, measurements and analysis of a number of parameters were conducted, including water quality, wind, current, waves, sediment, coastal abrasion, and social-economic factors.

***Water quality analysis***. Water quality measurements were carried out in the waters around the coast of Rupat Island, at high tide until low tide, at 5 sampling points. The measurements include salinity, pH, temperature, brightness, and dissolved oxygen parameters.

***Wind analysis***. Wind direction and speed data were obtained from the Meteorology, Climatology and Geophysics Agency, Republic of Indonesia (www.bmkg.go.id). This data was then processed, plotted in graphical form and analyzed.

***Current and tides analysis***. The processing of the current model was carried out using a two-dimensional numerical model, for one year, at high tide to low tide and low tide to high tide, each season. The analysis and interpretation of model data consisted of: mesh boundary, time series and point series. The Mesh boundary was created based on the study area using shoreline data and bathymetry data as inputs. Furthermore, the time series is the result of the prediction of tidal elevation and wind data in the form of maximum wind direction and speed stored in time series file (dfs0) format to create an oceanic current model, while the point series is a visualization model that displays current speed and current direction.

The location for tidal forecasting is determined by establishing model boundaries. Within these boundaries, there are 5 nodes, and the midpoint of these nodes represents the location of the tidal forecasting results. This is referred to as the Boundary condition model (Figure 7). The model settings and tidal locations are listed in Table 1.

***Waves analysis***. Wave height data were collected from Copernicus Marine Data Store (https://data.marine.copernicus.eu/products) during the west season and east season in 2022, at Rupat Island.

***Sediment analysis***. Each coastal area and the associated waters in North Rupat District have different characteristics. This study was conducted by taking sediment samples of coastal areas and then by analyzing the sediment fraction and Sephard classification with 3 repetitions.

Table 1

Model and tidal settings

| *Parameters* | *Data format* |
|---|---|
| Simulation time | The sum of the time series: 43200<br>Time interval: 30 seconds<br>Simulation time starts: 01/01/2023 23.00 AM<br>Simulation time ends: 30/12/2023 00.00 AM<br>Model simulations were conducted every 15 days to minimize time and 3 computers were used. |
| Area boundaries | GEBCO Bathymetry Year 2023 |
| Tidal elevation | Depth of low tide condition: 0.005 m<br>Depth of tide condition: 0.05 m<br>Lowest water level: 0.1 m<br>Type: Specific level<br>Format: Time-varying, constant throughout the area<br>Time series: tidal forecasting with the following coordinates: |
| Model area conditions | 1. Longitude: 101.129476362, Latitude: 1.514366022341<br>2. Longitude: 101.129476362, Latitude: 2.394317743513<br>3. Longitude: 102.0702874361, Latitude: 2.394317743513<br>4. Longitude: 102.0702874361, Latitude: 1.514366022341 |

***Coastal abrasion analysis***. Coastline data were gathered from Landsat 8 OLI/TIRS images (https://earthexplorer.usgs.gov), NAOTide for tide prediction data, and DEMNAS bathymetry data (https://tanahair.indonesia.go.id).

***Social economy analysis***. The socio-economic aspects analyzed include the local community's willingness to have mariculture businesses in the area, availability of main business infrastructure, availability of supporting infrastructure, market aspects, regulatory aspects and government policies.

## Results and Discussion

***Rupat Island as a mariculture centre***. The Riau Provincial Government, through the Fisheries and Maritime Service, is currently developing marine fisheries cultivation on Rupat Island. Apart from having the potential to develop the tourism sector, Rupat also has the potential to become a fisheries cultivation center. Recently, the cultivation of *L. vannamei* and *L. calcarifer* has begun to be developed in Rupat, contributing to the Regional Original Income (ROI) to Riau Province (more than 33,33 USD in 2022). In 2023, as the ponds increased in number and size, the tax contribution is expected to be more significant. Currently, the Riau Provincial Government has land for fish cultivation using fish ponds covering an area of more than 200 ha. So far, only 3 ha have been used. Apart from cultivating snapper and white shrimp ponds, the provincial government will also develop

crab pond cultivation. On the existing land it is still possible to build a seafood restaurant, because there are currently quite a lot of tourists. Then the seafood raw materials are also available in fish farms owned by the Riau Provincial Government. Because now Rupat Island is starting to attract tourists after the existence of the Pekanbaru-Dumai Toll Road. The market is still dominated by local buyers. However, it is estimated that in the future, if the ponds area will be expanded, state assistance is expected to promote the export of pond products. Complete data on the owners and size of vannamei shrimp and white snapper ponds on Rupat Island (North Rupat District and Rupat District) are presented in Table 2 and Table 3.

Table 2

List of *Lithopanaeus vannamei* cultivation business owners in North Rupat District

| *No.* | *Name of company/Business owner* | *Pond area (ha)* | *Land area (ha)* |
|---|---|---|---|
| 1. | Kelompok Pembudidaya Ikan Lapin Bersama | 8 | 8 |
| 2. | Pembudidaya AHOI | 2 | 2 |
| 3. | Kelompok Pembudidaya Dokoh Jaya | 4 | 4 |
| 4. | Kelompok Usaha Bersama Bintang Tri | 2 | 2 |
| 5. | PT. Fisheri Berkah Utama | 3 | 8 |
| 6. | CV. Sumber Rezeki | 8 | 8 |
| 7. | Kelompok Pembudidaya Ikan Bangkit Bersama | 2 | 2 |
| 8. | Kelompok Pembudidaya Ikan Lele Pesisir | 0.4 | 1 |
| 9. | Kelompok Pembudidaya Ikan Ulu Medang | 0 | 2 |
| 10. | Pembudidaya Muhammad Agustar | 1 | 2 |
| 11. | Pembudidaya Abdul kadir | 0.15 | 7 |
| 12. | Kelompok Pembudidaya Songeng Maju Bersama | 0 | 4 |
| 13. | Yayasan Rupat Utara Madani | 1 | 1 |
| 14. | Pembudidaya Evi | 4 | 4 |
| | Total (ha) | 35.55 | 55 |

Table 3

List of *Lithopanaeus vannamei* cultivation business owners in Rupat District

| *No.* | *Name of company/Business owner* | *Pond area (ha)* | *Land area (ha)* |
|---|---|---|---|
| 1. | Kelompok Pembudidaya Ikan Samudra Tanjung | 2 | 2 |
| 2. | Kelompok Pembudidaya Harapan Selat Morong | 4 | 4 |
| 3. | Kelompok Pembudidaya Ikan Laut Ketapang | 2 | 6 |
| 4. | Kelompok Pembudidaya Ikan Teluk Pelam Lestari | 2 | 8 |
| 5. | PT. Mitra Hayati Sejahtera | 6 | 6 |
| 6. | PT. Marindo Utama Lestari | 50 | 50 |
| 7. | PT. Tambak Libu Sagara | 30 | 30 |
| 8. | Kelompok Pembudidaya Ikan Bina Sejahtera | 4 | 4 |
| | Total (ha) | 100 | 110 |

***Water quality analysis***. Water quality measurements were carried out at 5 sampling points. The salinity ranged from 23-30‰, the pH ranged from 6.30-6.50, the temperature ranged from 29.7-33.9$^{o}$C, the brightness ranged from 0.94-1.15, and dissolved oxygen ranged from 5.30-7.75 (Table 4), suggesting that the environmental conditions are relatively suitable for a mariculture center.

Table 4

Water quality measurements during high tide to low tide conditions

| *Water quality parameters* | *Station* | | | | | *Unit* |
|---|---|---|---|---|---|---|
| | *I* | *II* | *III* | *IV* | *V* | |
| Salinity | 24 | 25.14 | 30 | 25.7 | 23 | ‰ |
| pH | 6.41 | 6.35 | 6.5 | 6.5 | 6.3 | - |
| Temperature | 29.7 | 33.4 | 32.9 | 33 | 33.9 | °C |
| Brightness | 0.94 | 0.95 | 1.15 | 1.05 | 1.1 | - |
| DO | 5.30 | 7.75 | 6.93 | 6.52 | 5.3 | mg $L^{-1}$ |

***Wind analysis***. The results of the seasonality analysis of wind data at sea level (in 2022, for 24 hours, for the Rupat Island area) are presented as wind rose diagram (Figures 1 to 4). In the diagrams, the radial lines represent the wind direction, while each circle represent wind events within the measurement time period. Wind speed actually has no direct effect on shrimp and fish. However, winds that are too strong can damage the facilities and infrastructure of this business. So far, on Rupat Island no such disturbance has been recorded.

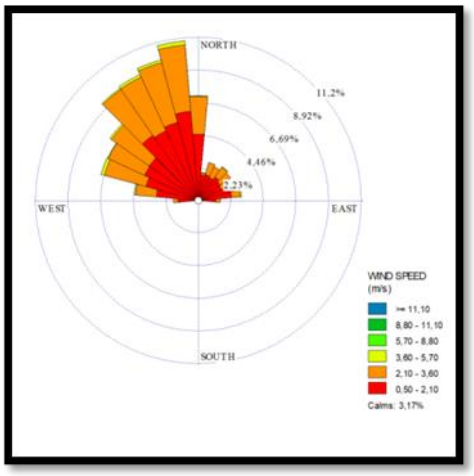


Figure 1. West wind (December-February).

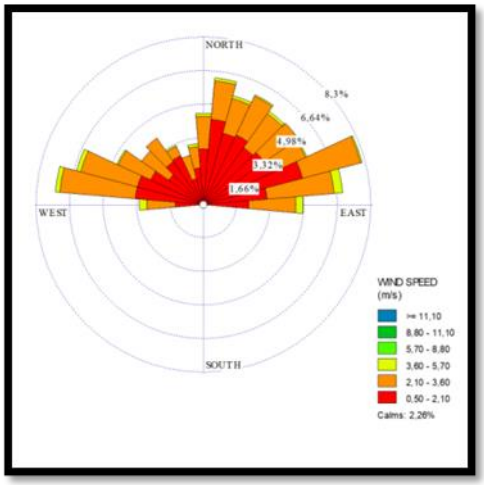


Figure 2. Transitional season I winds (March-May).

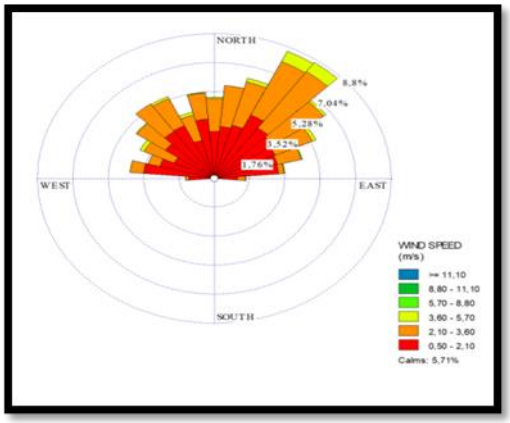


Figure 3. East Wind (June-August).

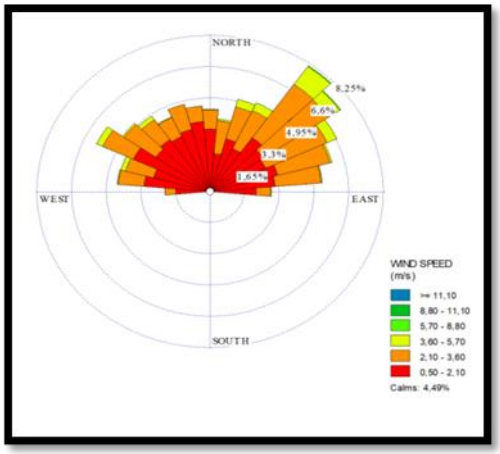


Figure 4. Transitional wind II (September-November).

Based on the wind rose diagram in Figure 3 for the western wind season, the dominant wind speeds ranged from 2.10 to 3.60 m $s^{-1}$. In Figure 4, the dominant speed ranged from 0.50 to 2.10 m $s^{-1}$, for the eastern wind season. The wind can be influenced by the geographical conditions of the wind observation location (wind flow obstacles), such as land or islands (Purwanto et al 2020).

During the West and East Seasons, the wind tends to have a higher speed compared to the Transitional Season, because during the West Season there is a high pressure on the Asian Continent and a lower pressure on the Australian Continent. Therefore, the wind moves with a high speed and a steady direction from the Asian Continent to the Australian Continent, across the territory of Indonesia. The opposite condition occurs during the East Season where there is a high pressure on the Australian Continent and a low pressure on the Asian Continent, so that the wind moves with a high speed and a steady direction from the Australian Continent to the Asian Continent across the territory of Indonesia. Meanwhile, during the Transitional Season, the pressure gradient is not so large, so that the wind moves with a low speed and a direction that is not fixed (Tjasyono 2009; Wardhani et al 2021).

***Current and tides analysis***. Overall, the current model obtained has varying current velocity results. The movement of the current has a direction that tends to be the same every season at tide, namely towards the ebb and vice versa. For more details, the results of the current model processing during low tide to high tide and tide to low tide, each season, are presented hereafter.

***West Monsoon flow model***. In the west season, the current pattern at low tide to high tide has the same direction from the northeast towards the southeast with the highest current speed, above 0.6 m $s^{-1}$, while at high tide to low tide, the current pattern has the

opposite direction from the southeast to the northeast, with the highest current speed, above 0.7 m $s^{-1}$, occurring in December.

***Transitional season flow model I***. In transition I, the current pattern at low tide to high tide has the same direction, namely from the northeast towards the southeast with the highest current speed occurring in May, above 0.8 m $s^{-1}$, while at high tide to low tide, the current pattern has the opposite direction, namely from the southeast to the northeast with the highest current speed occurring in March and May, above 0.8 m $s^{-1}$.

***East monsoon current model***. In the east season, the current pattern at low tide to high tide has the same direction from the northeast towards the southeast with the highest current speed occurring in July, above 0.87 m $s^{-1}$, while at high tide to low tide, the current pattern has the opposite direction from the southeast to the northeast with the highest current speed occurring in June, above 0.78 m $s^{-1}$.

***Transitional season II***. In the second transitional season, the current pattern at low tide towards the tide has the same direction, namely from the northeast towards the southeast with the highest current speed occurring in September, above 0.8 m $s^{-1}$, while at high tide towards low tide, the current pattern has the opposite direction, namely from the southeast to the northeast with the highest current speed occurring in October, above 0.81 m $s^{-1}$. The data from this research are not much different from the results of the research conducted by Rifardi et al (2020), where the current speed in the Rupat Strait ranged from 0.06 to 0.84 m $s^{-1}$ at high tide and 0.04 to 0.60 m $s^{-1}$ at low tide, in 2020). Current patterns and speeds are not closely related to mariculture activities on land such as vannamei shrimp and snapper ponds. However, for floating net cages at sea, this will be a serious problem. From the results of this study, it can be seen that the current speed is relatively high (0.70-0.80 m $s^{-1}$) throughout the year. This current speed is too high for installing floating nets and cultivating seaweed.

***Waves analysis***. Wave height is one of the hydro-oceanographic factors. For the waves height there were used the Copernicus marine data in the west and east seasons in 2022. Graphs of waves height forecasting on the coast of Rupat Island can be seen in Figures 5 to 8. As with the current, waves patterns and height are not closely related to mariculture activities on land. However, for floating net cages at sea, this will be a serious problem. Waves height (0.175-0.250 m) throughout the year is less suitable for installing floating nets and cultivating seaweed.

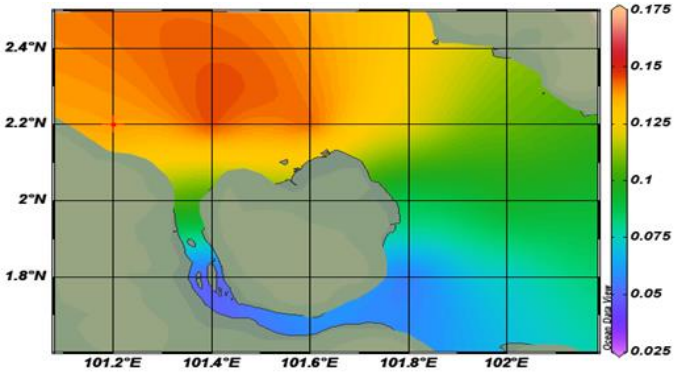


Figure 5. West monsoon tide (December-February).

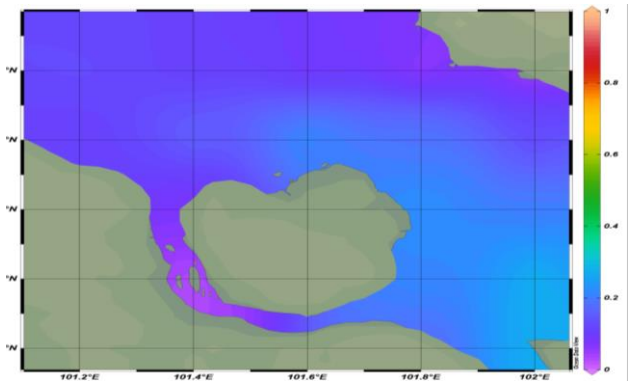

Figure 6. Transitional Wave I (March-May).

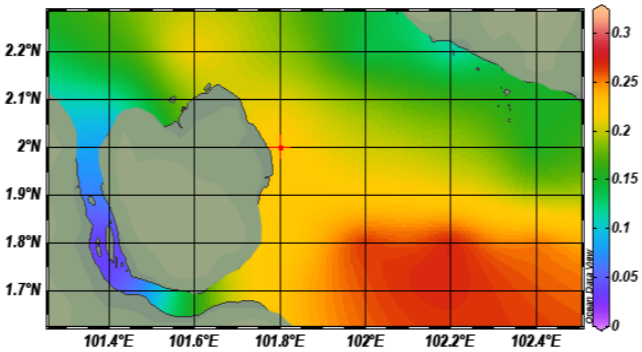


Figure 7. East Monsoon Wave (June-August).

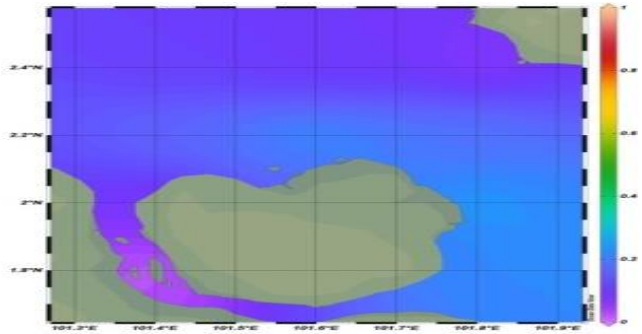

Figure 8. Transitional Wave II (September-November).

Based on Figure 5, it was found that in the west season, the waves were higher in the west but are included in the low category because they have an average height of 0.125-0.175 m. In Figure 7, it can be seen that the waves are higher in the east, although in the east season the waves are higher than the west season but are included in the low category because they have an average height of 0.2-0.25 m. Whereas in the Transitional Season, the speed and stability of the wind direction tend to be low so that the wave height formed is also low (Kurniawan 2011; Wardhani et al 2021).

According to Mahfudz (2012), generally the morphology and type of beach is determined by the intensity, frequency and strength of the energy that hits the beach. Low-energy areas are usually sloping, with fine sand or mud sediments, while those exposed to high-strength energy are usually steep, rocky or with coarse sand. In previous research conducted by Wati et al (2020), the significant wave height of the Rupat Strait under full conditions ranged from 0.12 to 0.90 m.

***Sediment analysis***. Sediment samples were collected from villages of Kadur, Tanjung Rhu, Lapin Beach and Tanjung Medang. The type of sediment consisted of sand, mud, gravelly mud, and sandy mud (Table 5).

Table 5

Sediment type classification in Rupat Island

| *Location* | *Station* | *Percentage of sediment fraction (%)* | | | *Sediment type* |
|---|---|---|---|---|---|
| | | *Gravel* | *Sand* | *Mud* | |
| Kadur | 1 | 21.29 | 19.26 | 59.45 | Gravelly mud |
| | 2 | 16.09 | 11.48 | 72.43 | Gravelly mud |
| | 3 | 12.17 | 29.78 | 58.05 | Gravelly mud |
| Rhu Bay | 1 | 0.14 | 91.94 | 7.93 | Sand |
| | 2 | 0.24 | 82.13 | 17.62 | Sand |
| | 3 | 0.16 | 80.57 | 19.27 | Sand |
| Lapin Beach | 1 | 5.56 | 26.23 | 68.21 | Sandy mud |
| | 2 | 7.6 | 16.66 | 75.74 | Mud |
| | 3 | 3.6 | 22.8 | 73.6 | Sandy mud |
| Tanjung Medang | 1 | 0.1 | 80.07 | 19.83 | Sand |
| | 2 | 0.19 | 86.61 | 13.2 | Sand |
| | 3 | 0.14 | 81.99 | 17.88 | Sand |

From Table 5, it can be seen that the classification of sediments in the waters and coastal areas of North Rupat sub-district consists of mud, gravelly mud, sandy mud and sand. The dominant sediment found in the coastal waters of North Rupat sub-district is sand with the highest fraction value at Tanjung Medang station 1 with a percentage value of 19.83% sand fraction. The smallest sand fraction is found at the location of Kadur station 2 with a percentage value of 11.48%. The highest gravel fraction value is found at Kadur station 1 location with a percentage value of 21.29% and the lowest at Tanjung Medang station 1 with a percentage value of 0.10%. The highest percentage of mud fraction was found at Lapin Beach station 3 with a percentage value of 75.74% and the lowest percentage at the Teluk Rhu station 1 location with a percentage fraction of 7.93%. According to Soerjawo & Maryanto (2017), the difference in sediment distribution at each station is due to the current velocity factor, where the current velocity at the bottom layer is weak, so that the stirring of the sand fraction in the lower layer does not occur. Deposition that occurs continuously can add new coastlines. However, in brief it can be stated that the area is still suitable for mariculture center in term of sediment analysis.

***Coastal abrasion analysis***. The dominant red color shows a reduction in land, but the addition of land or accretion also occurs evenly on each side of Rupat Island, both North, East, South and West of the island. Based on the results of the analysis of shoreline changes on Rupat Island using satellite imagery, it reveals that from 2018 to 2022, there is an abrasion rate of 4.7 m year$^{-1}$. This process accounts for 74.84% of the total sediment dynamics, while accretion contributes the remaining 25.16% of the process (Figure 9).

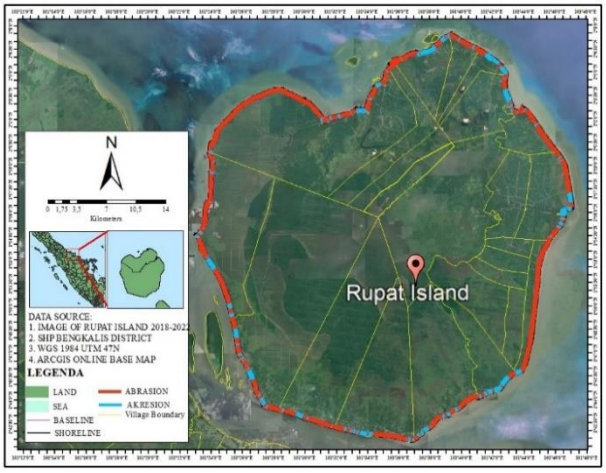


Figure 9. Shoreline change map of Rupat Island.

Rupat Island is classified as having a high hazard level due to the fact that it experiences a rate of coastal abrasion of -4.7 m year$^{-1}$. As stated by RMMAF (2018), if the average coastline abrasion rate is greater than 2 m year$^{-1}$, the abrasion is classed as belonging to the high hazard category. This classification indicates that the abrasion has the potential to cause a disaster for Rupat Island, including the mariculture region (Mashur et al 2021; Puspita 2021). According to Mubarak (2017), the rate of abrasion that actually takes place is nearly identical to the pace that occurred on Bengkalis Island, which was 4.91 m year$^{-1}$.

Mapping can be done to observe the condition of mangrove forests and to obtain an overview of the distribution of the mangrove forest areas (Shobirin et al 2016). Based on the analysis of the area of mangrove vegetation on Rupat Island using satellite imagery (Figure 10), in 2018 the area of mangrove vegetation on Rupat Island was 118.53 km$^2$ and until 2022 there was a shrinkage and the remaining 75.45 km$^2$. Mangroves are a group of plants that thrive in the intertidal zone at low latitudes along tropical and subtropical coastal areas (Kusmana & Sukristijiono 2016; Serosero et al 2020). On a global scale, mangrove ecosystems are also recognized for their ability to store and sequester large amounts of carbon and significantly contribute to climate change mitigation (Donato et al 2011).

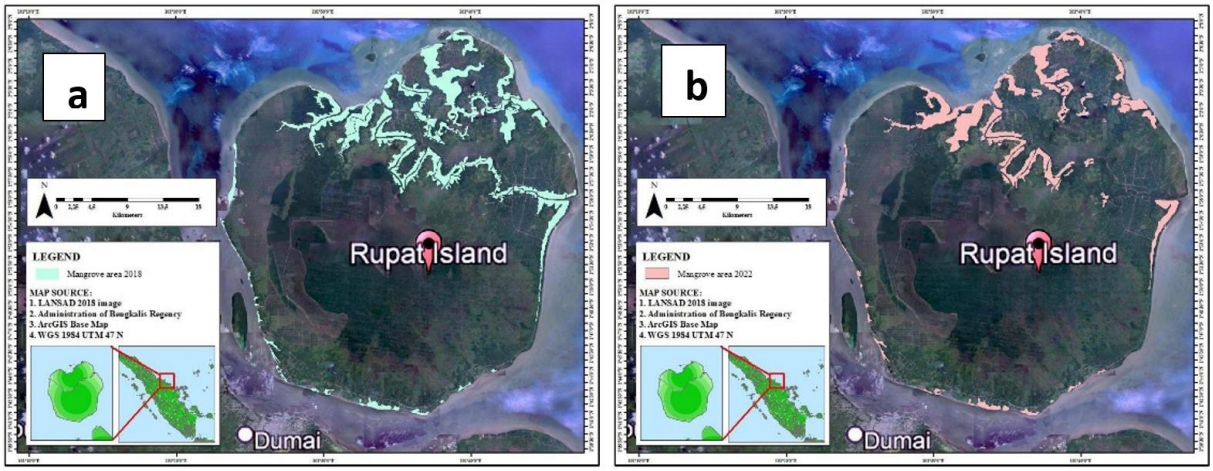

Figure 10. Map of mangrove vegetation distribution in (a) 2018 and (b) 2022.

***Social economy analysis***. Rupat Island is often called Hope Island, because it has enormous potential. The Bengkalis Regency Government is determined to make this hope a reality. Geographically, Rupat's position is very strategic. First, it is located in the Strait of Malacca which directly borders Malaysia, at the crossing of international shipping routes. secondly, Rupat Island is directly adjacent to the island of Sumatra and Dumai City, forming a large industrial area. This island has very interesting marine tourism potential. It is not impossible that one day cruise ships crossing the Malacca Strait will stop by this island to enjoy the charm of the beach with its white sand.

The central government of the Republic of Indonesia has designated Rupat Island as a National Tourism Strategic Area (NTSA), especially a marine tourism area. Unfortunately, until now there has been no concrete program in that direction, either from the central government or the Riau Provincial government. From the capital city of Riau Province, this tourist area can be reached after traveling about 4 hours by road. Rupat Island consists of 2 sub-districts, namely Rupat District (896.35 km$^2$) and North Rupat (628.50 km$^2$). The population of Rupat District is 39,513 people, of which 20,276 people are men and 19,237 people are women. The total population density of Rupat District is 44.082 ind km$^2$. The population of North Rupat is 13,342 people, of which 6,589 people are men and 6,753 people are women. The total population density of North Rupat is 21.23 ind km$^2$. People's livelihoods are generally farmers, livestock breeders, craftsmen, traders, civil servants, private employees, fishermen, laborers and others. From the perspective of the public perception, the development of Rupat Island as a mariculture center is very possible. The local community can accept the presence of mariculture businesses in the area, they even welcome it enthusiastically and want to join in. The openness and willingness of the

community around the mariculture business location is a very important factor to consider. This will be related to business security, labor supply, logistics provision and so on (Effendi et al 2022a; SBR 2023). The availability of the main infrastructure for the mariculture business is a problem in itself. Access is still relatively difficult, considering that you have to cross the Rupat Strait using a ferry boat with a travel time of around 2 hours. This trip will be even more disrupted due to the limited capacity of ferry boats, especially on weekends and national holidays. It is not uncommon for 4-wheeled vehicles, trucks and trailers to have to queue for hours waiting for their turn to be transported. The road conditions on Rupat Island itself are quite poor and make travel times longer. This condition results in the unavailability of all kind of supply centers. The availability of main infrastructure is certainly an obstacle for the development of a business (Fatkhurahman et al 2024).

Supporting infrastructure, such as communication facilities is quite available, but banking facilities are still relatively limited. So far, the domestic harvest has been completely absorbed locally and also marketed in several cities on the island of Sumatra. Government policies are very supportive, starting from the government at the district and provincial levels up to the Central Government in Jakarta. The Ministry of Maritime Affairs and Fisheries fully supports the development program of this maritime center. However, there are obstacles in terms of regulatory aspects from the Ministry of Environment and Forestry, namely regarding the environmental protection and prohibition of the use of mangrove forests (Effendi et al 2023; Mahary et al 2023; Effendi et al 2022b).

**Conclusions**. Rupat Island has been utilized for the cultivation of vannamei shrimp and white snapper. Salinity, pH, temperature, brightness, and dissolved oxygen are considered normal. Wind and current speed are relatively high, although the low and high tide waves' height differences are still suitable for the mariculture program. However, for floating net cages at sea, and cultivating seaweed, the current speed, wave height, and wind speed could be a serious problem. Sediments found t the observation site consisted of sand, mud, gravelly mud, and sandy mud. The average coastline abrasion rate was more than 2 m $year^{-1}$ and it was classified as a high-threat category. The surrounding community has a positive response to the mariculture development proposal. Still, the main business infrastructure is a problem in itself. Access to this area is relatively difficult by crossing the Rupat Strait. So far, the harvest has been completely absorbed locally and marketed to several cities in Sumatra. The government policy is very supportive. However, there are regulatory aspects imposed by the Ministry of Environment and Forestry, regarding the protection of mangrove forests.

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