ENVIRONMENTAL CHARACTERISTICS OF RUPAT STRAIT RIAU PROVINCE

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Abstract

Rupat Strait is one of small strait in Malacca Strait which located in among coastal of Town Dumai area with the Rupat Island in Riau Province. Dumai is known as oil city because there are two of the largest oil companies, namely PT Pertamina and Chevron Pacific Indonesia. In normal conditions, high waves in the Strait of Rupat range 0.07 to 0.21 m, flow velocity 0.22-0.82 m/ s and depths 3-27 m. The middle of the deepest part and the cruise line. Position of Rupat Strait semi-closed with the condition of semi-diurnal tide has potency to cause the happening of oil accumulation in territorial water which can generate the damage of ecosystem territorial waters. Strait Rupat own the variety of various type mangrove representing habitat of various fish type and protect the coast from wave and aberration. Various transportation activity, processing and oil distribution in coastal area of Dumai cause the territorial water of Strait of Rupat gristle to oil contamination.

Key Words: *Riau Province, Rupat Strait, semi-closed and oil accumulation*

1. BACKGROUND

The coastal area is very important and rich in natural resources and the development of environmental services. The intensity of the high coastal resource use can cause degradation of aquatic ecosystems, one of which is oil pollution.

Input of oil to waters from industrial activities and harbour (washing of boats, balasting, unloading of oil and harbor activities including boat traffic). Strait of Rupat is one of a small strait in the Straits of Malacca and is geographically located between the coast of the island of Dumai in Riau Province Rupat ± which has a length of 72.4 km and a width of 3.8-8 km.

Rupat Strait is a strategic transportation route which is susceptible to pollution, including oil. Rupat Strait semi-encloses a body of water which has two tides over the 24 hours. Types of pollutants that are difficult to decompose (resistant) can accumulate in these waters and cause damage to the aquatic ecosystems, including mangroves.

Activities on the island Rupat in general is still rare (only plantation activities). Instead of anthropogenic activities in the city of Dumai potential effects on the aquatic environment Rupat Strait. Activity around the Strait Rupat is transportation, processing, storage and distribution of oil supplies to various areas in Sumatra through freight. This activity caused the waters of the Strait of Rupat vulnerable to oil pollution. These factors include the dynamics of coastal waves, beach slope, tidal flows and currents along the coast has a significant influence to control pollution in the waters (Ali et al. 2008).

Oil Pollution can damage marine ecosystems. Animals and plants can be contaminated by pollutants. Mammals, reptiles and sea birds will be affected due to oil pollution (Romero & Wikelski. 2002). One of the important efforts made in controlling oil pollution is a study of the characteristics of the Straits Rupat include hydro-oceanography, and mangrove vegetation, in the Rupat Strait. Environmental characteristics of the study aim to determine the environmental conditions in the Rupat Strait region that can be used as a reference in policy-making related to planning areas especially Strait of Rupat.

2. RESEARCH METHODS

This study was conducted from April to November 2009 in the Rupat Strait which lies between the coastal of city of Dumai and Rupat Island in Riau Province. Data collection method used was a survey method. Data collected consisted of primary and secondary data. The primary data was obtained through direct measurements in the field, while the secondary data was obtained through literature searches of studies related to this research. Data of collected are hydro-oceanography (currents and waves), and mangrove vegetation. The method of data analysis used is method of descriptively by describing the data obtained (primary and secondary) according to the actual conditions in the field based on a variety of related references.

3. RESULTS AND DISCUSSION

Currents

Currents that occur in the waters of the Strait of Rupat are generated by the long wavy motion generated by the creeping tide of the waterway. In Rupat Strait, at high tide, the current travels from north to south and turns east to rejoin the flow in the Strait of Malacca to the South East and the entrance to the Strait Bengkalis. In contrast at low tide, currents will move from East to West and to the North and to turn out into the Strait of Malacca. Flow velocity in the Strait of Rupat ranges 0.22-0.82 m / s. The average current speed in the Strait Rupat current study can be seen in Figure 1.

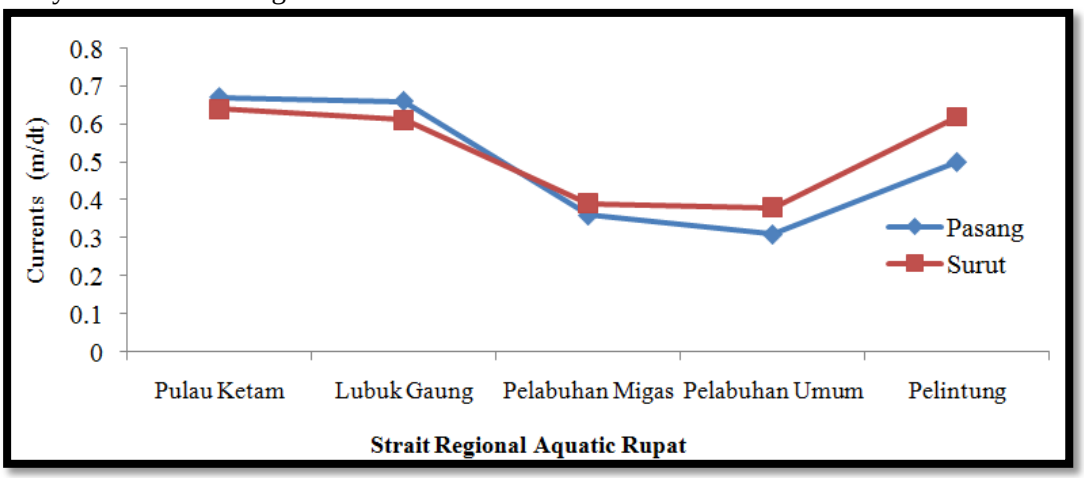

Figure 1 at the sites current Speed Channel waters Rupat

In Figure 1, the speed of surface currents in the Strait of Rupat varies depending on the location and condition of the waters. At high tide, the flow velocity in the territorial waters of Pulau Ketam and Lubuk Gaung are higher than at low tide. Average current speed is highest in the waters of Ketam island at high tide, which is an average of 0.65 m / sec and followed by water Lubuk Gaung of 0.63 m / s. The high speed of currents in these waters is because these waters are directly adjacent to an open waterway. According to Dahuri et al. (2001), open ocean

winds create a movement that is stronger and with bigger waves, so that the waters of the open ocean have a higher speed.

Conversely, at low tide in the Dumai port (common port for oil) and Pelintung, the flow velocity is higher than at high tide, due to the influx of water masses from the east adjacent to open water. Lowest flow velocities found in the harbor (public ports, oil and gas) at high tide with an average speed of 0:36 m/s and 0:40 m/s. The low flow velocity in this region is due to the presence of small islands (Ketam, Payung, Mampu, Rampang and Mantele) that can hinder the speed of flow in the waterway before the entrance to the harbor area.

Wave

In general, the waves in the ocean come from wind. The magnitude of the wave is determined by three factors, namely the strong gusts of wind, wind duration, andthe distance the wind can blow unimpeded. Size of the wave is determined by the high waves (Nontji, 2007). Waves in the Strait of Rupat are relatively smaller than in the Straits of Malacca as the Rupat Strait is a semi-enclosed water body.

In normal conditions, the waves in the Strait of Rupat range 0.07 to 0.21 m, while in the waterway about 0:10 to 0:40 am. The magnitude of the waves in the Strait of Malacca is caused by the open water that has a high wind speed, duration and distance the wind blows unimpeded.

Open water has waves greater than enclosed waters. Instead, the Strait of Rupat semi-encloses the body of water and therefore the waves that form have much smaller dimensions. Wave factors play an important role in determining the feasibility of a place for the location of the port. One of the requirements for a harbor is it must have calm waters and be protected from the onslaught of the waves so the process of loading and unloading can take place safely and quickly. Waves also affect the shape and morphology of the beach.

Based on observations of waves in the five areas of the Strait of Rupat (Ketam Island, Lubuk Gaung, Harbor Oil & Gas, Pelabuhan Umum and Pelintung), the wave height at the study site Strait Rupat vary depending on the location and condition of the waters. Wave height data in Rupat Strait can be seen in Figure 2.

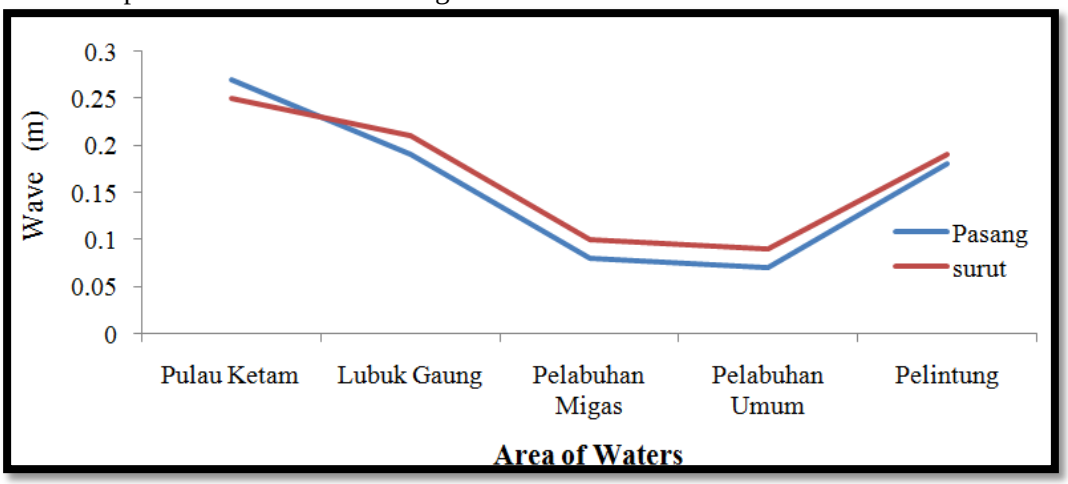

Figure 2 High waves at the sites Rupat Strait waters

At high tide, the waves in the waters of Pulau Ketam are higher than at low tide because the area is directly adjacent to open sea. Conversely, in Strait of Rupat, wave heights continue to decline. Port of Dumai (common port and oil) have smaller waves than other regions because it is protected by small islands (Ketam, Payung, Mampu, Rampang and Mantele) which are able to block the force of the waves from the Strait of Malacca. Furthermore, in the waters of Pelintung, wave heights have increased since been adjacent to the open sea.

Tide

Tide is the movement of rise and fall of sea level on a regular basis due to gravity of the moon and sun. Although based on its size, the mass of the sun is much larger than the moon, based on the mechanics of the universe, the distance between the bodies has more effect than mass. So, the position of the moon to the earth is very dominant in determining the tides in the oceans. Strait Rupat experiences ups and downs twice in 24 hours. According to NONTJI (2007), this type belongs to the type of semi-diurnal tides. Tide pattern is an important influence on marine transport activities, in particular traffic stream to the sea. This condition can potentially cause shipwrecks due to high tidal differences can be to 2.7 m.

Water Depth

The depth of the water is very influential on transportation and shipping flow and determine the feasibility for the development of a port. Water depth ranges from 3-27 m Rupat Strait. The middle of the deepest part and is shipping groove. Strait Rupat also a groove ships transport goods and passengers using the Port of Dumai (Figure 3).

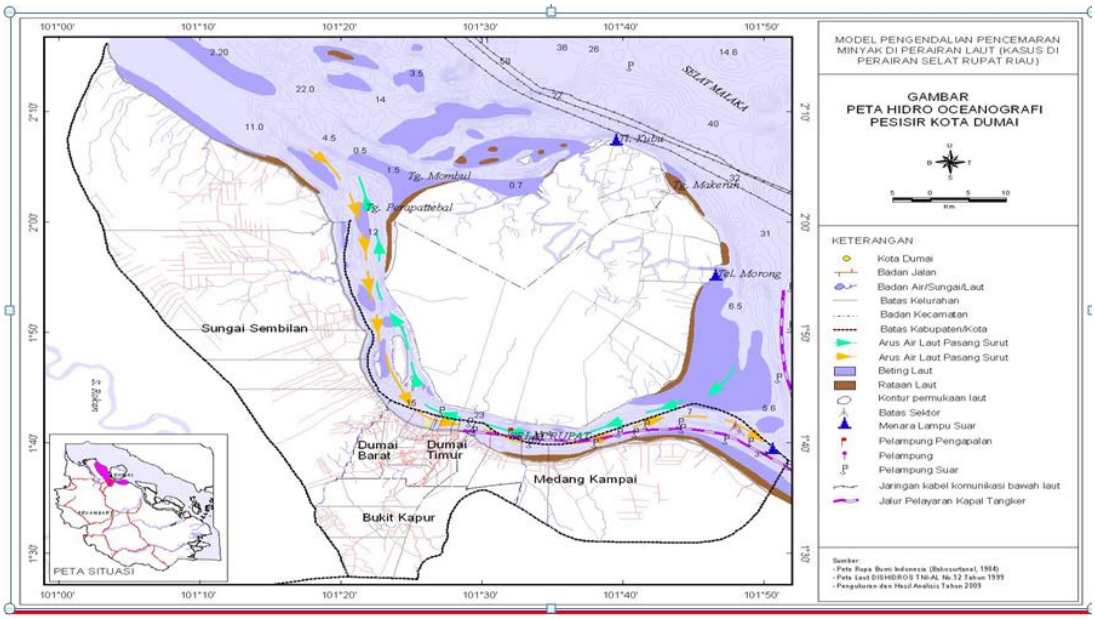

Figure 3 .Hydro-Oceanography conditions (currents and depths) in the waters of the Strait of Rupat

Activity around the Strait Rupat

Dumai is one of the major port city in Riau province, which borders with neighboring countries. Its strategic Dumai city developed rapidly into one of the gates Indonesia and Malaysia State. This position can support the coastal region Dumai City grew as a city of industry and services.

Industrial activity

Dumai is also known as an oil town because there are two biggest oil companies are PT. Pertamina and PT.CPI. Pertamina is the National Oil Mining Company (Pertamina) Refinery Unit II, which is engaged in the processing and distribution of oil and gas in the country. PT. Chevron Pacific Indonesia (PT.CPI) is engaged in the mining and oil and gas exports. Pertamina

UP II Dumai able to process light crude Sumatran crude produced by PT. CPI to be a product of fuel oil (BBM). Production processes at oil refineries Pertamina UP II Dumai supported by the accumulation tank installations, ports, and offices. Production capacity Pertamina Dumai oil refinery can be seen in Table 1.

Table 1 Production of the oil industry on the coast of Dumai oil refinery

No.	Product	Amount (barrels / month)
	BBM	
1	Premium 88	3 385 047
2	Avtur	1 484 048
3	Kerosene	3 827 273
4	ADO (automotif diesel oil)	13 144 040
5	Ref. Fuel Oil	1 545 593
	Non–BBM	
1	LPG	461 196
2	Green Cok	962 800
3	LSWR (low sulfur waxy residu)	335 625

Sources : Pertamina UP II Dumai 2008

Dumai is a strategically location and choice by oil companies for loading / unloading and oil shipments. The oil production from field operations PT CPI can accommodated in the 16 tanks that capacity of total of 5.1 million barrels (CPI 2004).

Maritime transport and port activities

Dumai Port is main ports in Riau province with a strategic geographical position because it has deep waters and protected by islands Rupat Island, Ketam Island, Babi Island, Payung Island and Island Mampu who protected from waves . The Rupat waters is relatively quiet so supportive Dumai Port activities throughout the year. Dumai Port is a distribution and collection center of crude oil, crude and its derivatives. The types of crude oil transported are in the form of LSWR, Naptha, petroleum and coke jet. Export destination to countries are India, USA, China, Korea, Singapore, and Malaysia (Bappeko 2008).

Port of Dumai can be serves regional and international cruise. Regional along the Bengkalis Pakning River, Tanjung Balai, Karimun, and Batam can served by ferry boats. International shipping to Malaysia can using the fast ferry.The number of ship visits and passengers to and from Dumai city each year can be seen in Table 2.

Table 2 Visits and Passenger Ships in the port of Dumai

Type	Year						
	2002	2003	2004	2005	2006	2007	2008
Ship visits	6420	6165	7321	7332	7256	4153	4089
Passenger Departure	451,315	423,456	394,403	398,804	346,895	380,551	375,903
Passenger Arrival	561,214	448,72	410,924	366,918	368,975	333,477	356,285
Total Passenger	1,012.529	872,176	805,327	765,722	715,87	714,028	732,188

Sources: ADPEL (2009)

Based on Table 2, visits of ship each year in the Port of Dumai show fluctuations. In 2002 until 2004 shown trend of increasing. This is due to the increased volume of trade with neighboring countries, especially Malaysia and Singapore. But the increase in ship traffic is inversely proportional to the number of passengers . This is caused by the competition between cost to travel by air versus travel by sea. The cost of travel by ship does not have a significant difference with air transport so that the number of passengers has decreased. In 2004 to 2006 the number of ship arrivals at the Port of Dumai stable, but in 2007 and 2008 the number of ship visits tend to decrease.

Dumai Port is also a port of export and import various of commodities. Export commodities generally consist of oil and gas, and non-oil. These commodities come from outside Dumai that uses the service delivery through the Port of Dumai. Loading and unloading of oil and goods (non-oil) in Dumai city each year can be seen in Figure 4.

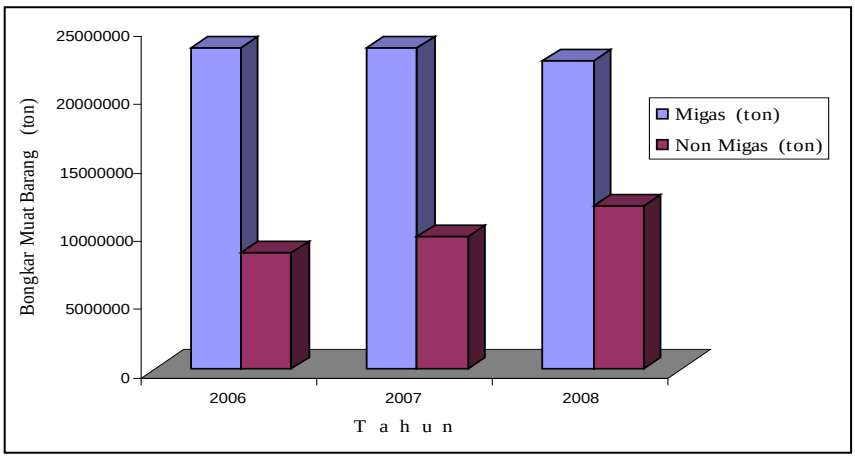

Figure 4 Weight in tons of loading and unloading of ships in the port of Dumai (ADPEL 2009).

The data obtained shows that the loading and unloading of oil and gas (oil) as well as goods in the port of Dumai from 2006 to 2008 tends to fluctuate. Loading and unloading of oil

and gas shows a declining trend due to declining oil production in the province of Riau while non-oil unloading showed an increasing trend.

Fishing activities

Traditional fishing activities in Dumai City show fluctuations and decline. It can be seen from the number of traditional fishermen and their catch. Along with the decline in fish caught by fishermen in Dumai City 2003-2008 (amounting to 5.3%), the number of fishermen who catch fish traditionally also decreased almost three times (546 to 190 fishing families). Data on the number of fish caught and the number of fishermen can be seen in Table 3.

Table 3 .The number of traditional fishing and catches

Description Fisherman and Catch	T a h u n					
	2003	2004	2005	2006	2007	2008
Number of Traditional Fishermen (people)	546	547	188	185	189	190
Total Catch (Tons / year)	903	819.98	657.1	872.02	779.57	854.71

Source: Anonimmuous (2009)

From Table 3, the catch by fishermen in Dumai City (2003-2008) tended to fluctuate. In the years 2003-2005, the catch of fishermen declined, traditional fishermen found fishing in the region difficult; even local fishermen using limited facilities must go to areas far from their village for catch of fish. Types of fish caught by traditional fishermen Dumai can be seen in Table 4.

Table 4. Types of fish caught by traditional fishermen in Dumai city.

No.	Local Name	Scientific Name
1	Belanak	Mugil cephalus
2	Gelodok	Periopthalmus sp
3	Gulama	Otolithis argenteus
4	Sebelah	Cynoglossus lingua
5	Selangat	Leiognathus brevirostris
6	Biang	Setipinna melonchir
7	Parang-parang	Chirocentrus dorap
8	Senangin	Ekutheronema tetradoctylum
9	Belukang	Arius maculatus
10	Mayung	Arius thalassinus
11	Udang putih	Penaeas merguensis
12	Udang lainnya	Penaeas sp

Sources : interviews with fishermen Dumai (2009)

Another factor that caused a decrease of the catch of fishermen from 1991 to 2008 because were damaged and decreasing mangrove ecosystems, covering an area of ± 3,342.7 ha . Based on these data, it indicates that each year in the Strait Rupat mangrove, the area was reduced by 196.6 ha/year. Reduction of the extent of mangrove vegetation was also due to the development of industrial activities, farming and settlements in the coastal areas of Dumai. Decline in mangrove area can affect fish habitat which has depressed .

The decline catch of fish caused reduced number of fishermen in the Dumai. Fishermen in coastal Beach Dumai assume that their catches are no longer able to make ends meet. In addition, the fishermen did not have the ability to catch fish in a location away from the coast of Dumai. Therefore, a party of them switched professions to become construction workers and plantation .

According to Irianto (2009), fish product catch in Dumai area is a range 600-700 kg /day. These fishery products has yet not able to meet the needs of people Dumai City. Therefore, to meet the needs of the community, needed from supply North Sumatra and West Sumatra.

Mangrove Vegetation

Colonies of coastal mangrove forests in the coastal of Dumai are dominated by Rhizophora sp, Avicennia sp, Bruguiera sp, Ceriops sp, and Sonneratia sp. In some locations there are also Xylocarbus sp, Exoecaria sp.), and Oncosperma sp.

According to Nibaken (1992), mangroves are highly productive areas and habitat for a wide range of organisms and contribute to the growth and development of various species of fish and shrimp that have high commercial value. Mangroves can be used directly as fuel wood (charcoal), construction timber, chips, tannin, and pharmaceuticals. Mangrove also indirectly produce trash (litter) who can increasing of fertility for marine organism such as fish, mangrove crabs, mollusks, and so forth (Supriyadi and Sam 2005)..

Based on the interpretation of satellite imagery in 1991, 2002 and 2008 the total area of mangroves in the coastal beach Dumai showed a declining trend, which is of 9206.01 Ha (1991), 7364.06 Ha (2002) and 5863.32 ha (in 2008). Based on these data it can be seen that the area of mangrove in Dumai coastal region has experienced shrinkage from 1991 to 2008 of ± 3342.7 ha. From these data shows that the average annual of mangroves in the Strait Rupat reduced by 196.6 ha. Decline in mangrove area has the potential to affect aquatic ecosystems, especially in the surrounding aquatic biota, including fish.

The development of economic activities in the coastal areas creates impacts to the coastal environment . As a result, the mangrove areas are prone to shrinkage and damage. According to Khomsin (2005), the shrinking area of mangroves in coastal areas is due to the conversion of mangrove forests to industrial and residential areas. Shrinkage and destruction of mangrove is a important problem who has to resolved in the future.

4. CONCLUSION

The heights of wave in Rupat Strait are in the range 0.07 to 0.21 m. The current speed ranges from 0.22 to 0.82 m / s and a depth of 3-27 m. The position of a semi-enclosed Rupat Strait could potentially lead to the accumulation of oil that may cause damage to the aquatic ecosystems. Interpretation of satellite imagery in 1991, 2002 and 2008 show the total area of mangroves in the coastal beach Dumai has shrunk by ± 3342.7 ha. Anthropogenic activities in the city of Dumai potential effects on the aquatic environment Rupat Strait. Depletion of the mangrove area in the Strait Rupat potentially affects the aquatic ecosystems in the vicinity.

5. SUGGESTION

Necessary, study the sensitivity of the Strait of Rupat in a holistic approach to understand the potential for hydrocarbon pollution and control efforts have been made to protect the Strait of Rupat from hydrocarbon pollution.

6. ACKNOWLEDGEMENTS

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