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Abrasion and Accretion in Batam Island

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Abstract. Abrasion and accretion occurring on the coast experienced influenced dynamics such as ocean waves, sedimentation, and development activities in coastal areas. The purpose of this research is to know the area of abrasion and accretion in Batam Island. The method used is to use remote sensing image. Analysis to be used to determine the occurrence of abrasion and accretion with the analysis of Geographic Information System. The results showed that there has been abrasion and accretion in Batam Island. Field survey results indicate that the abrasion caused the erosion of ocean waves and dredging on the coast. The cause of accretion is the development of ports and water attractions that cause additional land. The information of abrasion and accretion in Batam Island is presented in the form of a map.

Keywords: Abrasion, Accretion, Batam Island.

INTRODUCTION

Indonesia is one of the world's unique longest countries after Canada. The coastline of Indonesia is approximately 81,000 km. Indonesia's long coastline condition is a potential natural resource that must be optimized. Various advantages of countries that have the longest coastline among them can be used for marine tourism, fish farming, and marine biota cultivation. Another advantage that Indonesia has as a maritime country is Indonesia's strategic position among other countries.

Indonesia has a strategic position in international waterways. Indonesia's strategic position makes the country of Indonesia often crossed by trade ship traffic. Trade traffic in the Indonesian sea is very high. As a result of high trade traffic, the government seeks to realize the “Sea Toll” (Tol Laut) in Indonesian waters. To realize a Sea Toll in Indonesia required a number of ports that connect to each other, so as to support the smooth Sea Toll in the waters of Indonesia.

Based on Law No. 44 the Year 2007 on Free Trade Zone that Batam is an area belonging to free trade zone and free port, other than Bintan and Karimun [5], although now has changed to Special Economic Zone (KEK) in accordance with Law Number 39 the Year 2009 [7]. A number of ports are located in Batam starting from supporting ports to international-class ports. The number of ports on Batam Island proves that land use in coastal areas is very high and intensive.

The high utilization of land in Batam Island Beach can cause the erosion of land (abrasion) and the addition of land (accretion). Utilization of remote sensing images can be used as a solution to get quick information of abrasion and accretion. Based on the research problems that have been previously described, then this research will focus to know the area of abrasion and accretion in Batam Island. Source of data used to know the area of abrasion and accretion, namely Landsat Image. On the basis of problems and focus on this research, the purpose of this study to

know the abrasion accretion in Batam Island. To produce a specific discussion, the presentation of abrasion and accretion conditions is done based on the Kecamatan in Batam Island.

METHODS

Study Area

This research was conducted in Batam Island, Batam City, Riau Islands Province, Indonesia. Batam Island is divided into sub-districts, such as sub-district Nongsa, Batam Kota, Sungai Beduk, Bengkong, Batu Ampar, Lubuk Baja, Sekupang, Batu Aji, and Sagulung. The location of Batam Island is presented as shown in Figure 1.

Fig 1. Study Area

Data

The data used to know the area of abrasion and accretion that occurred in Batam Island using remote sensing image. The image used is Landsat Image 7 and 8. Landsat images can be through www.earthexplorer.usgs.gov. The Imagery Image used is an image with different year recording, which is Landsat 7 for 2009, Lansat 8 for 2013 and 2016. The method of extraction of coastline information on Batam Island using Landsat Image is by a visual method. Presentation of abrasion and accretion is presented in each sub-district on Batam Island. Stages of processing to obtain information abrasion and accretion in Batam Island, namely: 1) geometry correction, is the initial stage which aims to determine the actual position of the image that has been processed to fit the coordinates x and y, ie by using image processing software. 2) cutting the image, cutting is done at certain coordinates on a particular area, 3) image reinforcement, assist in image digitization process, 4) digitized On-Screen, digitized imagery, 5) overlapping, is a process carried out with at least two geospatial data [1,2,8,9]. Overlapping is done on the Landsat Image digitization for recording in 2009, 2013 and 2016 obtained from the image. [3,4]. The result of overlapping will show the areas experiencing abrasion and accretion in Batam Island, so that will get new geospatial information, that is abrasion and accretion. Geospatial information according to Law Number 4 the Year 2011 can be used as a tool in policy formulation and decision making.

RESULTS AND DISCUSSION

Based on the results of data analysis of areas that have occurred abrasion and accretion in Batam Island (Fig 2), determined by utilizing remote sensing image data. Remote sensing imagery used is Landsat Image 2009 (Landsat 7), 2013 and 2016 (Landsat 8). Abrasion and accretion that occur in Batam Island spread in 9 sub-districts, such as Nongsa, Batam Kota, Sungai Beduk, Bengkong, Batu Ampar, Lubuk Baja, Sekupang, Batu Aji, and Sagulung.

Fig 2. Images of Batam Island

1) Abrasion and Accretion in Nongsa Sub-district.

According to Figure 3, the coastline changes in Nongsa Sub-district have major changes in some areas, and partly the development of infrastructure such as marine tourism in coastal areas in the eastern part that make land increase or accretion in the Punggur Harbor, as well as the occurrence of abrasion along the harbor dock due to the dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

Fig 3. Abrasion and Accretion in Nongsa

2) Abrasion and Accretion in Batam Kota Sub-district

According to Figure 4, there is abrasion and accretion in Batam Kota Sub-district. There have been major changes in some places, and changes have been due to coastal development. The existence of harbors and industrial estates in the coastal areas that make the land increased or accretion due to hoarding, as well as the occurrence of abrasion throughout the industrial area due to dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

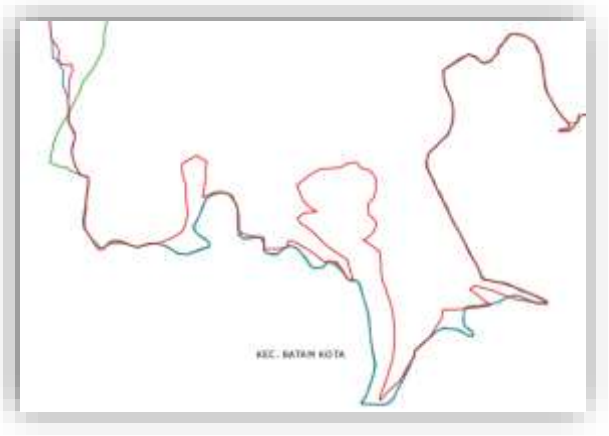

Fig 4. Abrasion and Accretion in Batam Kota

3) Abrasion and Accretion in Sungai Beduk Sub-district

According to Figure 5, it can be seen that there are abrasion and accretion in Sungai Beduk Sub-district. There have been major changes in some places, and changes have been due to development of infrastructure in the northwest coastal areas such as some harbors and industrial estates that have made land increase or accretion, as well as abrasion throughout the industrial estate due to dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

Fig 5. Abrasion and Accretion in Sungai Beduk

4) Abrasion and Accretion in Bengkong Sub-district

Based on Figure 6, it can be seen that there are abrasion and accretion in Bengkong Sub-district. There have been major changes in some places, and partly the development of infrastructure in the northwest coastal areas such as some harbors and industrial estates that have made land increase or accretion, as well as abrasion throughout the industrial estate due to dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

Fig 6. Abrasion and Accretion in Bengkong

5) Abrasion and Accretion in Batu Ampar Sub-district

Based on Figure 7, it can be seen that there are abrasion and accretion in Batu Ampar Sub-district. There have been major changes in some places, and partly the development of infrastructure in the coastal areas such as some harbors and industrial estates that have made land increase or accretion, as well as abrasion throughout the industrial estate due to dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

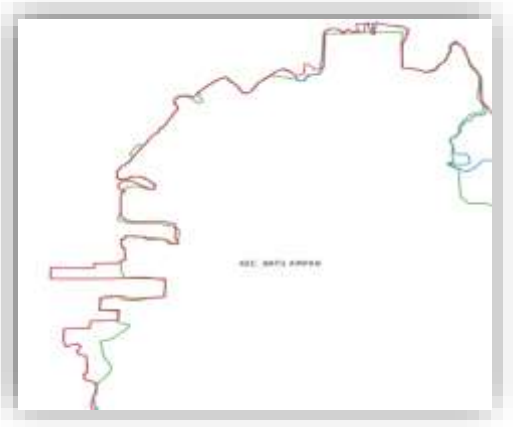

Fig 7. Abrasion and Accretion in Batu Ampar

6) Abrasion and Accretion in Lubuk Baja Sub-district

Based on Figure 8, it can be seen that there are abrasion and accretion in Lubuk Baja Sub-district. There have been major changes in some places, and partly the development of infrastructure in the coastal areas such as some harbors and industrial estates that have made land increase or accretion, as well as abrasion throughout the industrial estate due to dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

Fig 8. Abrasion and Accretion in Lubuk Baja

7) Abrasion and Accretion in Sekupang Sub-district

Based on Figure 9, it can be seen that there are abrasion and accretion in Sekupang Sub-district. There have been major changes in some places, and partly the development of infrastructure in the coastal areas such as some harbors and industrial estates that have made land increase or accretion. Sekupang Sub-district is known to have two major ports, it is a domestic port and international port. For domestic ports serve domestic passengers around the Riau Islands, while international ports serve passengers to Singapore and Malaysia.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

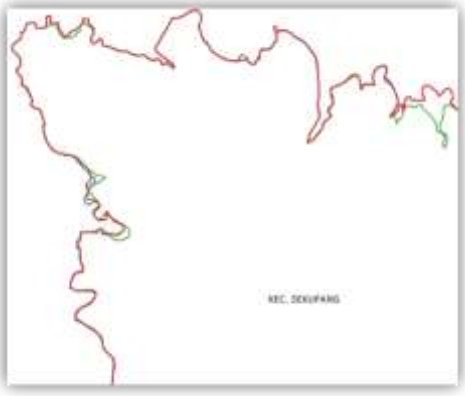

Fig 9. Abrasion and Accretion in Sekupang

8) Abrasion and Accretion in Batu Aji Sub-district

Based on Figure 10, it can be seen that there are abrasion and accretion in Batu Aji Sub-district. There have been major changes in some places, and partly the development of infrastructure in the coastal areas such as industrial estates that have made land increase or accretion, as well as abrasion throughout the industrial estate due to dredging.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

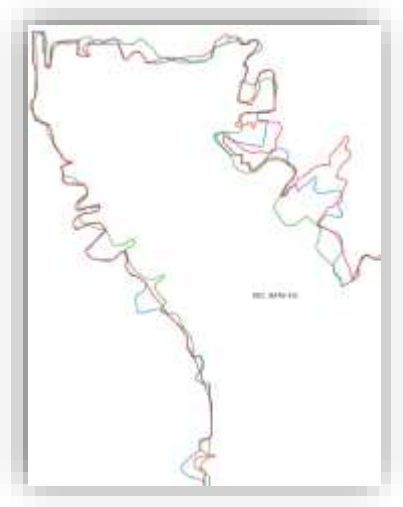

Fig 10. Abrasion and Accretion in Batu Aji

9) Abrasion and Accretion ini Sagulung Sub-district

Based on Figure 11, it can be seen that there are abrasion and accretion in Sagulung Sub-district. significant because the sea waves are not too large, along the coastline is a heavy industrial manufacture of heavy materials such as large ships and the sea currents velocity are relatively low including around the Batam Island [10]. The coastal area of Sagulung Sub-district is known to be a lot of shipyard industry so that the land use in the coastal area becomes very high.

a) Coastline of 2009
b) Coastline of 2013
c) Coastline of 2016

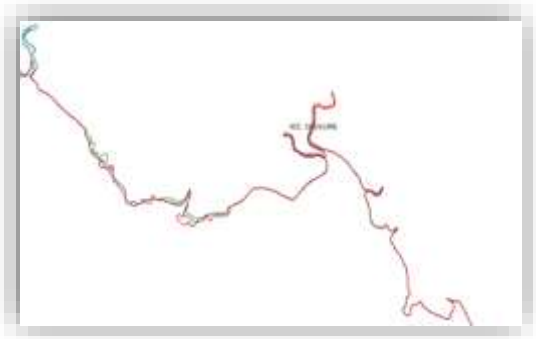

Fig 11. Abrasion and Accretion in Sagulung

CONCLUSION

Based on the results and discussion and its relation with the research objectives that have been determined, it can be concluded:

1) landsat imagery can be used as a source for obtaining abrasion and accretion information in Batam Island.
2) there has been abrasion and accretion in Batam Island spread over 9 Sub-districts, namely Nongsa, Batam Kota, Sungai Beduk, Bengkong, Batu Ampar, Lubuk Baja, Sekupang, Batu Aji, and Sagulung.

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