E-ISSN : 2686-6331
P-ISSN : 2686-6358
DINASTI INTERNATIONAL JOURNAL OF EDUCATION MANAGEMENT AND SOCIAL SCIENCE (DIJEMSS)
https://dinastipub.org/DIJEMSS dinasti.info@gmail.com +62 811 7404 455
DOI: https://doi.org/10.38035/dijemss.v5i6
Received: 1 July 2024, **Revised:** 19 August 2024, **Publish:** 30 August 2024

Coastal Protection Strategy And Its Impact On Abrasion Disaster Mitigation In The Wonokerto Coastal Area Pekalongan City

Hanung Garnish Aulia[1], Aditya Saputra[2]
[1]Faculty of Geography, Muhammadiyah University of Surakarta, e100200076@student.ums.ac.id
[2]Faculty of Geography, Muhammadiyah University of Surakarta, as105@ums.ac.id

Corresponding Author: e100200076@student.ums.ac.id[1]

Abstract: This study aims to identify what are the coastal protection strategies and identify the impacts of abrasion disasters on the region. In addition, this study also wants to ensure that mitigation efforts not only focus on physical protection, but also consider the sustainability of ecosystems and the well-being of coastal communities. In addition, this study also wants to ensure that mitigation efforts not only focus on physical protection, but also consider the sustainability of ecosystems and the well-being of coastal communities. The research method used is literature study and secondary data analysis related to coastal protection strategies that have been implemented and their impact on abrasion mitigation. The results of the study show that the implementation of coastal protection strategies such as the construction of breakwaters, sea embankments, mangrove management, sand management, by adding sand to eroded beaches, implementing integrated management of coastal areas has had a positive impact on abrasion disaster mitigation in the region. However, challenges such as climate change and ecological imbalances need to continue to be considered in designing sustainable coastal protection strategies in the future. In conclusion, this study provides useful insights for policymakers and practitioners related to abrasion disaster mitigation efforts in the coastal area of Wonokerto, Pekalongan.

Keyword: Strategy, Coastal Protection, Mitigation, Abrasion

INTRODUCTION

Indonesia is one of the largest archipelagic countries in the world and has the longest coastline compared to other archipelagic countries. As an archipelagic country, coastal areas in Indonesia are very vulnerable to a disaster. Various kinds of disasters can occur in coastal areas in Indonesia such as tsunamis, floods, abrasion, sea *level rise*, and other marine natural disasters (Arianto, 2020).

One of the threats to coastal areas in Indonesia is the change in coastline. Coastline change is a form of dynamism of coastal areas, changes in the coastline that occur are in the form of sedimentation or accretion and abrasion. The process of abrasion in coastal areas is caused by 2 factors, namely natural factors and human factors. Natural factors are usually caused by wave currents, an increase in temperature in the earth resulting in global warming

and, the topography of the region. The Human Factor is usually caused by the destruction and logging of mangroves in coastal areas and, sand mining activities in coastal areas (Palisu, 2020).

Coastal abrasion is one of the main threats to coastal areas around the world, including in the city of Pekalongan, Indonesia. This phenomenon is caused by a combination of natural factors such as waves, ocean currents, and storms, as well as unsustainable human activities, such as coastal development and mangrove deforestation (Bogart et al., 2021). The city of Pekalongan, located on the northern coast of Java, often experiences significant abrasion, resulting in economic losses, environmental damage, and threats to the sustainability of coastal communities.

The coastal area of Wonokerto Pekalongan, located on the northern coast of Java Island, is an area that is very vulnerable to the impacts of climate change and human activities. The main threats faced by this region are abrasion, sea level rise, and declining coastal environmental quality. The resulting coastal abrasion has caused significant land loss, damaged infrastructure, and threatened the livelihoods of local communities. This problem is further exacerbated by climate change causing sea level rise and an increase in the frequency of tropical storms (Bariroh & Surtikanti, 2024).

Coastal abrasion in Pekalongan has had a direct impact on the lives of coastal communities, especially fishermen and pond farmers. The real impact experienced by Wonokerto residents due to abrasion disasters based on initial observations of the research, researchers obtained information related to this including: 1) loss of land and settlements, one of the most obvious impacts of abrasion is the loss of land and settlements. Abrasion causes the coastline to continue to shift to the mainland, so that houses and land owned by residents are flooded or lost. Many houses are severely damaged or even collapsed due to constant abrasion, 2) loss of livelihoods, most of the residents of Wonokerto depend on agriculture, fisheries, and small businesses related to coastal resources. Coastal abrasion destroys farmland and reduces fish catches, resulting in a decrease in income. Fishermen are experiencing difficulties because their fishing areas are affected by changes in coastlines, 3) damage to infrastructure, infrastructure such as roads, bridges, and other public facilities are also affected by abrasion. Roads that were previously accessible are now submerged in seawater or severely damaged, so that the mobility of residents is disrupted. This damage to infrastructure also makes it difficult to access basic services such as education and health, 4) health problems, abrasion disasters also have a bad impact on the health of residents. Seawater that enters settlements causes clean water to be polluted, thereby increasing the risk of diseases such as diarrhea and skin infections. Humid and waterlogged environmental conditions are also a breeding ground for mosquitoes, which can cause dengue fever.

Degradation of the coastal environment affects their productivity and reduces the space for other economic activities such as tourism and small industries (Adriadi & Afifi, 2022). Coastal protection efforts are very important to maintain environmental sustainability and the welfare of people in this region. Therefore, various coastal protection strategies have been implemented by the government and local communities (Jatayu et al., 2024).

To address this problem, various coastal protection strategies have been implemented in different parts of the world, ranging from hard approaches such as the construction of sea walls and groins, to soft approaches such as mangrove ecosystem restoration and coastal sand engineering (Sánchez-artús et al., 2024). Each strategy has its own advantages and disadvantages, and its effectiveness is highly dependent on local conditions, including wave characteristics, sediment types, and human activity around the coast (Carolina et al., 2024).

In Pekalongan City, the government and local communities have made various efforts to mitigate coastal abrasion. Some of the steps taken include replanting mangroves, building breakwaters, and arranging coastal areas. However, the effectiveness of these strategies still

needs to be evaluated in depth to ensure their sustainability and long-term success (Lower et al., 2024).

One of the strategies that is often used is the construction of hard infrastructure such as *breakwater* and *seawalls*. This structure is designed to withstand the rate of abrasion by breaking waves before reaching the coast (Arifah, 2023). Although effective in the short term, these methods often have adverse environmental impacts, such as changes in current patterns and sedimentation that can damage coastal ecosystems (Salsabila & Karmilah, 2022). Therefore, there needs to be a thorough evaluation of the effectiveness and impact of this strategy.

In addition to hard infrastructure, ecosystem-based approaches are also increasingly popular as coastal protection strategies. Mangrove planting and coral reef rehabilitation are examples of this approach. Mangroves, with their strong and complex roots, are able to resist erosion and provide important habitats for various marine species (Tabalessy, 2023). Similarly, coral reefs not only serve as a natural barrier to ocean waves, but also support high biodiversity.

However, the implementation of coastal protection strategies does not always provide the expected results. Hard infrastructure can lead to natural habitat destruction and ecosystem changes that negatively impact biodiversity (Nizam et al., 2024). On the other hand, ecosystem-based approaches take a long time to show significant results and often face challenges in terms of maintenance and sustainability (Puspita et al., 2021). Therefore, it is important to evaluate the impact of these two approaches comprehensively.

The results of this study are expected to provide relevant recommendations for policymakers, local governments, and communities in more effective and sustainable coastal protection efforts. With the right approach, it is hoped that the coastal area of Pekalongan Beach can be protected from the threat of abrasion and climate change, while still maintaining the balance of the ecosystem and environmental sustainability.

The importance of this research also lies in its contribution to developing better adaptation strategies to climate change. By understanding the impacts of different coastal protection approaches, authorities can develop more comprehensive and responsive policies to changing environmental dynamics.

Overall, this study aims to identify what are the protection strategies to overcome abrasion in the coastal area of Wonokerto, Pekalongan city and identify what are the impacts of abrasion disasters in the area. In addition, this study also wants to ensure that mitigation efforts not only focus on physical protection, but also consider the sustainability of ecosystems and the well-being of coastal communities. Through this research, it is hoped that solutions can be found that can provide long-term benefits for the environment and communities in the coastal area of Wonokerto, Pekalongan city.

METHOD

The research method used in this study is qualitative. Qualitative research is research that is descriptive and tends to use analysis (Abdussamad, 2021). This research focuses on an in-depth understanding of coastal protection strategies and their impact on the environment in the coastal area of Wonokerto Pekalongan.

A qualitative approach was chosen because it can provide a holistic and in-depth insight into the experiences, perceptions, and views of the stakeholders involved in the issue. The first step in this method is the study of the literature, where secondary data is collected from various sources such as scientific journals, research reports, and government documents to provide the necessary theoretical basis and context.

Furthermore, field observations are carried out to gain a direct understanding of the physical condition of the beach, the protection infrastructure that has been built, and the visible environmental impact. These observations are important to complement the

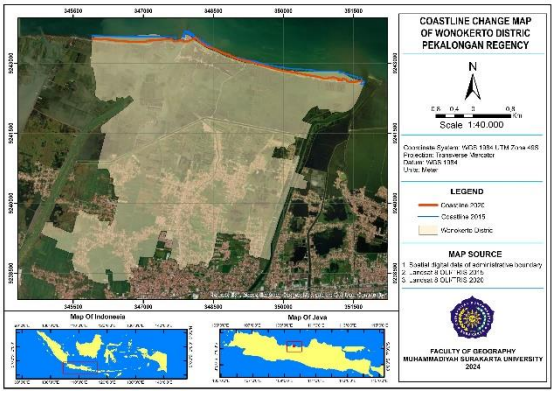
information obtained from literature studies and provide a more complete picture of the situation in the field (Nasution, 2023). In addition, in-depth interviews will be conducted with various stakeholders, including local governments, local communities, environmentalists, and non-governmental organizations.

This semi-structured interview will help in gaining an in-depth perspective on the effectiveness and impact of the coastal protection strategies that have been implemented, as well as the challenges faced in their implementation. Focus Group Discussions (FGDs) will also be held to hold focus group discussions with representatives of coastal communities, which aim to gather various views and experiences related to coastal protection and its impact on daily life.

Data obtained from observations, interviews, and FGDs will be analyzed using thematic analysis methods. This analysis involves identifying the key themes that emerge from the data, thematic groupings, and in-depth interpretations of each theme. Triangulation techniques will also be used to improve the validity and reliability of data by comparing data from various sources and methods to ensure consistency of findings (Nasution, 2023). With this method, it is hoped that the research can provide a deep understanding of the effectiveness of coastal protection strategies and their impact on the environment in the coastal area of Pekalongan Beach.

RESULTS AND DISCUSSION

Wonokerto, a beautiful coastal region in Indonesia, faces serious challenges related to coastal protection due to increasing erosion and the threat of natural disasters such as flash floods and tsunamis. To protect the fragile environment and the communities living around the coastline, various protection strategies have been implemented in hopes of reducing damage and promoting sustainability.



Images of the Research Location

Coastal protection strategies in Wonokerto, as in many other coastal locations, are critical to reducing environmental damage and protecting communities and infrastructure from the adverse effects of extreme weather and coastal erosion. Some commonly applied strategies for coastal protection in Wonokerto include:

A. Hard Structure (Hard Engineering)

1. Breakwater

   Breakwaters have been implemented in some parts of Wonokerto beach. These structures are placed offshore to reduce the energy of waves hitting the coastline, which in turn reduces abrasion.

2. Seawall

Sea embankments are built along the coastline to protect coastal areas from ocean waves and floods. This embankment is designed to hold seawater so as not to damage the land behind it.

B. Soft Structure (Soft Engineering)

1. Planting of Coastal Vegetation

The planting of mangroves and other vegetation on the coast of Wonokerto has been carried out to strengthen the soil and reduce the speed of water flowing to the beach. The roots of mangrove plants help to hold sand and soil, thus reducing the risk of abrasion.

2. Sand Management (Beach Nourishment)

Sand management is carried out by adding sand to the beach that has been eroded. This process helps to increase the width of the beach, provide natural protection against waves and reduce abrasion.

C. Integrated Coastal Zone Management (ICZM)

The Pekalongan local government collaborates with various stakeholders in an effort to implement ICZM. This approach involves sustainable planning and management as well as community participation to protect the coastal area as a whole.

Impact on Abrasion Disaster Mitigation in Wonokerto

1. Reduce Abrasion Rate

The breakwaters and seawalls built in Wonokerto have effectively reduced the energy of waves hitting the coastline. This has a direct impact on reducing the rate of abrasion in this region. Mangrove planting also strengthens the soil and resists erosion.

2. Protection of Infrastructure and Settlements

Hard structures such as sea embankments have provided significant protection to infrastructure and settlements in Wonokerto. With this protection, the risk of economic and social damage and losses can be minimized.

3. Coastal Ecosystem Conservation

Mangrove planting on the Wonokerto coast not only reduces abrasion but also supports the sustainability of coastal ecosystems. Mangroves provide habitat for various marine species and birds, as well as serve as a natural barrier against waves.

4. Adaptation to Climate Change

Wonokerto's coastal protection efforts are helping the region adapt to extreme weather conditions that are more frequent due to climate change. The hard and soft structure applied is able to reduce the impact of storms and high waves.

5. Economic and Social Efficiency

Investments in coastal protection strategies have reduced the costs associated with damage and recovery after abrasion disasters. In addition, coastal protection also supports local economic activities such as fisheries and tourism, which are highly dependent on good coastal conditions.

The coastal area of Wonokerto in Pekalongan City has implemented various coastal protection strategies to reduce the impact of abrasion. The use of a combination of hard structures such as breakwaters and sea embankments with soft structures such as mangrove planting and sand management shows positive results in abrasion disaster mitigation.

ICZM's approach of involving various stakeholders and the participation of local communities allows for more effective and sustainable management. This approach involves not only technical aspects, but also considers social and environmental aspects, so that coastal protection strategies can be applied holistically.

The results of the coastal protection strategy in Wonokerto show a decrease in abrasion rates, protection of infrastructure and settlements, and conservation of coastal ecosystems. In addition, adaptation to climate change has also become better, with structures that are able to withstand high waves and storms. Economic and social efficiency is also increasing, with support for sustainable local economic activities.

Overall, the coastal protection strategy in Wonokerto provides an example of how an integrated and participatory approach can be effective in addressing abrasion problems and protecting coastal areas from the impacts of disasters.

CONCLUSION

The city of Pekalongan has adopted various coastal protection strategies to overcome abrasion, including the construction of breakwaters, seawalls, and mangrove planting. Breakwater and seawalls aim to dampen ocean waves, while mangrove planting serves as a natural barrier against abrasion.

These strategies have shown effectiveness in reducing the impact of abrasion in some coastal areas. Mangrove planting, for example, has succeeded in stabilizing the coastline and increasing local biodiversity.

In addition to environmental protection, coastal protection strategies also have a positive impact on people's welfare. With reduced abrasion, agricultural land and residential areas are more protected, which in turn supports economic and social stability.

Despite the improvements, some challenges remain, such as limited funding and a lack of public awareness of the importance of coastal protection. Therefore, collaborative efforts are needed between the government, the community, and the private sector to continue to improve these mitigation efforts.

The coastal protection strategy implemented in Pekalongan City has made a significant contribution to abrasion disaster mitigation. This success demonstrates the importance of an integrated approach involving various stakeholders and the use of nature-based technologies and solutions in addressing coastal environmental issues.

REFERENSI

Abdussamad, Z. (2021). *Metode Penelitian Kualitatif*. CV. syakir Media Press.

Adriadi, G. S., & Afifi, M. (2022). *Pengembangan Kegiatan Ekonomi Berbasis Blue Economy Di Kawasan Pesisir Kek Mandalika*. 1–10.

Arianto, M. F. (2020). *Potensi wilayah pesisir di negara indonesia*. *November*.

Arifah. (2023). *Pemanfaatan Data Hidro-Oseanografi Untuk Menentukan Tipe Bangunan Pantai Menggunakan Analytical Hierarcy Process (Ahp) Di Dusun Laok Bindung, Situbondo*.

Bariroh, G., & Surtikanti, H. K. (2024). Strategi masyarakat pesisir Margolinduk dalam penanganan banjir rob serta implikasi terhadap sikap peduli lingkungan. *Applied Environmental Science*, *1*(2), 69–86. https://doi.org/10.61511/aes.v1i1.2024.303

Bogart, J., Abrogueña, R., Joydas, T. V, Pappathy, M., Cali, N. A., Alcaria, J., & Shoeb, M. (2021). Structure and composition of the macrobenthic community associated to shallow mangrove-seagrass habitat along the southern Red Sea coast , Saudi Arabia. *Egyptian Journal of Aquatic Research*, *47*, 61–66. https://doi.org/10.1016/j.ejar.2020.10.001

Carolina, N., Battiau-queney, Y., Ventalon, S., Abraham, R., Sipka, V., Cohen, O., & Marin, D. (2024). *Bedforms and Sedimentary Features Related to Water-Depth Variations in a Sandy Tidal-Flat Environment*. *2012*, 80–103. https://doi.org/10.2112/JCOASTRES-D-23-00025.1

Jatayu, A., Idajati, H., Umilia, E., & Abdurrakhman, A. (2024). *Penguatan Kapasitas dan Strategi Adaptasi Sektor Pariwisata Gili Ketapang dalam mendukung*

Pengembangan Wisata Berbasis Ketahanan Iklim. *8*(3), 1–13.

kepdirjen Kelautan, K., & Perikanan, D. A. N. (2021). *Direktorat jenderal pengelolaan ruang laut*.

Lower, E., Sturtevant, R., Iott, S., Martinez, F., Rutherford, E., Mason, D. M., Redinger, J., & Elgin, A. K. (2024). The Great Lakes ' most unwanted : Characterizing the impacts of the top ten Great Lakes aquatic invasive species. *Journal of Great Lakes Research, September 2023*, 102365. https://doi.org/10.1016/j.jglr.2024.102365

Nasution, A. F. (2023). *Metode Penelitian Kualitatif*.

Nizam, K., Maulud, A., Azmi, A. T., & Harun, S. N. (2024). *Eko-kejuruteraan dalam Penerapan Pertahanan Pantai berasaskan Alam Eko-kejuruteraan dalam Penerapan Pertahanan Pantai berasaskan Alam Semula Jadi*. *36*(January). https://doi.org/10.17576/jkukm-2024-36(1)-08

Palisu, B. J. (2020). *Investigasi Bencana Abrasi Di Berbagai Wilayah Masyarakat Pesisir Di Indonesia*. *5*(2), 148–152.

Puspita, Z., Juhanda, A., & Windyariani, S. (2021). *Pengaruh Pendekatan Inkuiri-Kontekstual Berbasis Teknologi Informasi Terhadap Keterampilan Proses Sains Peserta Didik SMA Pada Konsep Ekosistem*. *07*, 176–184.

Salsabila, A., & Karmilah, M. (2022). *Potret Krisis Sosio-Ekologi Kawasan Pesisir Dampak Reklamasi*. 9–21. https://doi.org/10.26418/uniplan.v3i1.52818

Sánchez-artús, X., Subbiah, B., Gracia, V., Espino, M., Grifoll, M., Espanya, A., & Sánchez-arcilla, A. (2024). Evaluating barrier beach protection with numerical modelling . A practical case. *Coastal Engineering*, *191*(April), 104522. https://doi.org/10.1016/j.coastaleng.2024.104522

Tabalessy, R. R. (2023). *EKOSISTEM MANGROVE KOTA SORONG (Kajian Kondisi Ekosistem, Nilai Manfaat dan Prioritas Pengelolaan)*.