The Abudance Of Makrozoobenthos On Different Break Water In Semarang And Demak Coastal Area

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The Abudance Of Makrozoobenthos On Different Break Water In Semarang And Demak Coastal Area

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Abstract. The coast of Semarang and Demak has suffered some damage to its coastal areas. This damage is caused by natural factors and also human activities. There are number of mitigation methods such as hard, soft and hybrid that available for mitigation erosion. In Semarang and Demak coastal area using hard and hybrid option as their mitigation erotion. Breakwater is one of the way beach structure that often used as mitigation erosion di coastal area. Breakwater will cause sediment deposits that will become the living place of various organisms such as makrozoobenthos. The aim of this research is compare the abudance of makrozoobenthos in different type breakwater in Semarang and Demak coastal area.This research held on December 2016 – January 2017 in five different location with different breakwater type. Hard structure in Mangkang (West Semarang), Morosari (Demak district) and Tambak Lorok (North Semarang) and the hybrid engineering in Morosari 2 (Demak district) and Timbulsloko (Demak district). The method used in this study is descriptive comparative. Makrozoobenthos has been found in each station and the highest indeks is in hybrid engineering location. Polychaeta is a genus that dominates at every location because muddy sand is its main habitat.

Keywords: mitigation, breakwater, makrozoobenthos, Semarang, Demak

1. Introduction

The coastal region is a potential area for various activities, since the coastal area is a large zone for settlements, it has an important role in the wealth of many countries [1]. Because the area is very potential for various activities, then this region is also very vulnerable to the environmental

changes [2]. The changing of coastal area has influenced by several factors. It has regularly affected by natural mechanism and has rapidly received human activities [3]. As in some coastal areas in Semarang and demak has been damaged in its coastal areas.The coastal damage of Semarang has also been investigated by FoE (Friend of the Earth) Japan (2009) [4] stating that since 1998 many residents in the coastal area of Tugu sub-district lost the ponds due to the abrasion by the sea water into the river with a high intensity so that the access road becomes drowned. Furthermore [5] in the period of 1991 - 2011 there was a change in the characteristics of the beach that is the length of the coastline increased 9.70 km (103.6%) and the area of abrasion in 2011 = 22.7% or 1,198.8 ha. If this is continue, the citizens will lose farmland and aquaculture areas. In Timbulsloko area (Morosari, Demak district), coastal change mainly because of the land conversion [6]. Furhermore [8] land conversion is not the only cause damage of Timbulsloko coat, but there are other triggering factors, namely the extension of the breakwater of Tanjung Emas harbor, land subsidence and sea-level rise Mangkang beach (West Semarang) is one of the beach that used for livelihood by the fishermen, and Morosari beach (Demak district) also became a tourist attraction for the people of Demak and surrounding areas.

To overcome various environmental damage can be through several ways as mitigation methods. Such as build some permanent structure or soft structure as breakwater in some coastal area. Mangkang (West Semarang), Morosari (Demak district) and Tambak Lorok (North Semarang) coastal area has breakwater to reduce the wave. The breakwater structure made from different material with different type. The type was hard structure in Mangkang and Tambak Lorok, and hybrid enggineering in Morosari. The hard structure is made from the concrete block and stone block and the second type is hybrid enggineering, this type using Paralon and bamboo as its main material. Hybrid engineering is a new methods thats being developed. The basic principle of the development of the breakwater with hybrid engineering type is to mimic the function of mangrove in protecting coastal, which dampen wave energy and trap sediment using environmentally friendly materials[6]. The impact of breakwater development is the formation of sediments on every breakwater. Sediment is a habitat for some living things such us makrozoobenthos. The aim of this research is to see the difference of macrozoobenthos abundance in the breakwater structure that has different material arrangement. Macrozoobenthos is used as an indicator, because macrozoobenthos is a living organism (sesile) and has varying adaptability to several environmental conditions [10]. Some macrozoobentos are also used to indicate whether a water is being polluted or not like Oligochaeta that has been used as an indicator of polluted waters [6]. [8] also explain that the diversity of macrozoobenthos can increase along the age of mangrove species in the rehabilitation programs. Thus, the purpose of this research is to see what is the difference of macrozoobenthos between hard structure and the hybrid enggineering breakwater type.

2. Methodology

This research was conducted in December 2016 - January 2017 in Mangkang (West Semarang), Morosari (Demak) and Tambak Lorok (North Semarang) coastal area. The research material includes sediment substrate, organic matter content, water quality and macrozoobenthos in Mangkang, Morosari and Tambaklorok coastal area. This research method is descriptive comparative method.

2.1 *Study area*

The location of the research is in five stations: Mangkang beach that breakwater made from concrete buis, Morosari beach first station that breakwater made from block stone, Morosari beach second station with hybrid enggineering type from paralon as the main material, Timbulsloko stasiun with hybrid enggineering from bamboo and the last one is Tambak Lorok

station with break water from concrete buis. Each station is taken with 5 sampling points. Map of the study shown in Figure 1.

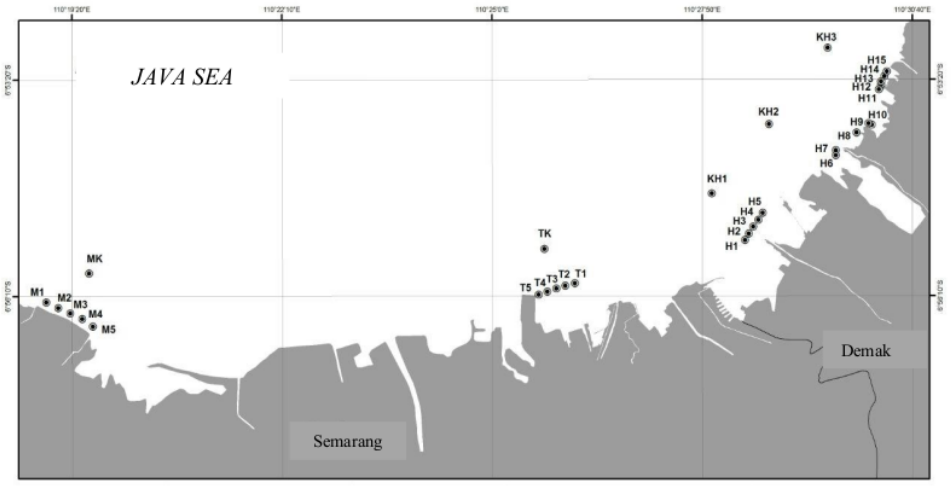

Figure 1. Area of Study

2.2 *Sediments sample*

Samples of mud containing macrozoobenthos were taken using Van Veen Grab tool, mud samples separated ± 25 grams for organic material analysis, 250 grams for grain size analysis and the rest sieved using bentos filter made from wire. The macrozoobenthos sample was then preserved by using 10% formalin which had been mixed with Rose Bengale solution. After reaching the labolatorium the sample was washed and sorted and then samples in the form of worms preserved with a 70% alcohol solution. Furthermore the sample is identified up to the genus level. Data analysis is done by determining the value of diversity index (H'), uniformity index (E) and dominance index (C). Measurements of water quality parameters include temperature, salinity, dissolved oxygen and pH.

3. Result and Discussion

Mitigation of coastal erosion is a difficults task since a number of parameters and processes are involved in the same [7]. Some parameters like biological, chemical and physic parameter will involved during the process. Most of conventional protection methods are build breakwater. Breakwater can build by three type which is soft structure, hard structure and hybrid structure. Hard structure usualy expensive because its using material permanent such us concerete and rubble mound, masive in size and sometimes not eco-friendly[7]. The soft structure is using green belts, dune rehabilitation, dune vegetation. This type is not expensive, not massive in size and mostly eco-friendly. The last type is hybrid that is combination between the hard and soft structure type. Its also calles as permeable dams [8]. This type is hard structure with soft engginering. The hybrid type using bamboo, wood or paralons as their materials.

Breakwater on each coastal area may vary, depend on the amount of the damage [9]. Hydroocenography and substratum are the major aspects need to be identified accurately prior to design the permeable breakwater. Factors that need to be identified include: water depth, bed

slope, type of soil and its substrate, salinity, height and direction of wave, tidal, velocity and direction of currents, and sediment source.

The breaking wave which has been existed in surf zone will be transporting sediment along coastal area. With the breakwater among the coastal area it will caused some effect. One of the effect is sedimentasion. The accumulated sediments are home to a variety of organism, such as makrozoobenthos. From the Grain size analyze for all station indicated that the substrat dominated by the silt and clay which is the main habitat of makrozoobenthos. This research goal is to know the different breakwater with hard type and hybrid type based the abudance of makrozoobenthos.

Water quality indeks each station shown in Figure 2. Based on the data we can see that the lowest Disolved Oxygen (DO) is on Morosari 2 and Timbulsloko that have breakwater with hybrid engineering system with bamboo, probably it is because of high turbidity. Temperature has no significant difference in every station, salinity range below salinity standar its because of heavy rain before sampling, organic matter range is high in every station.

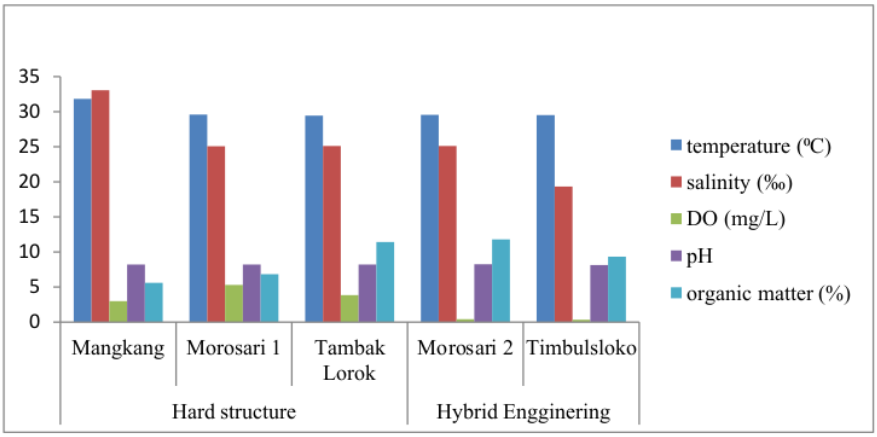

Figure 2. Water quality and organic matter each station

Based on research results has been identified that Mangkang station has 25 genus with 20 genus from Polychaeta, 2 genus from Bivalve, 2 genus Bivalve and 1 genus from Ophioroidea. Morosari 1 station has 18 genus 12 genus from Polychaeta, 3 genus from Bivalve, 1 genus Gastropoda, 1 genus from Ophioroidea dan 1 genus from Crustacea. Morosari 2 station has 30 genus 23 genus from Polychaeta, 3 genus from Bivalve, 1 genus Gastropoda, 1 genus from Ophioroidea dan 2 genus from Crustacea. Timbulsloko station has 20 genus with 16 genus from Polychaeta and 4 Bivalve. Tambak Lorok has 21 station with 17 genus from Polychaeta, 3 Bivalve and 1 Ophiouroidea. Detail of genus in each station showed by the Table 1 until Table 5. Polychaeta class has dominated in every station because in this area their habitat is muddy beaches.

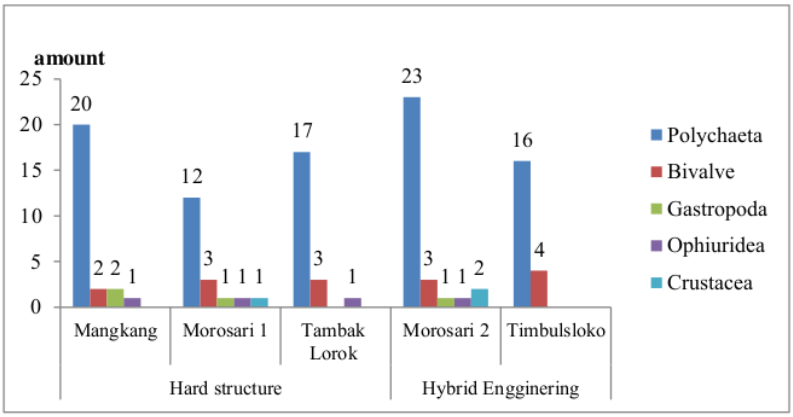

Figure 3. Genus amount in every station

Table 1. Genus on Mangkang station

Genus	Sampling location				
	M1	M2	M3	M4	M5
Polychaeta					
Aricidae	-	1	-	-	-
Capitella	-	6	10	6	2
Ceratocephale	-	-	1	-	1
Chrimia	-	-	1	-	-
Chone	-	1	-	-	-
Glycera	-	2	-	1	-
Glycinde	-	-	1		1
Goniada	-	3	1	3	-
Heteromastus	3		5	1	
Lumbrineris	1	2	-	-	3
Nereis	-	2	1	-	1
Notomastus	1	-	2	-	-
Perineris	-	-	-	1	-
Platynereis	-	-	-	-	1
Poechilochaetus	-	2	3	1	3
Prionospio	-	-	1	-	-
Pygospio	-	-	-	1	-
Sipuncula	-	-	-	1	-
Spionida	1	-	-	-	-
Sternapsis	-	1	1	1	-
Bivalve					
Asaphis	-	-	-	-	1
Tellina	1	-	-	1	-
Gastropoda					
Cerithium	-	-	1	1	-
Littorina	-	-	-	1	-
Ophiuridea					
Ophicuma	-	-	56	8	-
Total individu	7	20	84	27	13
Total amount	151 individu				

Polychaeta has dos dominated in Mangkang station with genus Capitella the most amount in Polychaeta class. In this station genus Ophicuma from Ophiuridea genus has been found 64 organism. Maybe its their breeding season, so the amount is abundance. Detail genus on Morosari 1 station shown by table 2. The number of organism in Morosari station less than Mangkang station. Maybe because on the location, behind breakwater at Mangkang station has mangrove vegetation. Its also called green belts, mangrove also produce nutrien to water.

Table 2. Genus on Morosari 1 station

Genus	Sampling location				
	H1	H2	H3	H4	H5
Polychaeta					
Capitella	1	-	-	2	1
Cossura	-	-	-	2	-
Echiura	-	-	-	1	-
Glycera	-	-	-	1	-
Goniada	-	-	1	-	2
Heteromastus	1	-	-	1	-
Lumbrineris	-	-	-	1	-
Platynereis	-	-	-	1	-
Poechilochaetus	1	-	-	2	-
Polynoidea	-	-	-	-	-
Prionospio	-	-	-	1	-
Spionida	-	-	1	-	-
Bivalve					
Anadara	-	2	-	-	-
Asaphis	-	1	1	-	-
Tellina	-	-	1	-	3
Gastropoda					
Cerithidea	-	1	-	-	-
Ophiuridea					
Ophiureidea	2	-	-	-	-
Crustacea					
Amphipoda	-	1	-	-	-
Total individu	5	5	4	12	6
Total amount	32 individu				

The amount of Tambak Lorok station is more than Morosari 1 station. Genus Anadara from Bivalve class at Tambak Lorok has dominated this station. Because this station near fishing pond. Polychaeta still dominated this station. Polycaheta almos dominated in every station because it is theirm main habitats. Breakwater with hard type with permanent material Polychaeta class has been dominated in each station even its not the biggest amount. In Mangkang station the biggest amount is Ophicuma from Ophiuroidea class and Tambak Lorok station is Anadara from Bivalve class. Genus from Tambak Lorok station shown on Table 3.

Table 3. Genus on Tambak Lorok station

Genus	Sampling location				
	T1	T2	T3	T4	T5
Polychaeta					
Aglaophamus	-	-	-	-	1
Capitella	1	3	1	-	1
Ceratocephale	2	3	3	1	5
Chaeptopterus	-	-	-	-	1
Cossura		1	-	-	-
Glycera	-	-	-	-	1
Goniada	5	1	1	-	1
Heteromastus	1	-	-	-	2
Hipponoa	-	1	-	-	1
Mediomastus	-	1	-	-	-
Neanthes	-	-	-	-	1
Nereis		1	-	1	-
Notomastus	2	-	-	1	-
Platynereis	-	1	-	-	-
Poechilochaetus	-	1	-	-	-
Polynoida	-	-	-	-	5
Prionospio		-	-	-	1
Bivalve					
Anadara	-	38	5	10	18
Asaphis	-	1	-	-	-
Perna viridis		4	-	-	-
Ophiuridea					
Ophicuma	1	1	-	2	4
Crustacea					
Amphipoda	-	-	-	-	3
Jumlah individu	12	57	10	15	36
Total amount	130 individu				

Morosari 2 station and Timbulsloko station is breakwater with hybrid type. Morosari 2 using paralons as their main structure and Timbulsloko using bamboo as their main struture. Detail genus on Morosari 2 station shown at Table 4. Polychaeta are dominated this station, Sternapsis genus is dominated this biggest amount in this station. At Morosari 2 station surounded by mangrove vegetation. Mangrove also has important effect to coastal environment, besides it role as nursery and spawning ground its also can be sediments trap.

Table 4. Genus on Morosari 2 station

Genus	Sampling location				
	H6	H7	H8	H9	H10
Polychaeta					
Anaspio	1	-	-	-	-
Aricidae	-	-	-	-	1
Capitella	4	7	-	-	1
Ceratocephale	3	1	-	3	-
Chaetozone	-	1		1	-
Cossura	1	5	-	-	-
Drilonesis	1	-	-	-	-
Glycera	1	2	-	-	1
Glycinde	-	-	-	1	-
Goniada	5	1	-	-	-
Heteromastus	-	2	5	9	-
Mediomastus	2	2	-	-	-
Nassarius	-	1	-	-	-
Nereis	-	-	-	-	2
Neanthes	-	-	-	-	1
Notomastus	1	2		3	-
Paraonella	-	1	-	-	-
Perineris	1	-	3	-	-
Poechilochaetus	-	3	-	1	1
Polynoidea	1	3	-	2	-
Spionida	1	-	-	-	-
Sternapsis	7	3	2	21	1
Terebelida	-	2	-	-	-
Bivalve					
Macoma	-	-	-	-	1
Solen	-	-	-	-	1
Tellina	1	-	-	-	1
Gastropoda					
Cerithidea	-	-	-	1	-
Ophiuridea					
Ophicuma	-	-	-	-	1
Crustacea					
Amphipoda	-	1	-	-	-
Uca	-	-	-	-	1
Total individu	30	37	10	43	13
Total amount	133 individu				

Timbulsloko station is breakwater with hybrid type with bamboo as their main materials. Detail genus shown on Table 5. Polychaeta has dominated this station with Sternapsis has the biggest amount. This station also surounding by mangrove vegetation but not as much as Morosari 2.

Table 5. Genus on Timbulsloko station

Genus	Titik Sampling				
	H11	H12	H13	H14	H15
Polychaeta					
Anaspio	-	1	-	-	-
Capitella	2	2	6	-	2
Ceratocephale	-	7	1	-	1
Glycera	-	-	4	-	1
Glycinde	2	-	-	-	1
Goniada	-	-	-	-	2
Heteromastus	-	-	4	-	-
Lumbrineris	-	-	4	-	-
Mediomastus	3	-	-	-	3
Nereis	-	-	5	1	-
Notomastus	1	1	-	-	3
Platynereis	-	2	3	3	-
Poechilochaetus	1	1	6	1	-
Polynoidea	1	-	1	-	-
Prionospio	-	-	2	-	-
Sternapsis	7	8	-	-	-
Bivalve					
Anadara	-	1	-	-	-
Asaphis	-	-	-	-	1
Macoma	1	-	-	-	-
Tellina	-	2	-	-	-
Total individu	18	25	36	5	14
Total amount	98 individu				

Every breakwater has been found various organism with different class and genus. The index shown at Figure 4.

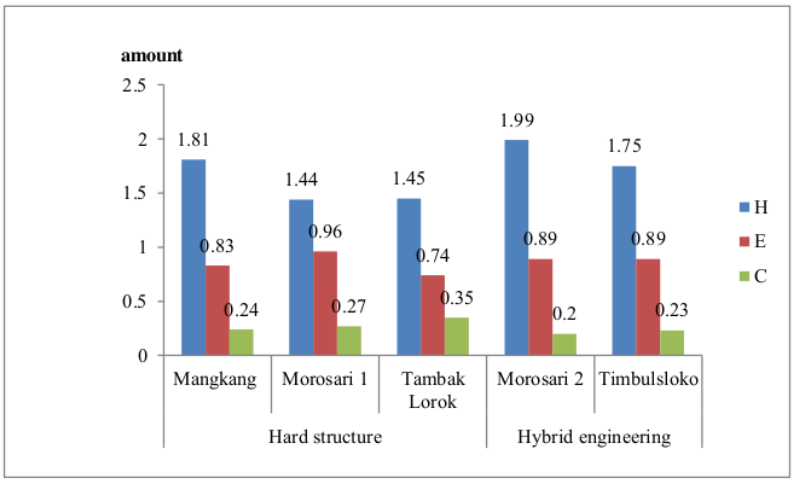

Figure 4. Diversity Index (H'), Equatibility index (E) and Dominance Index (C)

Breakwater with hybrid enggineering type has higher indeks comparing with the hard structure type based on Figure 3. Its because of mangrove mud beaches as a result of the hybrid enggineering type breaking waves naturally provide a variety of ecosystem needs such as coastal protection, fishery resources, marine life spans and improved water quality[4].

Each breakwater has their own advantages and disdvantages, for example the hard type its expensive, not eco-friendly and more durable than soft type. The soft cheaper than hard, but eco-frienly but not durable. One the option is using hybrid type that using permanent structure with eco-friendly materials. The breakwater that has been choosed to manage the damage can be different each location. Its depends on the charateristic each coastal area, and if it allows combine it with green belts so the proctection become double.

4. Conclusion

Based on the result by the research, that in all types of coastal retaining structures there are macrozoobenthos populations with varying degrees of diversity. Thus, the breakwater structure will form a new population of organisms. The abundance of macrozoobenthos is one of the supporting data in the determination of the right breakwater structure. Required other supporting data to be able to determine the right building, such as substrate type, current pattern, sedimentation, tidal vegetation type etc.

5. Acknowledgement

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