International Journal of Applied Environmental Sciences
ISSN 0973-6077 Volume 14, Number 3 (2019), pp. 259-268

http://www.ripublication.com

Molluscs Biodiversity Based on its Preference toward Habitats Characteristics in Abrasion Area at Bedono Waters Demak, Central Java, Indonesia.

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Abstract

Coastal village Bedono Sayung Demak experienced abrasion of about 200 ha Potentially to be new habitat of various aquatic organisms, Including the molluscs. Mangrove Be the are still survive and have a function as a buffer and limitation for fertility waters and in life mollusks. Research aims to analyze the abundance of molluscs and influence water quality on the abundance of molluscs in the aquatic area in the abration waters at Bedono Sayung Demak. Research based method survey to be held on 15 stations represent the mangrove area, mangrove and the waters around the trees on the outside may to june 2017. Variables measured is H2S, the organic matter sediment, chlorofil a, abundance of mollusks, dissolved oxygen, visibility, total phosphorus, nitrates and texture sediment, as many as 3 times. The results of the study is that there is a gradient fertility; lowest waters are oligotropic at in mangrove waters with mollusks abundance 22 ind / m2, mesotrofic around mangrove with mollusks abundance 39 ind / m2 and eutrophic in the outside mangrove waters with mollusks abundance 53 ind / m2. Gastropods dominant on the number and frequency of the invention is between stations are *Clypeomorus chemnitziana, Cassidula aurisfelis* and *Littorina scabra* from 15 species; and bivalvae dominant on the number and frequency of the invention is between stations are *Anadara granosa, Perna viridis* and *Circe scripta* from 10 species. The relationship between variables is abundance of (ind / m 2) = 44.358to 272.924 H_2S - organic matter sediment 0.551 + 2.54 + 0.21 DO visibility - 0,339 + 1,919 chlorofil a salinity (r = 0.978).

Keyword: Bedono waters, mollucs, H_2S, sediment organic matter

INTRODUCTION

Bedono is a village in Sayung Demak sub-district with extensive abrasion, which has destructioned settlements and mangroves. This region has been change the ecological function of the land became sea. In the semi-enclosed waters as a result of mangrove survival makes this region into a new ecosystem inhabited by a variety of water organisms including mollusks. According Cappenberg *et al*. (2006), mollusks can live on many kind of substrates, sand, loam, rocky and clay, and encountered from coastal to deepwater, occupying coral reefs, some immersing themselves in sediments, some can be found attached to marine plants. In addition, molluscs also have a high adaptability to place and environmental changes.

From the utilization aspect, the increasingly widespread abrasion area causes decrease in the carrying capacity of the land to many aspects, such as reduced private property in the coastal region of land such as farms, destruction of settlements and etc. This has implications for loss of livelihood, reduced living convenience, separated access between regions and so on. Ultimately causing an impact on the welfare of coastal communities. On the other hand, increasing abration area and switching landscapes into waters ecologically open opportunities for the formation of new ecological niches that have great benefits in this environment both in the present and future.

Molluscs are one of the product widely used in this region. Soil erosion is an opportunity as a new habitat for them to thrive. This study examines the Existance potential of mollusks on the basis of utilization of new niches simultaneously, and to see a fairly extensive mangrove support growing in this region. The purpose of this research objective is: the fertility status of the waters of the abraded, analyzing the effect of water quality on the abundance of mollusks in waters abraded Bedono village Sayung Demak.

MATERIALS AND METHODS

The research was conducted in the abrasion area of Bedono Village, Sayung, Demak. This area has been permanently inundated with sea water. The existence of some coastal and natural buildings then cause these irregular waters are separated into 3 areas. The western region is limited by the embankment of the Sayung River Morosari tourist location with mangrove area and the religious tourism location of Bedono. In this segment determined 3 stations (St-1, St-2 and St-3). The second segment is the abrasion area separated by the wider mangrove area of Senik Village. In the abration area determined 3 research stations (St-4, St-5 and St-6). In the area of mangrove Senik Village determined 5 stations there are (St-7, St-8, St-9, St-10 and St-11). Meanwhile St-12, St-13 and St-14 are located in the eastern abrasion area of Senik village. The St-15 is outside the abrasion area (Figure 1). Sampling has been conducted 3 times in July as a repetition with an interval of 1 week.

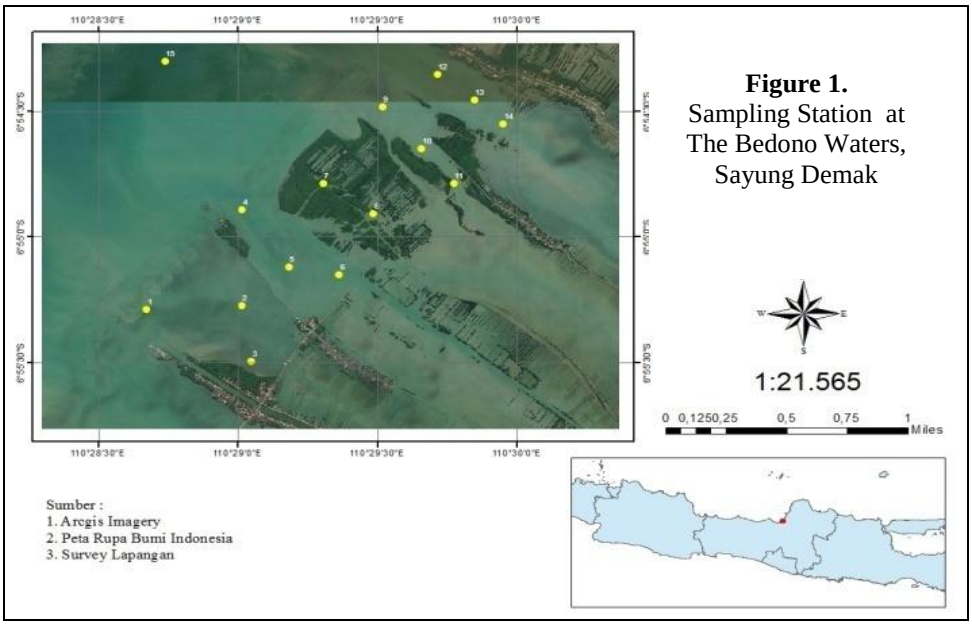

Figure 1.
Sampling Station at The Bedono Waters, Sayung Demak

Mollusks Sampling was conducted in accordance by the method of Frith *et al.,* (1976) and Nugroho (2002) modified on plot 5 x 5 m^2, at low tide. All types of samples found through filtration were taken with 10 cm deep digs. The mollusk samples obtained are then cleaned and inserted into the sample bottle, then given a formalin solution 4% as pickling. Then, The identification of molluscs was done in the Laboratory based on Dance (1984), Dharma (1988), FAO (1998) and Peter & Sivasothi (1999).

The water fertility status was analyzed using the Carlson TSI test, so the next step was measured on nitrate, visibility, total phosphate and chlorophyll-a. Potential of mollusks were analyzed based on the abundance and diversity, while to analyze the relationship between water quality with an abundance of molluscs using factor analysis and multiple regression (Ghozali, 2016). Another water quality variables required are H_2S, sediment organic matter, dissolved oxygen and sediment texture. The statistical test used to analyze the differences of several variables between the research stations used the Tukey difference test and variance test.

RESULTS AND DISCUSSION

Results

Water fertility analyzing conducted aim to test the feasibility of habitat in life support for organisms. Another consideration is the area of this waters is a relatively new area formed due to the erosion of land land by the waves and currents and the land transfer function on land (Asiyah *et al,* 2015).

The results of the analysis of several variables supporting the TSI test obtained the status between stations and distribution as shown in Table 1 and Figure 2.

Table 1. Result of Analysis of Fertility Status of Sooted Water Bedono

Station	TSI SD	TSI TP	TSI Chlo a	TSI	Information
1	73.48	67.61	46.30	62.46	Eutrophic
2	73.67	68.15	46.97	62.93	Eutrophic
3	77.61	62.13	42.41	60.72	Eutrophic
4	69.38	64.73	40.63	58.25	Eutrophic
5	73.84	64.75	38.57	59.05	Eutrophic
6	79.51	56.09	29.84	55.14	Eutrophic
7	81.64	7.64	24.79	38.02	Oligotropic
8	81.70	8.95	25.44	38.70	Oligotropic
9	77.57	18.49	37.30	44.45	Mesotropic
10	76.62	11.51	26.36	38.16	Oligotropic
11	75.03	10.63	25.75	37.14	Oligotropic
12	70.37	45.30	26.49	47.39	Mesotropic
13	76.25	45.36	26.97	49.52	Mesotropic
14	77.58	46.76	28.15	50.83	Eutrophic
15	70.47	71.93	49.40	63.93	Eutrophic

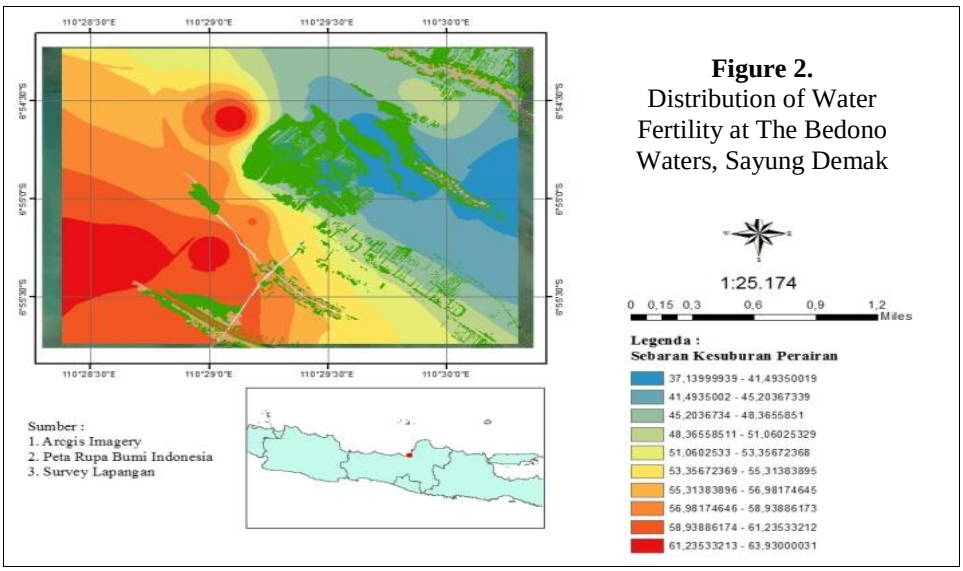

Figure 2.
Distribution of Water Fertility at The Bedono Waters, Sayung Demak

The waters within the mangrove area are represented by 7, 8, 9, 10 dn 11 stations which have low fertility quality (Oligotrophic – Mesotrophic). areas in an open environment tend to have fertile conditions (mid to moderate eutrophic).

The biological measure of the presence of mollusks in the bedono environment is the level of diversity. This measure was a combination of individual abundance and the total of species found. The results of identification and calculation are as shown in Table 2.

Based on these results indicate that the highest abundance was found at 15 stations and some stations 1 to 6. Then, as tested statistically by variance analysis we

concluded that there are differences in the abundance of mollusks between stations (α <0, 05) with the highest order of the average start at station 15 , 1 and 2; followed by stations 4, 5 and 3, followed by the station 12, 6, 14 nd 13, then stations 9 to 11 and the lowest at station 7 and 8. The results of the multiplicative analysis of diversity show a similar pattern.

Table 2. Analysis Abundance of Mollusk (ind/m^2) at The Bedono Waters

Famili	**Species**	**Station**														
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Cerithiidae	*Clypeomorus chemnitziana*	2	4	1	2	0	1	1	0	2	2	1	3	2	2	3
Ellobiidae	*Cassidula aurisfelis*	3	4	4	0	3	4	1	1	3	2	1	2	2	4	0
	Ellobium aurisjudae	1	1	0	0	1	0	1	0	1	1	0	1	0	1	0
Littorinidae	*Littorina carinifera*	1	0	0	3	1	2	1	1	2	0	4	2	1	3	1
	Littorina scabra	5	2	4	2	1	2	0	0	2	0	1	1	2	2	3
	Littoria undolata	1	1	0	1	1	1	0	0	1	0	0	1	0	2	3
	Nodilitorina pyramidalis	4	5	3	0	1	1	0	2	0	2	2	2	0	2	2
	Mya	2	0	1	3	0	0	1	0	2	1	0	2	3	2	4
Neritiidae	*Neritina violacea*	0	0	2	5	4	1	0	0	1	2	1	1	0	1	5
Potamididae	*Cerithidea quoyii*	1	1	0	0	0	1	0	1	1	0	1	1	1	1	0
	Cerithdiopsis malayensis	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0
	Cerithidea cingulata	1	1	1	1	0	2	1	1	1	1	3	1	2	2	1
	Cerithidea obtusa	2	2	1	2	2	1	0	1	0	1	0	0	0	1	2
	Telescopium telescopium	2	3	1	1	2	1	1	1	3	0	1	0	3	2	1
Synceriidae	*Syncera brevicula*	3	2	2	0	1	1	0	1	1	1	1	2	0	1	2
Arcidae	*Anadara granosa*	2	5	1	5	5	3	0	0	2	1	0	3	5	3	7
Cardiidae	*Trachycardium subrugosum*	1	4	3	5	3	4	1	1	1	0	1	5	0	2	3
Donacidae	*Donax cuneatus*	3	1	4	4	1	2	1	1	1	2	1	0	0	0	1
Mytilidae	*Perna viridis*	6	4	1	4	5	2	0	1	1	2	1	4	2	1	9
	Mediolus micropterus	1	2	5	3	3	2	0	1	1	0	1	1	3	2	4
Pinnidae	*Pinna muricata*	6	2	3	1	2	0	0	0	2	1	1	1	1	4	2
Tellinidae	*Tellina Sp*	1	5	2	3	1	1	2	2	1	1	1	2	3	1	1
	Soletellina alba	2	1	2	1	4	2	0	1	2	3	2	3	1	0	2
Veneridae	*Circe scripta*	2	2	3	3	5	4	1	0	1	1	1	1	1	0	5
	Gafrarium tumidum	5	2	0	1	1	1	1	0	1	1	2	1	0	1	0
	Jumlah Individu	57	55	45	50	47	40	14	17	32	24	27	41	35	39	63
	Jumlah Species	24	23	20	22	21	24	19	20	24	17	22	24	21	22	23
	Indeks keanekaragaman	2.93	2.95	2.82	2.83	2.82	2.96	2.79	2.86	3.06	2.72	2.88	2.97	2.76	2.94	2.87
	Indeks Keseragaman	0.92	0.94	0.94	0.92	0.93	0.93	0.95	0.96	0.96	0.96	0.93	0.94	0.91	0.95	0.92

Based on the biota profile it is known that bivalve averages were found to be higher in the research area compared with the gastropod group, with 288 individuals in the gastropod group while the gastropod group was 297 individuals. Compared with the group of bivalvea, then the group of gastropods were more common in the area bermangrove (Station 7, 8, 9, 10, 11, 13 and 14), while the remainder were more common bivalvea group.

Based on the types of individuals who found the five species of gastropods most consecutive, there are *Cassidula aurisfelis, Littorina scabra, Clypeomorus chemnitziana, Littoraria arinivera* and *Neritina violacea.* Then most of the 5 species bivalvae group there are *Perna viridis, Anadara granosa, Trachycardium subrugosum. Circescripta* and *Mediolus micropterus.* The map of gastropod and bivalve distribution that has been found can be seen in Figures 3 and 4.

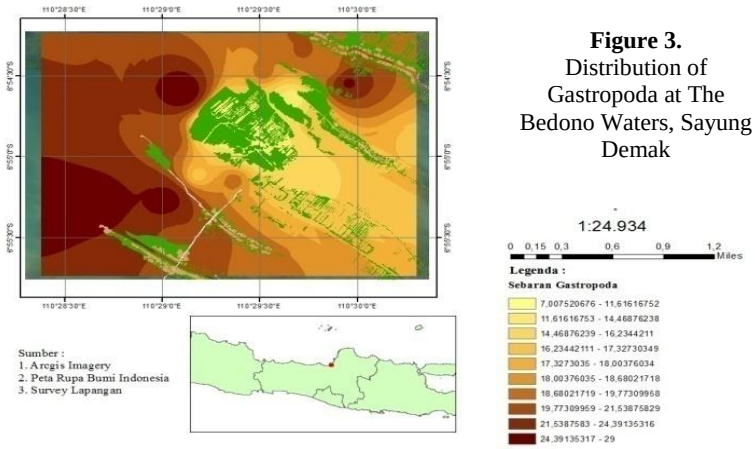

Figure 3. Distribution of Gastropoda at The Bedono Waters, Sayung Demak

Based on the analysis of the relationship between the abundance of individuals with the total species found then obtained information that both have a significant linear relationship ($\alpha < 0.05$).

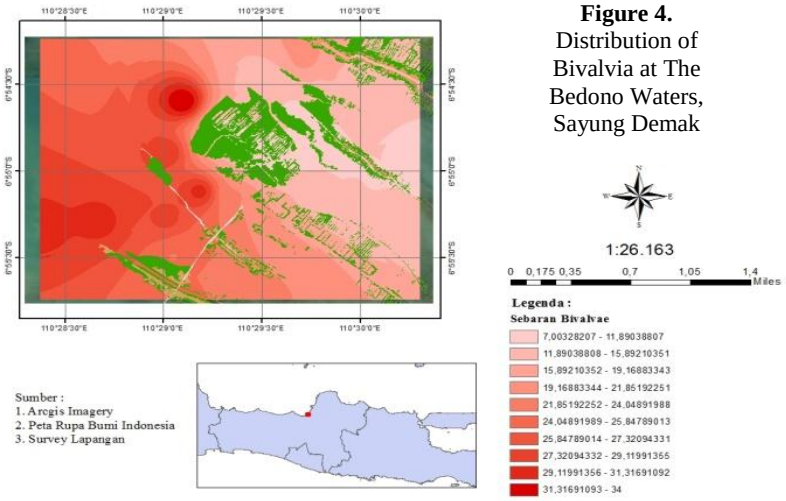

Figure 4. Distribution of Bivalvia at The Bedono Waters, Sayung Demak

This means that there was a proportional relationship between individual abundance and the species found. This phenomenon is estimated to be related to the condition of the chemical physics environment. Indication of the role of environmental factors is quite prominent in the abrasion area Bedono. This was because of the environmental variability as described in the previous section. The results of the water quality measurements are presented in Table 3.

DISCUSSION

Bedono coastal area is a specific environment because it is a new area formed due to the abrasion, where the area was previously a mangrove conservation area that became a ponds. While the specific level is supported by the still maintained part of the area as a dense mangrove environment and well developed with its surroundings which is the new waters of abrasion. From the other side that the area of abrasion was broad and elongated, then in this region eventually become the shelter flow of small rivers coming from the upstream area especially from the Sayung area which was quite densely populated as well as some industries.

Table 3. Anayisis of water Quality at The Bedono Waters

Station	H_2S	Sediment Organic Matters (%)	DO (mg/l)	Total Fosfat (mg/l)	Nitrat (mg/l)	Depth (cm)	Visibility (cm)	Temperatur (ºC)	Salinity (ºº/ºº)	pH
1	0.002	10.23	4.288	0.0815	0.2203	102.30	39.23	29.53	30.62	7.44
2	0.003	12.89	4.284	0.0847	0.2287	69.63	38.72	29.22	28.71	7.28
3	0.009	15.04	3.028	0.0558	0.1507	52.28	29.47	30.22	27.62	7.01
4	0.004	13.94	3.656	0.0667	0.1803	112.30	52.15	30.31	30.65	7.38
5	0.008	14.81	3.342	0.0668	0.1806	67.40	38.26	30.43	27.46	7.31
6	0.010	16.86	3.106	0.0367	0.0991	56.70	25.83	30.26	18.43	7.22
7	0.043	28.56	0.051	0.0013	0.0029	58.30	22.27	27.43	25.65	6.12
.8	0.041	29.74	0.549	0.0014	0.0038	61.40	22.18	27.18	23.43	6.23
9	0.019	18.53	0.727	0.0027	0.0460	58.40	29.54	28.44	29.66	6.42
10	0.030	18.99	0.811	0.0017	0.0071	53.90	31.55	29.02	28.89	6.21
11	0.024	23.25	1.242	0.0016	0.0052	58.60	35.25	27.34	28.06	6.66
12	0.011	15.40	2.164	0.0173	0.0469	89.40	48.68	29.22	29.63	7.03
13	0.018	18.85	3.086	0.0174	0.0471	76.40	32.38	29.53	28.48	7.16
14	0.017	14.13	3.065	0.0192	0.0519	81.80	29.52	30.02	28.75	7.04
15	0.001	7.78	4.387	0.1100	0.2495	184.70	48.34	29.33	31.84	7.33

Based on these descriptive data, the conspicuous deviation was the abundance of molluscs, brightness and sedimentary organic matter. The initial expectation of this was that of habitat variability, for this reason, factor analysis of all these components is carried out. Factorial analysis test obtained information that there was one root grouping measured data and be able to explain 77% correlation between the measured data.

This grouping was then used as a reference for conducting relationship studies between dependent and independent variables. In this case, the abundance of molluscs as a dependent variable, while the independent variables are H_2S, nitrate, total phosphate, organic sediment materials, dissolved oxygen at the base, brightness, salinity and chlorophyll-a. The statistical test was using multiple regression analysis. After it was calculated by considering multicollinearity requirement and autocorrelation test then got the equation as follows: The abundance of molluscs (ind/m ^{2}) = 44.358 - 272.924 H_2S - 0.551 sediment organic matters + 2.54 Dissolved Oxygen + 0.21 Visibility - 0.339 salinity + 1.919 chlorophyll-a ($r = 0.978$). so, the increase in the number of molluscs was inversely proportional to H_2S, organic matter and salinity, and it was directly proportional to dissolved oxygen, brightness and chlorophyll-a.

In terms of the role of water status to the quality and quantity of molluscs, there was a very strong correlation between that variables. The abundance of molluscs has an inverse relationship with H_2S and organic matter. This did not mean that the mangrove external environment has less support, but the levels are grouped from medium to high. Meanwhile, the inverse nature of multiple regression is caused by the mangrove area found in high levels of organic material and the abundance of molluscs are limited by H_2S and low dissolved oxygen.

The low quality of marine habitat in mangroves is characterized by high H_2S although the organic matter also was high, this was cause depression in the life of molluscs or other organisms. The types of gastropod have a neuro control for the feeding process, so this group is more flexible in the feeding process and adaptation of environmental conditions. Although this biota was quite abundantly found in the mangrove area, but they were that generally did the distribution on the mangrove root (Elliott and Susswein, 2002). Then, its movement was a molluscan response to its environmental conditions. This condition was different from the bivalve, which this condition relatively lower found compared to the surrounding open environment. In this area, although it had lower organic materials but it still has expected to sustain the life of molluscs. In addition, the high dissolved oxygen in the marine environment outside the mangrove and its texture which has a higher sand content allows the pore water of sediment within a few centimeters can still support the bivalvae life.

According to Nerlovi'c *et al* (2011) benthic organism structures including molluscs are under pressure after the aquatic base environment undergoes an anoxic post, although some bivalve can survive. It was then argued that during times of temporal environmental stress, most bivalve species exercise protection by closing their shells. Corbula type is one of the bivalves that have that ability. According to Llanso (1992) and Diaz and Rosenberg (1995), the severity of environmental pressures caused by toxic variables such as H2S or anoxic will affect the recovery rate of benthic communal structures particularly bivalve.

Based on the description then obtained a description that the existence of mangrove on one side to provide benefits to the surrounding environment, but on the other side affects the structure of non mangrove communities. Important benefits are indicated

by the increased fertility status and survival rate of mollusks in outside mangroves area. Meanwhile, the environment in the mangrove area, although having a high sediment organic material but has a lower degradative response and effect on the emergence of anoxic and H_2S conditions. Both are limits to the metabolic activity of aquatic organisms.

CONCLUSION

The conclusion of this research are: (a) The status of water fertility in the mangrove area tends to be low in the oligotrophic to mesotrophic categories, while in the surrounding waters more fertile, (b) bivalve abundance was higher than gastropod with the dominant type, they were *Anadara granosa*, *Perna viridis* and *Circe scripta* and *Clypeomorus chemnitziana, Cassidulaaurisfelis* and *Littorina scabra,* (c) Water quality was very influential on the abundance of mollusks in the waters of abrasion Bedono, there was H_2S and dissolved oxygen.

Acknowledgements. We are grateful to the Faculty of Fisheries and Marine Science Diponegoro University for funding and logistic support in this study.

REFERENCES

[1] Asiyah, S., Moh Gamal R, dan Chatarina M. 2015. Analisis Perubahan Permukiman dan Karakteristik Permukiman Kumuh Akibat Abrasi Dan Inundasi di Pesisir Kecamatan Sayung Kabupaten Demak Tahun 2003 – 2013. Jurnal GeoEco, 1(1): 83 – 100. ISSN: 2460 -0768.

[2] Cappenberg, H. A. W., A. Aznam dan I. Aswandy. 2006. Komunitas Moluska Di Perairan Teluk Gilimanuk, Bali Barat. Oseanologi dan Limnologi di Indonesia, No 40: 53-64.

[3] Diaz R.J. & Rosenberg R. 1995. Marine benthic hypoxia: A review of its ecological effects and the behavioural responses of benthic macrofauna. Oceanogr. Mar. Biol. Ann. Rev. 33:245–303.

[4] Dance, S. P. 1984. The Encyclopedia of Shell. Blandford Press. Poole. 288 pp.

[5] Dharma B. 1992. Siput dan Kerang Indonesia II. Jakarta: Sarana Graha.

[6] Elliott. C. J. H. and A. J. Susswein. 2002. Comparative neuroethology of feeding control in mollusks. The Journal of Experimental Biology 205, 877–896 (2002).

[7] FAO, 1998. The Living Marine Resources of The Western Central Pasific. Vol. 1: Seaweeds, corals, bivalves and gastropods. FAO of The United Nation. 686 pp.

[8] Frith. D.W., R. Tantanasiriwong, and O. Bhatia. 1976.Zonation of macrofauna on a mangrove shore,Phuket Island. *Phuket Marine Biological Center Res. Bull*,

10: 1-37.

[9] Ghozali I., 2016. Aplikasi Analisis Multiveriete dengan Program IBM SPSS 23. Badan Penerbit Universitas Diponegoro. Semarang.

[10] Llanso R.J. 1992. Effects of hypoxia on estuarine benthos: thelower Rappahannock River (Chesapeake Bay), a case study. Estuarine, Coastal and Shelf Science 35 (5): 491–515. DOI:10.1016/S0272-7714(05)80027-7.

[11] Nerlovi´c, A. A. Do˘gan and M.Brenko. 2011. Response to oxygen deficiency (depletion): Bivalve assemblages as an indicator of ecosystem instability in the northern Adriatic Sea. Biologia 66/6: 1114—1126.

[12] Nugroho, A. 2002. Struktur dan Komposisi Vegetasi serta Struktur Molluska di Hutan Mangrove Muara Sungai Ajkwa dengan Nuara Sungai Kamora, Kabupaten Mimika, Papua, Laporan Penelitian. Fakultas Perikanan dan Ilmu Kelautan. Universitas Diponegoro. Semarang. 76 hlm

[13] Peter, K.L. Ng. and N. Sivasothi. 1999. A Guide to the Mangrove of Singapore II (Animal Diversity). Published by Singapore Science Centre. 168 pp