

# 25 Correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, indonesia

*by* Sapto Purnomo Putro

---

**Submission date:** 21-Jul-2018 12:03PM (UTC+0700)

**Submission ID:** 984072645

**File name:** 25.Sharani\_2018\_J\_Phys.\_3A\_Conf.\_Ser.\_1025\_012081.pdf (344.77K)

**Word count:** 3606

**Character count:** 20213

PAPER • OPEN ACCESS

1  
Correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, Indonesia

8  
To cite this article: Jeanny Sharani *et al* 2018 *J. Phys.: Conf. Ser.* **1025** 012081

View the [article online](#) for updates and enhancements.

# Correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, Indonesia

Jeanny Sharani<sup>1</sup>, Jafron W. Hidayat<sup>2</sup>, and Sapto P. Putro<sup>3\*</sup>,

<sup>1,2</sup> Department of Biology, Faculty of Science and Mathematics, Diponegoro University, Semarang,

<sup>3</sup> Centre of Marine Ecology and Biomonitoring for Sustainable Aquaculture (Ce-MEBSA), Diponegoro University, Semarang, Indonesia


\*Corresponding author: saptoputro@gmail.com

**Abstract.** Macrobenthic community play important role in sedimentary habitats as a part of food chain. Their structure may be influenced by environmental characteristic spatially and temporally. The purpose of this study is to access the correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, Indonesia. Water and sediments samples were taken twice, where the first and second sampling time were taken in June and October 2016, respectively. Samples were taken in the area of fish farming at coastal area of policulture/IMTA (as Location I), site of 1 km away from fish farming area as a reference site (as Location II), and monoculture sites (as Location III), with three stations for each location. Data of abiotic parameters included the composition of sediment substrate and DO, pH, salinity, temperature, and. Sediment samples were taken using Ekman grab. The organisms were 1 mm -size sieved and fixed using 10% formalin for further analysis, i.e. sorting, preserving, enumerating, identifying, and grouping. The relationship between biotics (macrobentos) and abiotics (physical-chemical factors) was assessed using a non-parametric multivariate procedure (BIOENV). This study found 61 species consisting of 46 families and 5 classes of macrobenthos. The most common classes were member of Mollusca and Polychaeta. Total nitrogen, silt, and clay were the abiotic factors most influencing macrobenthic structure (BIO-ENV;  $r = 0.46$ ;  $R^2 = 21.16\%$ ).

**Keywords:** macrobenthic structure, relationship, biotic, abiotic, and Tembelas Island

## 1. Introduction

One of the growing aquaculture sector in Indonesia is in Riau Archipelago. Riau Archipelago is a province that has many islands, one of them is Tembelas Island which is currently used as one of aquaculture locations. Fish farming techniques that exist in Tembelas Island is policulture/IMTA aquaculture (Integrated Multi-Tropic Aquaculture) and monoculture. The activities are potentially have impact on organisms in the aquaculture and marine environment. Macrobenthic is an abundant organism and has a marine waters based life cycle. Ref [1] stated that most of macrobenthic species live as a sedentary lifestyle, intermediate trophic level positions, relatively long life-span and varying responses to changes in environmental stress that make macrobenthic an effective and useful indicator for the assessment of environmental disturbance at coastal ecosystem. Ref [2] emphasised research in

 Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

the field of ecology, especially discussion of the spatial and temporal distribution of macrobenthic abundance can be used to determine the level of environmental disturbance over time. Through their spatial and temporal variability, the water ecosystem may be in disturbed or undisturbed situation. Furthermore, Ref [3] stated that analysis of organisms macrobenthic infauna has been applied as one of the main criteria in determining environmental quality for aquaculture management in various countries. Most environmental research have concentrated on severe impacts under and immediately adjacent to fish farming [4]. However, this study differs from previous research, due to the presence of macrobenthic structure correlation and the sedimentary-aquatic characteristics at two different aquaculture, i.e. IMTA aquaculture and monoculture, and at different sampling periods (temporal). The purpose of this study is to access the correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, Indonesia.

## 2. Materials and Methods

This research was conducted on Tembelas Island, Karimun Regency of Riau Archipelago between 103°29'47" - 103°29'90" BT and 0.991°16'63" - 0.989°06'37" LS. The location of the research was divided into three stations at each location sites; fish farming IMTA (Integrated Multi-tropic Aquaculture) site (Location I), Reference site (Location II; ± 1 km away from IMTA aquaculture), and Monoculture site (Location III; ± 3 km away from IMTA aquaculture). The samples of macrobenthic organisms were taken twice at three station at each location. The sediments taken using Ekman grab (10 cm<sup>2</sup>) were then fixed in 10% formalin solution. The organisms retained from 1 mm meshsize sieve for each station were then preserved in 70% ethanol solution. Further analysis were sorting, preserving, enumerating, identifying and grouping into the finest taxa resolution (species and genus). The measurement of the physics-chemical water parameters were done three times for each location. The parameters measured in this study were pH, temperature (°C), turbidity, dissolved oxygen (DO), and salinity. Sediment samples analysis at each station comprised sediment composition (sand, silt, clay) and organic content (carbon and nitrogen organic). Data of biotic and abiotic parameters were presented in tables, pie diagrams and histogram with standard deviation. The relationship between biotics (macrobentos) and abiotics (physical-chemical factors) was assessed using a non-parametric multivariate procedure (BIOENV) by PRIMER V.6.1.5. software. It was considered effective to analyze the relationship between select environmental variables (abiotic) and macrobenthic community (biotic) structure. The details of the BIO-ENV algorithm and its suitability for use in analyzing biological/ environmental data interactions are described by Ref [5] and Ref [6].

## 3. Results

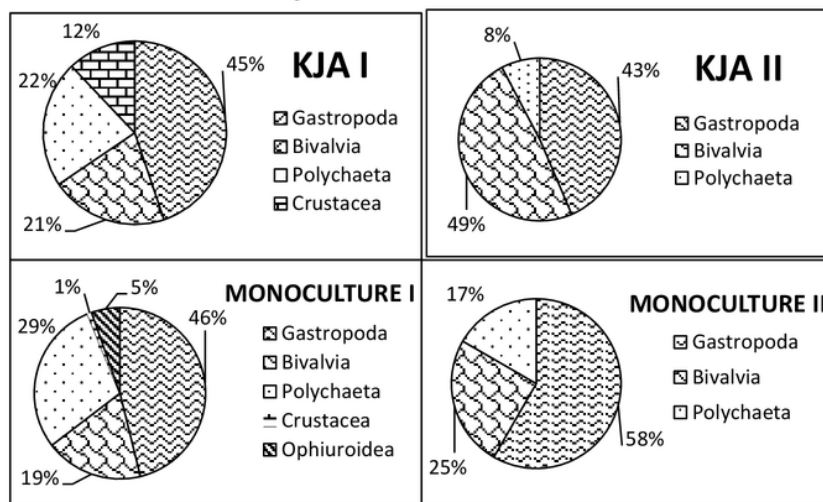
### *Macrobenthic structure in space and time*

The organisms collected from all locations belonged to 5 groups/classes, i.e. 48 molluscs, 13 annelids, 3 arthropods, and 1 ophiuroid, as shown in Table 1. The analysis of macrobenthic organisms at IMTA and monoculture sites indicated a difference in their abundance spatially and temporally, owing to their different in aquaculture technique and sampling time (taken in June and October). Difference in time sampling resulted in differences in water physics-chemical parameter values due to seasonal hydrographical condition.

**Table 1.** Macrobenthic in Tembelas Island

No.	Groups of Taxa	∑ Spesies Sampling I	∑ Spesies Sampling II
1.	Gastropoda	30 spesies	12 spesies
2.	Bivalvia	13 spesies	5 spesies
3.	Polychaeta	9 spesies	5 spesies
4.	Crustacea	3 spesies	1 spesies
5.	Ophiuroidea	1 spesies	0 spesies

Overall, number of macrobenthic taxa in sampling time II (represent as rainy season) exhibited lower, compared to sampling time I (represent as dry season). In particular, molluscs (gastropods and bivalves) were recorded the highest species found in each location. According to Ref [7], during the rainy season, there are limiting factors for macrobenthic in the presence of anoxic waters and enormous enrichment of nutrients in coastal waters. The presence of changes in sediment substrate (increased sand particles) in sampling II, may cause polychaetes less-able to survive. Ref [8] added that the silty substrate is the preferred habitat of polychaetes to grow and reproduce, since the organic materials on the substrate is used as the main food of the organisms, especially deposit feeders. As shown in Fig 1, the biggest abundance was found in sampling I, there were 55 individuals/grab at IMTA site, 139 individuals/grab at monoculture site, and 398 individuals/grab at reference site, whereas in sampling II there were 38 individuals/grab at IMTA aquaculture site, 48/grab at monoculture site, and 46 individuals/grab at reference sites.



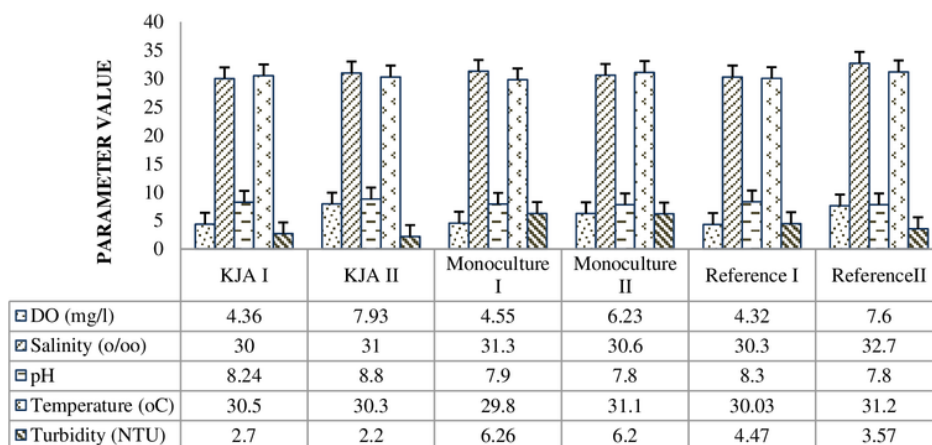
**Fig. 1.** The differences in proportion makrobenthic groups by location and sampling time.

Member of molluscs found in three locations were *Nassarius* sp and *Anodontia* sp whose presence in almost all sampling sites. *Tellina* sp is also dominant organism of macrobenthic scattered in the farming areas. Ref [9] found that Mollusca is one of the main organisms commonly found inhabiting soft sediment in coastal areas. Infaunal molluscs also usually inhabit sandy and muddy sediments at coastal areas as macrobenthic community. The lowest abundance was crustacean with 3 genus and 1 genus of ophiuroids, which exist only at monoculture site. This may be the site was favorable habitat for those organisms, compared to the farmed sites. According to Ref [10] reference location (as control) is considered as a location that has not been disturbed by human activities, especially the aquaculture of fish cages. The site would have natural water ecosystem that can be used as reference site to be compared to disturbed areas. Ref [11] emphasized that the family Nassariidae of Gastropod generally lives on sandy and silty substrates. Nassariidae is also an organic feeder and suspension feeder that decomposes below on water surface [12]. Furthermore, Ref [13] stated that *Anodontia* sp is often called mud shells due to it inhabits silt areas where its life immersed in mudflat. This is supported by the conditions of sediment at Tembelas Island (all three sampling locations), where the sites were dominated by mud (silt). *Tellina* sp is one of Mollusca that get benefits from the aquaculture activities that undergoes organic enrichment below the water. Ref [14] stated that *Tellina* sp is a deposit feeder organism (immersed in silt) and a suspension feeder at the bottom surface of the sediment. *Nereis* sp, *Capitella* sp, and *Sternaspis* sp were Polychaeta that only inhabit IMTA and monoculture sites. According to Ref [15], *Sternaspis* sp is a deposit feeder organism, especially feed on detritus. *Sternaspis* sp usually inhabit smooth silty sediment. Furthermore, Ref [16] stated that the

presence of capitellids as deposit feeders are related to sediment characteristics, especially in the silty sediment. Ref [10] stated the physical-chemical changes of an environment can be responded by increasing number of macrobenthic species and abundance.

#### **Physical-chemical water parameters**

Physical-chemical aquatic parameters measured at IMTA aquaculture, monoculture, and references were dissolved oxygen, salinity, temperature, pH, turbidity, nitrogen content, and carbon, as well as sediment composition on the bottom of aquaculture. The physical and chemical data obtained were pH (7,8 - 8,8), DO (4,32 - 10,93 mg/l), salinity (30 - 32,7‰), temperature (29,8 - 31,2°C), and turbidity (2,2 - 6,26 NTU).

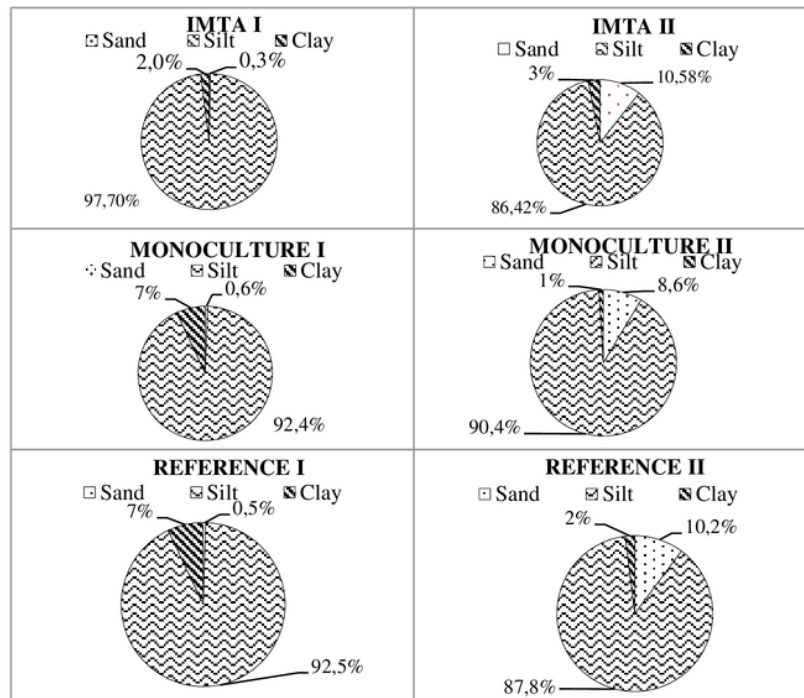


**Fig. 2.** Physical-chemical water parameters by location and sampling time ( $\pm$ SD).

It can be concluded that parameter values of physical-chemical water were recorded within normal range over the study period, as shown in Fig.2. Salinity at all sampling sites was still within a limits of tolerance for farmed and macrobenthic organism life. According to Ref [17], optimum salinity for gastropods and bivalves ranged from 26 to 32‰ and from 24-36‰, respectively. Based on Ref[18], standard of salinity for marine biota is 33-34 ppt, pH range from 7 – 8,5, dissolved oxygen > 5 mg / l, turbidity less than 5 NTU, and temperature range from 28-32°C. The results of DO in time sampling I were under quality threshold, but the value of DO was still within a limits of life and development of macrobenthic and farmed biotas. Furthermore, Ref [19] stated that oxygen depletion may be due to respiration and decomposition of organic substances used by microorganisms. Ref [10] stated that organic matter appeared from aquaculture activities can cause changes in aquatic and sedimentary environments. The continuous accumulation of organic matter can result in reduced oxygen in boundary layer between water and sediment, which ultimately affects changes in composition of infauna macrobenthic organisms.

#### **Sediment properties: sediment grain size and organic content**

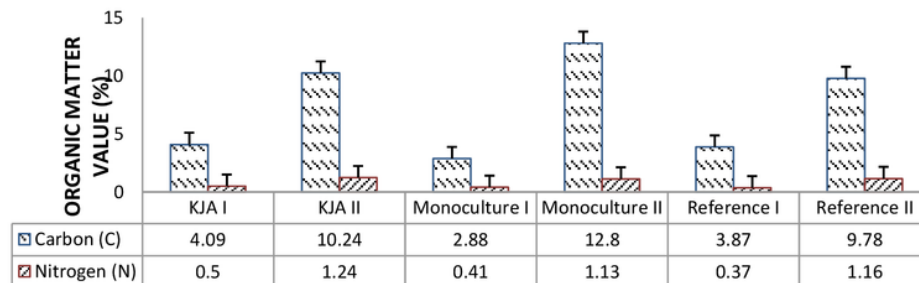
Sediment properties recorded at the two aquaculture sites and reference site were dominated by silt, i.e. 86,42-97,7% at at IMTA site, 90,4-92,4% at monoculture site and 87,8-92,5% at reference site. The proportion of clay at IMTA, monoculture, and reference sites ranged from 2-3%, 1-7%, and 2-7%, respectively. The proportion of sand at IMTA, monoculture, and reference sites ranged from 0,3-10,58%, 0,6 - 8,6%, and 0,5 - 10,2%, respectively (Fig. 3).



**Fig. 3.** Composition of sediment grain size by location and sampling time

Ref [20] stated that silty sediment can be affected by high suspended particles in waters column, resulting in low oxygen levels in the sediment. Type of substrate in the bottom of water column is considerably important for development of macrobenthic community. Sandy substrate may make it easier to macrobenthos move to another place than silty substrate that contains less oxygen. Therefore the organisms live in silty substrate have to adapt under this circumstances. Macrobenthic of bivalves, gastropods, and polychaetes were found in silty sampling sites. According to Ref [21] bivalves and gastropods species have a wider spread, because they are able to adapt to marine habitats with soft or hard sediment textures.

Meanwhile, the composition of organic content at IMTA, monoculture, and reference sites were ranging from 4,09-10,24% C and 0,5-1,24% N, 2,88-12,8% C and 0,41-1,13% N, and 3,87-9,78% C and 0,37-1,16% N, respectively, as shown in Fig. 4.



**Fig. 4.** Proportion of organic matter in the form of Carbon and Nitrogen by location and sampling time ( $\pm$ SD).

### Assessment of relationship between abiotic and biotic factors

The results of analysis BIO-ENV, as shown in Table 2, explained that total percent of nitrogen, silt, and clay were the abiotic factors most influencing macrobenthic structure (BIO-ENV;  $r = 0.46$ ;  $R^2 = 21.16\%$ ). This may imply that nitrogen in sediment of marine waters is a basic requirement that affects in growth and reproductive control of macrobenthic organisms. Therefore, the sedimentary substrate greatly determines abundance and distribution of macrobenthic community. The high organic matter (Carbon and Nitrogen) at farmed sites, especially in sampling time II (as rainy season) may be generated from accumulation of organic matter (nutrient enrichment) from the residual feed and residual feces during farming activities in sediments and water column. Ref [22] stated that sediments that have high organic matter can support an abundance of infauna dominated by deposit feeders. Furthermore, Ref [23] stated that source of organic nitrogen in water column is mainly produced from decay process of living things that have died, while anthropogenic source is derived from fishery and industrial activities.

**Table 2.** The relationship between abiotic and biotic factors using BIO-ENV software PRIMER V.6.1.5.

No	Correlation Coefficient (r)	Determination Coefficient ( $R^2$ )	Variables	Number of Variable
1.	0,46	21,16%	7,9,10	3
2.	0,46	21,16%	8, 9, 10	3
3.	0,44	19,36%	9, 10	2
4.	0,44	19,36%	7, 9	2
5.	0,42	17,64%	7, 8, 9, 10	4
6.	0,41	16,81%	6, 9, 10	3
7.	0,40	16%	7, 8, 9	3
8.	0,40	16%	3, 9, 10	3

Table 1  
 footnote: <sup>1)</sup> DO, <sup>2)</sup> Salinity, <sup>3)</sup> pH, <sup>4)</sup> Temperature, <sup>5)</sup> Turbidity, <sup>6)</sup> %C, <sup>7)</sup> %N, <sup>8)</sup> Sand, <sup>9)</sup> Silt, <sup>10)</sup> Clay,

### Acknowledgments

We would like to thank Ministry for Research, Technology, and Higher Education Degree (Simlitabmas – RISTEK DIKTI) for supporting research on the development of sustainable productive aquaculture through funding the research grant under the scheme National Strategic Research – ‘PUSN’ year period 2015 – 2017. The study was also supported by a Center of Marine Ecology and Biomonitoring for Sustainable Aquaculture (Ce-MEBSA), Diponegoro University, and Laboratory of Ecology and Biosystematics, Biology Department, Faculty of Science and Mathematics, Diponegoro University.

### References

- [1] Dauvin, J.C., Thiebaut, E., Gomez Gesteira, J.L., Ghertsos, K., Gentil, F., Ropert, M., Sylvan, B., 2004. Spatial Structure of A Subtidal Macrobenthic Community In The Bay of Veys (Western Bay of Seine, English Channel). *J. Exp. Mar. Biol. Ecol.* 307: 217-235.
- [2] Widowati, S. P. Putro, S. Koshio, dan V. Oktaferdian. 2016. Implementation of ARIMA Model to Asses Seasonal Variability Macrobenthic Assemblages. *Science Direct: Aquatic Procedia* 7 (2016) 227 – 284.
- [3] Putro, SP. 2016. *Konsep Aplikasi Budidaya Sistem Polikultur Terintegrasi Biomonitoring: Menuju Akuakultur Produktif Berkelanjutan*. Plantaxia. Yogyakarta.
- [4] Sahidin, A., I, Setyobudiandi dan Y. Wardiatno. 2014. Struktur komunitas makrozoobentos di Perairan Pesisir Tangerang, Banten. Program Studi Pengelolaan Sumberdaya Perairan,

- Sekolah Pascasarjana, Institut Pertanian Bogor. Bogor. ISSN 2089-7790 Desember 2014. Depik. 3(3): 226-233.
- [5] Clarke, K.R. and Warwick, R.M. (2001). Change in Marine Communities An Approach to Statistical Analysis and Interpretation. 2nd Edition, PRIMER-E, Plymouth, 172 p.
- [6] Clarke, KR, and Gorley, RN (2006). PRIMER v6: User manual/tutorial, PRIMER-E, Plymouth UK, 192p.
- [7] Pearson T.H., and Black K.D. 2001. in Black. KD (ed.). *Environmental impact of aquaculture*. Sheffield Academic Press, UK
- [8] Sundaravarman, K., D. Varadharajan, A. Babu, A. Saravanakumar, S. Vijayalakshmi, T. Balasubramania. 2012. A Study of marine benthic fauna with spacial reference to the environmental parameters, South East Coastal of India. *International Journal of Pharmaccutical & Biological Archives*, 3(5): 1157-1169.
- [9] Hendrick, M.E, Brusca R.C, Cordero M, and Ramirez G. 2007. Marine and brackishwater molluscan biodiversity in the Gulf of California, Mexico. *Scientia Marina*, 71: 637-647.
- [10] Putro, SP. 2014. *Metode Sampling Penelitian Makrobentos dan Aplikasinya: Penentuan Tingkat Gangguan Lingkungan Akuakultur*. Graha Ilmu. Yogyakarta.
- [11] Morton, B and Chan, K. 1999. Hunger Rapidly Overrides The Risk of Predation in The Subtidal Scavenger *Nassarius siquijorensis* (Gastropoda: Nassariidae): An Energy budget and comparison with the intertidal *Nassarius festivus* in Hong Kong. *Journal of Experimental Marine Biology and Ecology*, 240: 213-228.
- [12] Gofas, S.; Bouchet, P. (2016). *Nassarius reticulatus: Mollusca Base*. Accessed through: World Register of Marine Species at <http://www.marinespecies.org/aphia.php?p=taxdetails&id=140513> pada 2017-09-17.
- [13] Rochmady, 2011. *Aspek Bioekologi Kerang Lumpur Anodontia edentula Linnaeus, 1758 (BIVALVIA: LUCINIDAE) di Perairan Pesisir Kabupaten Muna*. Program Pascasarjana Universitas Hasanuddin. Makassar.
- [14] Bouchet, P.; Gofas, S.; Rosenberg, G. 2017. *Tellina versicolor: Mollusca Base*. Accessed through: World Register of Marine Species at <http://marinespecies.org/aphia.php?p=taxdetails&id=157004> pada pada 17 September 2017.
- [15] Polytraits-Team 2017. *Polytraits: A database on biological traits of polychaetes*. LifewatchGreece, Hellenic Centre for Marine Research. Available from <http://polytraits.lifewatchgreece.eu>. Diakses pada tanggal 22 September 2017.
- [16] Brito, R.M., Pompolo, S.G., Martins, M.F., Barros, E.G., and Sakamoto-Hojo, E.T. 2005. Cytogenetic Characterization of Two *Partamona* Species (Hymenoptera, Apinae, Meliponini) by Fluorochrome 182 Staining and Localization of 18 rDNA Clusters by Fish. *Cytologia* 70:375-380.
- [17] Pennak, R.W. 1978. *Freshwater Invertebrates of the United States*. Second ed. A Willey Interscience Publication. Jhon Willey and Sons, Inc. New York.
- [18] Decree of State Minister of Environment No 51 Year 2004. Website: [http://www.ppk-kp3k.kkp.go.id/ver3/media/download/RE\\_keputusan-menteri-negara-lingkungan-hidup-nomor-51-tahun-2004\\_20141008143942.pdf](http://www.ppk-kp3k.kkp.go.id/ver3/media/download/RE_keputusan-menteri-negara-lingkungan-hidup-nomor-51-tahun-2004_20141008143942.pdf). Accessed on 12 February 2017.
- [19] Tijssen, S.B., M. Mulder and F.J. Wetsteyn. 1990. Production and Consumption Rates of Oxygen, and Vertical Oxygen Structure in the upper 300 m in the eastern Banda Sea During and After the Upwelling Season, August 1984 and February/ March 1985. *Proc. Snellius-II Symp., Neth. J. Sea Res.* 25: 485 - 499.
- [20] Borja A, Franco J, and Pe´rez V. 2000. A marine biotic index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. *Marine Pollution Bulletin*. 40, 1100-1114.
- [21] Barnes, R. S. K., Hughes, R. N. 1982. *An Introduction to Marine Ecology*. Whitefriars Press. Australia.

- [22] Putro, S.P. 2007. Spatial and Temporal Patterns of The Macrobenthic Assemblages in Relation to Environmental Variables. *Journal of Coastal Development*, 10 (3): 15-22, June 2007, ISSN: 1410-5217. Lemlit-UNDIP, Semarang.
- [23] Effendi, H. 2003. *Telaah Kualitas Air Bagi Pengelolaan Sumber Daya Lingkungan Perairan*. Kanisius. Yogyakarta.

# 25 Correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, indonesia

## ORIGINALITY REPORT

20%

SIMILARITY INDEX

7%

INTERNET SOURCES

17%

PUBLICATIONS

8%

STUDENT PAPERS

## PRIMARY SOURCES

- 1 M Abyan Syuja', Sapto P. Putro, Fuad Muhammad. "Biomonitoring on Integrated Multi-Thropic Aquaculture (IMTA) activities using macrobenthic mollusks on Tembelas Island, Kepulauan Riau Province", Journal of Physics: Conference Series, 2018  
Publication 5%
- 2 Submitted to Universitas Diponegoro  
Student Paper 5%
- 3 eprints.gla.ac.uk  
Internet Source 2%
- 4 Widowati, Sapto Purnomo Putro, Sunshuke Koshio, Vivin Oktaferdian. "Implementation of ARIMA Model to Asses Seasonal Variability Macrobenthic Assemblages", Aquatic Procedia, 2016  
Publication 1%
- 5 [www.ejournal.undip.ac.id](http://www.ejournal.undip.ac.id)

6

Abdullah Aufa, Mochamad Hadi, Sapto Purnomo Putro. "Spatial and temporal patterns of macrozoobenthic community inhabiting sediments under tropical fish farming", Journal of Physics: Conference Series, 2018

Publication

7

Puri Veiga, Waldo Redondo, Isabel Sousa-Pinto, Marcos Rubal. "Relationship between structure of macrobenthic assemblages and environmental variables in shallow sublittoral soft bottoms", Marine Environmental Research, 2017

Publication

8

[eprints.whiterose.ac.uk](http://eprints.whiterose.ac.uk)

Internet Source

9

TOBY D. AUTH. "Distribution and community structure of ichthyoplankton from the northern and central California Current in May 200406", Fisheries Oceanography, 07/2008

Publication

10

[cdn.intechopen.com](http://cdn.intechopen.com)

Internet Source

11

Riche Hariyati, Sapto Putro. "Environmental quality assessment using microalgae

structures adjacent fish faming at Setoko  
Island, Batam City, Kepulaun Riau Province",  
Journal of Physics: Conference Series, 2018

Publication

---

---

Exclude quotes      Off

Exclude matches      < 1%

Exclude bibliography      On

# 25 Correlation between macrobenthic structure (biotic) and water-sediment characteristics (abiotic) adjacent aquaculture areas at Tembelas Island, indonesia

---

GRADEMARK REPORT

---

FINAL GRADE

**/0**

GENERAL COMMENTS

**Instructor**

---

PAGE 1

---

PAGE 2

---

PAGE 3

---

PAGE 4

---

PAGE 5

---

PAGE 6

---

PAGE 7

---

PAGE 8

---

PAGE 9

---