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Macrozoobentos Diversity Index as a Bioindicator in Krueng Cunda River to Support the Success of the Shrimp Agribusniness at Lhokseumawe City, Aceh Eka Maida , Adhiana and Zuriani Faculty of Agriculture, Departement of Agribusiness, Universitas Malikussaleh, Muara Batu, Indonesia Abstract Purpose – The purpose of this research is to examine the diversity of macrozoobenthos as well as its relationship with water quality and substrate in the pond culture area.

Design/Methodology/Approach – The method of sampling area is on ? ve observation stations by purposive sampling. The research was done indirectly (ex situ) for macrozoobenthic identi ? cation at the Ecology Laboratory, Faculty of Mathematics and Natural Sciences. Findings – The fairness/uniformity index obtained from the ? ve research stations ranging from 0.483 to 0.923 indicates a high degree of uniformity.

This indicates that the macrozoobenthos biological index at the study site can be used as an indicator that water quality is in good condition and has the potential to be developed into an aquaculture area as well as supporting the success of the shrimp farming as one of the sub- systems of the shrimp agribusiness. Research Limitations/Implications – This research can be a source of information for the management and utilization of environment in the research area, so that shrimp harvest can be optimized in the pond farming area. Originality/Value – This research has found that macrozoobenthos included 61 species.

Keywords Macrozoobenthos, water quality, bioindicator, shrimp farming All papers within this proceedings volume have been peer reviewed by the scienti ?c committee of the Malikussaleh International Conference on Multidisciplinary Studies (MICoMS 2017). 1. Introduction Macrozoobenthos in water can be used as an indicator of the quality of

the aquatic environment as they may re ? ect changes in environmental factors including the level of environmental pollution over time (Oey, 1978 in Maulana, 2010).

Macrozoobentos can be used as biological parameters in determining the condition of ponds or rivers because their life is relatively silent based on ponds or rivers. The purpose of this research is to see the

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110 8/ 9 78- 1- 78 75 6- 79 3- 1 - 00 011 diversity of macrozoobenthos and its relationship with water quality and subtract on river area which becomes water source for pond culture. This research area is a river ? ow mixed with sea water (estuaria) and has a feature that this area is a sea area which divides the mainland of Sumatera island to the strait. The ? ow of water that irrigates the pond area comes from salt water because its position is in the strait area.

This area has important roles for the society, such as cultivating groupers, snapper, shrimp, crab, and also oysters. The management of coastal environments as cultivated land to boost shrimp production sustainability should be done taking into the natural capabilities established by biodiversity. Improvement in environmental quality will arti ? cially cost and high risk, so the concept of natural recovery is the best alternative.

Biotic and abiotic components in coastal areas have speci ? c roles, but they are interconnected with each other to maintain the stability and fertility of cultivated land in coastal areas. Macrozoobenthos have sensitivity to some contaminants, low mobility, easily to catch, and long-lived. Therefore, the role of macrozoobenthos is to maintain the balance of aquatic ecosystems including cultivated land can be an indicator of recent ecological conditions in a particular area. The main problem is how to improve the amount of shrimp harvest.

This study aims to see the diversity of macrozoobenthos as well as its relationship with water quality and subtract in pond culture area. The results of this study are expected to be an information for the management and utilization of the environment in the coastal

areas of research for the utility of pond farming and optimizing the results of shrimp harvest. 2. Methodology 2.1.

Time and location The research was conducted in May 2017 until June 2017 along the Krueng Cunda River which is the source of water for the Lhokseumawe ' s aquaculture area. Sampling area is on ? ve observation stations by purposive sampling. The research was done indirectly (ex situ) for macrozoobenthic identi ?cation at Ecology Laboratory Faculty of Mathematics and Natural Sciences. 2.2.

Tools and materials research The tools and materials used in this research are the tools for measuring the physical condition and chemistry of the water environment, Global Position System was used to determine the coordinates of the research station, and Identi ? cation Book Tropical Paci ? c Invertebrate used to identify the macrozoobenthos species and sampling tools macrozoobenthos.

The other materials are plastics, plastic bags, sample bottles, stopwatch, label paper, markers, and digital camera. 2.3. Sampling method Determination of observation station is using purposive sampling method at ? ve observation stations based on consideration of ecological condition. Sampling was done by method of transect line plots systematically randomized.

Each observation station is divided into three substations in the form of a 100-m transect line which is operated perpendicular to the coastline. For taking macrozoobenthos, each substation is divided into three plots (10 _ 10) m 2 . Samples of macrozoobenthos were taken with the surber net by means of dredging the substrate three times.

The obtained macrozoobenthos samples were sorted and then inserted in 40% formalin ? lled sample vessels then identi ? ed in the laboratory. Water samples were taken at each station without in situ repeats and substrate sampling was performed using a 4 inch diameter paralonic pipe to a depth of 10 cm, then the substrate was stored in plastic and labeled for further analysis in the laboratory. Proceedings of MICoMS 2017 158 2.4. Statistical analysis 2.2.1.

Macrozoobenthos community structure M ac r oz oo ben thos C om m unit y Str uc tur e c om pr is in g: to tal num ber o f taxa (N), num ber o f spe c ie s (S), div ersit y (H 0), u n if o r m it y (E 2) , a n d do mi nanc e (D) w ith Sha nnon– W ie ne r D ive r s ity/ D ive r si ty Inde x (H 0) (K r e b s , 19 89) f oll ow s : H 0 ¼_ X pi ln pi where pi ¼ ni N (1) H 0 5 diversity index ni 5 the number of individual taxa i N 5 total number of individuals Pi 5 proportion of species i Uniformity/Evenness Index Type/Evenness Index (E) (Fachrul,

2007): $E = X H 0 Hmaks$ (2) with: E 5 uniformity index H 0 5 diversity index Hmaks 5 maximum diversity index Index dominance (Odum, 1994): $D = X pi 2$ (3) with: D 5 index of dominance Ni 5 the number of individual taxa i N 5 total number of individuals Pi 5 ni / N 5 proportion of species i 3. Results and discussion 3.1.

Geographical condition of research sites The research location is located at Kota Lhokseumawe in 04°54 0 to 05°18 0 North Latitude and 96° 20 0 to 97°21 0 East Longitude, staple by the Malacca Strait. The research location is the area of the river that irrigates aquaculture. Map of research area illustrated in Figure 1. 3.2. Density and composition type of macrozoobenthos The results of the analysis consist of macrozoobenthos community structure (number of individuals and macrozoobenthos type composition, diversity index, uniformity index, and dominance).

(1) Density of macrozoobenthos: The total number of individual macrozoobenthos obtained during the sequential study of the highest was 293 individuals/m 3 at station I, 194 individuals/m 3 at station II, 109 individuals/m 3 at station III, 51 individuals/m 3 at station IV, and 31 individuals/m 3 at station 5. Macrozo- obenthos Diversity Index as Bioindicator 159 (2) The composition of macrozoobenthos: The macrozoobenthos composition at the study sites consisted of 19% Annelida, 37% Bivalves, 2% Crustaceans, 40% Gastropods, 0.4% Holothuroidea, 0.1% Insecta, 1.3% Malacostraca, and 0.1% Oligochaeta.

The ?ve sampling stations Figure 1. City of Lhokseumawe Proceedings of MICoMS 2017 160 that have been conducted are dominated by species from the Gastropoda class and bivalves. (3) Diversity index, uniformity index, and dominance index: Overall the results of the analysis can be seen in comprising the index of macrozoobenthos diversity in the ?ve research stations ranging from 1.056 to 2.500. The fairness/uniformity index obtained from the ?ve research stations ranged from 0.483 to 0.923.

The dominant index of the ?ve research stations ranged from 0.099 to 0.520. The research location is located at Krueng Cunda River is the source of water for the cu ltivation of Lhokseumawe municipal pond. It is the expanse of ? shery aquaculture pond development which is dominated by the maintenance of shrimp commodity, milk ? sh, and also keramba ? oating.

Cultivation production obtained by farmers community still ? uctuate because the cultivation method applied is still different, that is, traditional and semi- intensive and intensive The results showed that the number of individual macrozoobenthos found in observation stations in the Krueng cunda River were 61 species consisting of eight classes, Annelida, Bivalvia, Crustacea, Gastropoda, Holothuroidea, Insecta, Malacostraca,

and Oligochaeta.

Bivalves and Gastropada are the ever-present classes at every station. The number of classes of Gastropoda and Bivalvia allegedly related to the substrate contained in each station, namely in the form of mud, sandy mud, dusty soil to clay. The type of Gastropoda and Bivalvia can grow and develop on muddy substrate types because it has a special physiology of long siphon (Nybakken, 1988) .

Cerithidea cingulata dominates the species against other species in all research stations. According to Marpaung (2013), Cerithidea cingulata is one of the benthos whose habitat is on a muddy substrate like a substrate in a pond. The presence of dominance due to the highly favorable environmental conditions in favor of the growth of certain species.

The macrozoobenthos composition at the study site consisted of 19% Annelida, 37% Bivalves, 2% Crustaceans, 40% Gastropods, 0.4% Holothuroidea, 0.1% Insecta, 1.3% Malacostraca, 0.1% Oligochaeta (Figure 2). The ? ve sampling stations that have been conducted are dominated by species from the Gastropoda and Bivalvia class. The number of classes of Gastropoda and Bivalvia allegedly related to the substrate contained in each station, namely in the form of mud, sandy mud, dusty soil to clay.

According to Nybakken (1988), the type of Gastropoda and Bivalvia can grow and develop on muddy substrate types because it has a special physiology of long siphon. Cerithidea cingulata is a species found in the ? ve research station sites, it is suspected that the adaptation of this species is high. According to Syamsurisal (2011), this type of Cerithidea cingulata has a thick and strong shell, columella usually rolled up and has a short canal.

Body structure like this causes the organism is not easily preyed by predators, so its existence is always abundant. Differences in macrozoobenthos composition in each station show that macrozoobenthos communities have speci ?c adaptations to the environmental and ecological conditions to be viable, to grow, and to breed (Pong and Andi, 2006). The macrozoobenthos diversity index in the ?ve research stations is moderate from 1.056 to 2.500.

Moderate (moderate) community conditions are a volatile community condition only with relatively small environmental in ? uences. The value of H 0 < 1 then the biota community is categorized as unstable, and if the value of H 0 ranges from 1 to 3, then the stability of the biota community is moderate, and if the value of H 0 > 3 then the community of biota is categorized in good condition (Pong and Andi, 2006).

Macrozo- obenthos Diversity Index as Bioindicator 161 The diversity index at station 5 is higher than the other four stations, presumably because t his st at i on is lo cat e d in t h e e s t u ar y ar ea cl ose t o t h e ? s h in g d oc k . T h e v a lu e of lo w d iv er s it y in d e x is f ou n d in s t at io ns 1, 2, 3, an d 4, it is su s p ec t e d t h at t h is st at ion i s c los e t o t h e re si d en t ia l area of resident s.

The exi stence of envi ro nmental zone diff erences causes the diversity of the into ler ant or ganism s to de cli ne, other w is e the to ler ant or ganis ms w ill be high. Suwo ndo et al. (20 04) me ntions t hat the r e is a cl ose r e latio nship betw e en diver s ity and e nvir onme ntal qualit y. The fai r nes s / unif or m ity i nde x obta ine d fr om the ? ve r e s ea r ch s ta tio ns r a ngin g f r om 0. 483 to 0.

923 indi ca te s a h igh de gr e e o f unif or m ity. The hig hes t uni for m i ty inde xe s a t s tat ions 4 a nd 5 a r e 0 .8 38 an d 0 .9 23, an d low a t s t at ion s 1 , 2 , a n d 3 ar e 0. 5 94, 0. 54 3, an d 0 . 483 , r e s p e ct iv e ly . The numb er of s pec ie s o btai ne d i s sm a ll and no dom in ant sp ec ie s , w he r ea s the 4 a nd 5 i nde xes in dic ate high va lue .

T his is thoug ht to be due t o en vir o nme nta l fa ct or s t hat a r e le s s s uppo r tiv e fo r th e li fe of m ac r oz oo be ntho s. The va lue o f E cl os e to 0 m ea ns uni for m i ty o f or ga nis m type s in an unba lan ce d w a te r s due to c om pe ti tio n bo th p lac e a nd fo od (R os yad i a nd T ham r in, 2 00 9).

If t he valu e o f E appr o ac he s 1 indi ca te s the unif or m ity o f th e t ype o f o r gani sm in the w ate r s in a s tat e of bal anc e be c aus e t her e is no c om pe tit io n e it her to pl ac e or foo d. The dominant index shows the values obtained from the ? ve research stations ranging from 0.099 to 0.520, indicating moderate dominance. If $0 < D < 0.5$, then the dominance is low; if $0.5 < D < 0.75$, then the dominance is moderate; and if $0.75 < D < 1.00$, then the dominance is high (Susiana, 2011). The highest dominant index in the embankment is at station 3 and the lowest dominant index is at station 5.

This is expected to affect the substrate type. Substrate type is the main factor that controls the distribution of macrozoobenthos. This is due to the smaller number of species and the presence of some larger individuals dominating the area (Setiawan, 2010). References Fachrul, F.M. (2007). Methodology of Bio-Ecological Sampling , Bumi Aksara, Jakarta. Krebs, C. (1989) Experimental Analysis of Distribution and Abudance (3rd ed.), Harper and Row Publisher, New York, NY. Figure 2. Composition of Macrozoobentos throughout the Station Proceedings of MICoMS 2017 162 Marpaung, A.A.F. (2013).

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