CONFERENCE PROCEEDINGS

THE 1st INTERNATIONAL CONFERENCE ON APPLIED MARINE SCIENCE AND FISHERIES TECHNOLOGY (MSFT) 2015

ENFORCING SUSTAINABLE DEVELOPMENT OF THE MARINE RESOURCES OF SMALL ISLANDS

August 18-21, 2015 - Langgur, Kei Islands, Indonesia

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Proceedings of The 1st "International Conference On Applied Marine Science and Fisheries Technology (MSFT) 2015

Editors :
Prof. Les Christidis
Assoc.Prof. Fil.Dr. Tomas Cedhagen
Dr. Andreas Kunzmann
Dr.rer.nat. Ir. Eugenius Alfred Renjaan, M.Sc
Dr.rer.nat Gino Valentino Limmon, M.Sc

Tual State Fisheries Polytechnic
Langgur-Sathean Ring Road. Km. 6, Langgur Southeast Maluku Postal Code 97611
Phone(+62) 812 12161645; www.polikant.ac.id

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MESSAGE FROM DIRECTOR OF TUAL STATE FISHERIES POLYTECHNIC

On behalf of Tual State Fisheries Polytechnic, I am thanking all scientists and delegations to attend the 2015 MSFT The 1st International Conference in Langgur, Southeast Maluku, Indonesia.

Communities on small islands are generally isolated from many scientific and technological advances, which often results in the non-sustainable use of marine resources and low economic growth. This international conference was initiated to serve as a platform for the information exchange of research results from various fields of marine science and fisheries technology, including relevant socioeconomic and business disciplines, as well as the sharing of practical experiences in the utilization and management of the marine resources of small islands on an on-going basis.

I am honored that the conference opened by Maluku Provincial Governor Ir. Said Assagaff. With over 40 National and International speakers from, Australia, United States of America, Sweden, Denmark, Malaysia, German and France and Indonesia. The conference also as bridge for small islands like Southeast Maluku and Maluku in particular and Indonesia in general to the world in order to enforcing and improving sustainable development with applied marine science and fisheries technology.

The first MSFT covers a broad range of topics related to applied marine science and fisheries technology, from monetizing marine resources, latest technology on improving aquaculture, density on coral reef related to sustainable of marine resources to the practical solution on increasing the welfare of small islands communities.

I hope these Proceedings will furnish the scientists of the world with an excellent reference book. I trust also that this will be an impetus to stimulate further study and research in all these areas.

Eugenius Alfred Renjaan

PREFACE

From August 18-21, 2015 Tual State Fisheries Polytechnic was pleased to host The First biannual "International Conference On Applied Marine Science and Fisheries Technology (MSFT) 2015" with main theme "Enforcing Sustainable Development of Marine Resources of Small Island". MSFT 2015 was held in Langgur, Kei Islands, Southeast Maluku Regency, Indonesia.

The Organizing Committee was pleased to note that the event gained significant interest, With over 40 National and International speakers from, Australia, United States of America, Sweden, Denmark, Malaysia, German and France and Indonesia from 22 institutions around te world as well as 31 oral presenters 18 poster presentations during 4 panel sessions.

The conference hosted six keynote presentations. Dr. Zainal Arifin (Indoneisia) "Potential of Marine Pollution from Oil and Gas Industries in Eastern Indonesia and Its Prevention Efforts", Prof. Les Christidis (Australia) presented "Incorporating diversity in aquaculture approaches as a way of future proofing the sustainable development of marine resources of small islands", Prof. Laszlo Szekely, MD, PhD (Sweden) presented "Do we need thousand new anti-cancer drugs and can we find them in the sea?", Assoc.Prof. Fil.Dr Tomas Cedhagen (Denmark) presented "Environmental Monitoring Through next-generation sequence Metabarcoding: Assessing The Impact of Fish Farming on bentchic macro and meiofauna communities", Prof. Hans Glise, MD, PhD (Sweden) presented "Monetizing Marine Biodiversity for Economic Development in a Sustainable way" and Dr. Andreas Kunzmann (Germany) presented "Improving Seaweed Farmers Livelihoods Through Integrated Multitrophic Aquaculture (IMTA) and High Quality Seaweed Processing"

We wish to express our gratutide to sponsors that generously assisted the work of MSFT 2015, Bank Mandiri, Bank Modern and Bank BRI. The organizing committee was delighted with the success of the conference, and wishes to note that the conference would not have occurred without the efforts of the many members of the committee, who gave generously of their time.

Finally, editors have worked hard to review and edited all papers of MSFT Proceeding and we apologize if there are still any shortcoming and it will be our valuable evaluation for better work in coming years.

We thank all authors and participants for their contributions.

Chairman, Co Chairman, Program Chair

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MACROBENTHOS DIVERSITY AT BULI BAY: ECOLOGY DETERMINANTS AND RELATIONSHIP WITH WATER QUALITY PARAMETERS

Mohammad Ridwan Lessy[1], Jefry Bemba[1], Salim Abubakar[2]
1) Marine Science Department, Fisheries and Marine Science Faculty Khairun University – Ternate
2) Water Resources Management, Fisheries and Marine Science Faculty Khairun University – Ternate
Correspondent Email: mrlessy_8375@yahoo.com

ABSTRACT

Macrobenthos are commonly used as biomonitors to detect pollution impacts in marine environment due to their unique characteristics. The present investigation synthesized information on macrobenthos biodiversity in Buli bay, Halmahera Island during August 2014. A total of ninety species belonging to two orders of phylum Mollusk and echinoderm has been recorded. The class wise densities were as Holothuroidea (3%), Asteroidean (4%), echonoidea (2%), Bivalve (25%) and Gastropod 56%). The value of individual diversity indices like Shannon – Weiner index (H); Margalef's index (d) and Pielou Eveness Index (J) of macrobenthos community of Buli bay shows that the ecological condition is light pollution due to standard of assessment.

Keywords: *Macrobenthos, Shannon – Weiner index; Margalef's index; Pielou Evenness Index and Buli bay-Halmahera Island.*

1.INTRODUCTION

Increase of human activity around the Buli bay direct or indirect give the impacts to the coastal area. Both domestic and industrial wastes are becoming an increasing threat to coastal marine habitats. Its influence the biological diversity, extending from gene to ecosystem. Biological approaches can be use to determine the ecological effects of pollution has been preferred widely for decades. These approaches have more advantages than determining the pollution with only using physico-chemical methods, because physicochemical variables give information about only the situation of water at the time of measuring (Rosenberg and Resh 1993).

Varying environmental conditions differently responses by Species in the natural community (Soininen, 2007; Van Dam et al., 1994; Shah et al., 2013; Shah and Pandit, 2013). Thus the changes of community can be use to evaluate the environmnetal condition. The use of macrobenthos to assess water quality is an example.

One of the most preferred group in biomonitoring studies are macrobenthos diversity (Koperski, 2011). Because of having limited habitat and less moving ability, they cannot change their habitats quickly and they respond to any pollutants by changing their community composition (Rosenberg and Resh, 1993). Various diversity indices are used to determine the distribution of macrobenthos related to habitat quality. Diversity index is a statistical method which is planned to evaluate the variety of a data group consisting of different types of components.

This study aims to determine the diviersity of macrobenthos based on diversity indices in which can be used more effectively to find out habitat quality of Buli bay, East Halmahera.

2.METHODOLOGY

2.1. Study Area and Sampling Sites

Buli bay is located at North Maluku Province in Halmahera Island region. Geographically, the bay was surrounded by several hills which contain many minerals such as nickel and copper. Therefore, a number of mining companies had been operation in this area since 90's. Sampling was carried out at 7 sites around the Buli village (Fig. 1). The locations of the sites were chosen by their relevance for human activity, coastal area, Small Island and mining area.

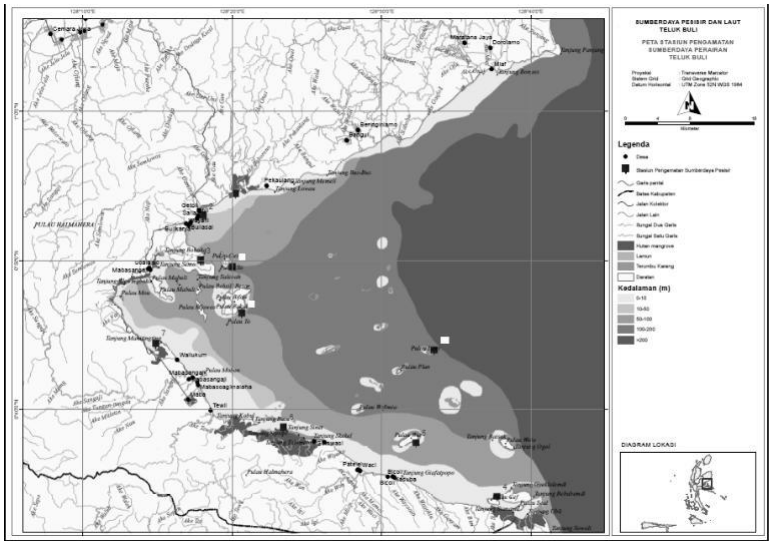

Figure 1. Map of the study area with the location of sampling sites

2.2 Sample Collection Method

Collection and study of macrobenthos were done by following the methods of Rondo (2004). Specimens were preserved in plastic jars containing 4% formalin, packed in polythene bags and brought to the laboratory. They were identified by reference with Dharma (1988); Dharma (2005); Allen (2000); Oemarjati and Wardhana (1990);

Water quality parameters were determined using a Horiba Water Quality Checker for oxygen content, salinity, pH and water temperature. For chemical parameters such as; BOD_5, Phosphate (PO_4-P) and Nitrate (NO_3-N), samples were collected and analyzed at Safety and Health Worker Laboratory, Macassar - Indonesia.

Data Analysis

The following diversity indices were calculated using PRIMER software: Shannon-Wiener diversity ($H' = - \sum_i pi \log (pi)$, using log *e*); Margalef's index ($d = (S-1)/Ln\ N$) for species richness, with higher values indicating higher species numbers per individual numbers); Pielou's index ($J' = H''/H_{max}$). To assess the environmental quality, refer to Table1 for assessment standard of three diversity indexes

Table1. Assessment standard of diversity index

Diversity Index	Assesment standard	
Shannon- Wiener index (H)	0 - 1 Heavy Pollution	> 3 Light Pollution
Margalef Index (d)	0 - 1 Heavy Pollution	> 3 Light Pollution
Pielou Index (J)	0 – 0.3 Heavy Pollution	>0.5 light Pollution

Ren. et al, (2012).

3. RESULTS AND DISSCUSSION

3.1. Species Composition and Distribution

During the study, total 189 individuals distinguished in 90 taxa were identified from all sites. The number of individuals belonging to each class was shown in Figure 2. From all taxa, Gastropods were the largest group and richest in species, with 56 species recorded. In respect to both diversity and abundance, this group is represented at high levels compared to other groups. Most of gastropods group came from neritidae family. The second, Bivalves were present with 25 species, and others were Holothuroidea present with 3 species, Echinoidea 2 species and Asteriodea 4 species.

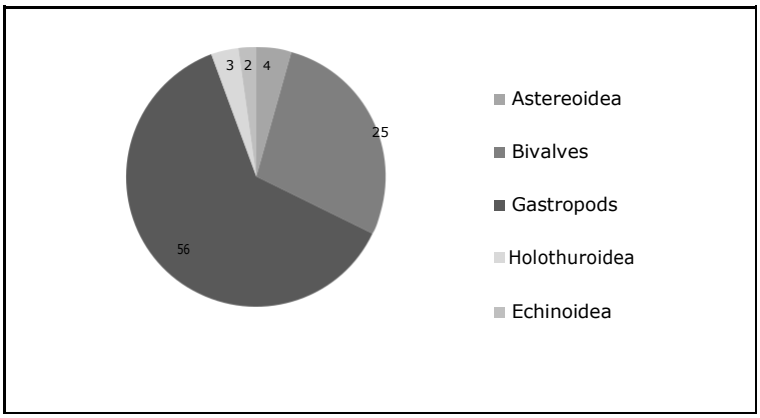

Figure 2. Number of Individuals Based on Each Family

The distribution of species was not equally distributed in all study sites. The Islands sites contained more species than all terrestrial sites. The total number of species recorded in all study sites was shown in Figure 3. The highest number of species was 41 in Englan Island, followed by 38 in Pakal Island, 31 in Wor Island, and 23 in Ge Island. Whereas, Meriniting island just found 15 species. Meanwhile for terrestrial areas, Buli site 1 and Buli site 2 noted 21 and 15 species.

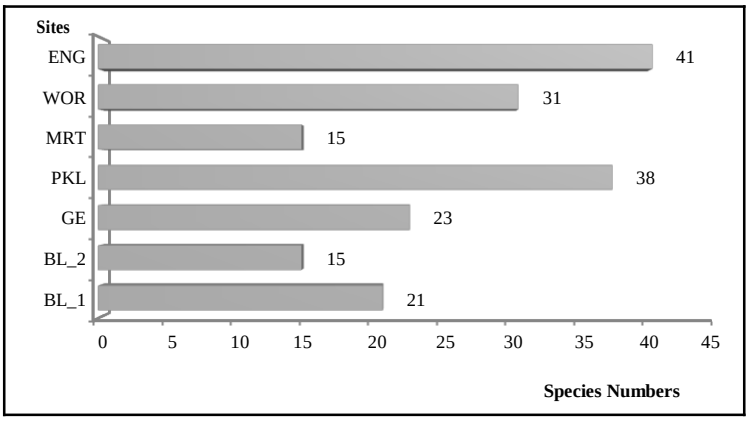

Figure 3. Total number of Species recorded at the sampling sites

3.2. Biology Diversity Index

Shannon Diversity Index

The Shannon-Wiener diversity index, developed from the information theory, is perhaps the most popular diversity index with marine biologists has been tested in various environments and since it is calculated solely from the relative abundance of species is considered a perfectly valid parameter from a biological point of view (Simboura and Zenetos, 2002). The values of Shannon Diversity Index were found in this study from all sites between 2.25 – 3.59. The lowest value was for Site 5 and the highest value was for Site 4 (Figure 4, Table 2). All results were found in the proper range (1.5 - 3.5) and macrobenthos composition was found very diverse. Thus, Shannon Diversity Index result was found as the highest value.

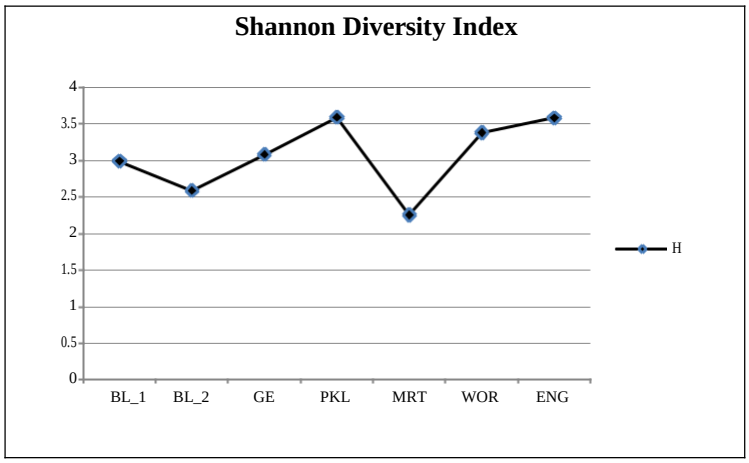

Figure 4. Shannon Diversity Index values of sites

Pielou's Index

Pielou Index or Species evenness index refers to how close in number each species in an environment are. This index is a measure of the distribution of individuals among species. Low evenness values indicate an uneven distribution with high densities of only few opportunistic species. The values of Pielou Index were found in this study between 2.25 – 3.59. The lowest value was for Site 5 and the highest value was for Site 4 (Figure 5, Table 2).

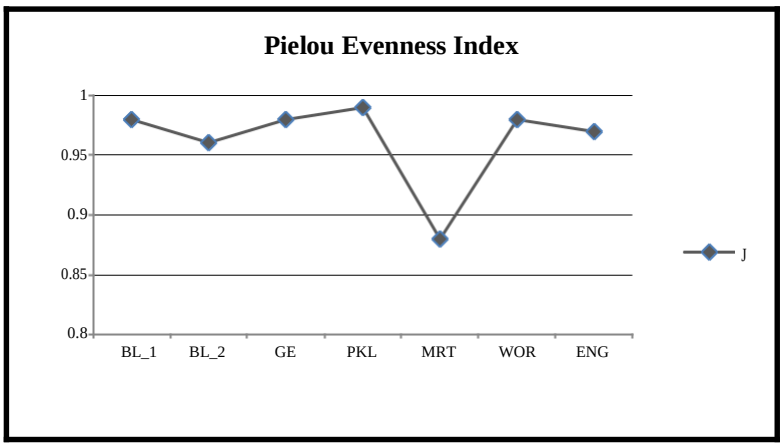

Figure 5. Pielou Evenness Index values of sites

Margalef Diversity Index

Margalef's index is a simple species diversity index emphasizing species richness. It's can be use to explain ecological status classification of water bodies within the environmental framework implementation. The values of Margalef Diversity Index from this study were between 2.74 – 7.24. The lowest value was for Site 5 and the highest value was for Site 7 (Figure 6, Table 2). This index shows variation depending on number of species, so that the number of individuals is less important for calculation. It has a different purpose of usage from other indices. However, it showed similar results with the other indices. For example, Site 4 had the highest value in this index like in the others.

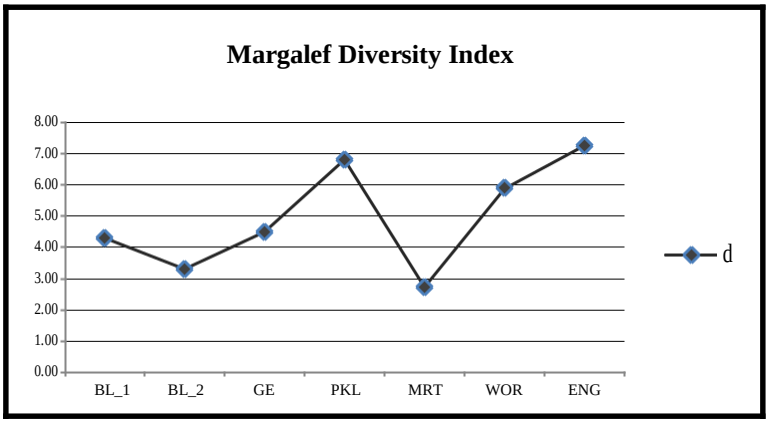

Figure 6. Margalef Diversity Index values of sites

Table 2.Number of Species and Diversity indices for each sampling sites

Sites	S	N	Shannon-Wiener Index (H)	Pielou's Index (J)	Margalef's index (d)
BL_1	21	106	2.99	0.98	4.29
BL_2	15	70	2.59	0.96	3.30
GE	23	134	3.08	0.98	4.49
PKL	38	230	3.59	0.99	6.80
MRT	13	80	2.25	0.88	2.74
WOR	31	163	3.38	0.98	5.89
ENG	41	251	3.58	0.97	7.24

Water Quality Parameters

A summary of the physical and chemical parameters of the study area is given in Table 3. Overall, the water temperature followed closely that of the ambient temperature and its value above standard quality for aquatic life. Same with water temperature, salinity was naturally and the value above the standard from all sites. Alkaline pH from each sites were recorded between 7.75 - 8.26.

Table 3. Water Quality at sampling sites

Parameter	Unit	BL_1	BL_2	GE	PKL	MRT	WOR	ENG	Quality Standard *
Water Temperature	oC	24.4	24.5	24.5	24.7	24.6	24.7	24.7	Natural
Salinity	ppt	29.8	29.3	29.8	29.5	30.2	29.7	30.1	Natural
Dissolved Oxygen	mg/l	5.31	5.11	5.32	5.78	5.14	5.22	5.33	> 5
pH		7.75	8.02	8.17	8.26	7.81	8.04	8.01	7-8.5
BOD 5	mg/l	3	2	3	2	2	2	3	20
Phosphate (PO4-P)	mg/l	4.48	0.15	0.17	0.17	0.2	1.12	0.65	0.015
Nitrate (NO3-N)	mg/l	0.3	0.9	0.5	0.7	0.7	0.5	0.8	0.008

**Quality standard for aquatic life based on Environmental Ministry Regulation No. 51/2004*

During the study, Dissolved Oxygen (DO) was found between 5.11 - 5.78 mgL-1 from all sites. This value was above the quality standard. On the other hand, the average of Biological Oxygen Demand (BOD) found between 2 - 3 mgL-1 and its value below the standard (20 mgL-1). These parameters indicate that unstressed condition for fish and aquatic biota. Meanwhile, as the basic nutrients, Phosphorus and nitrogen are important to determine the productivity of seawater.

During the study, phosphate was found between 0.15 - 4.48 mgL-1 and nitrate was found on range 0.3 - 0.9mgL-1. The value of those parameters from all sites has been higher than quality standard for aquatic life.

The fauna macrobenthos was important for enhancing the aquatic resources and also have an important role in food chain and biological purification of water (Quasin et al., 2009). From the results of present study it is clearly evident that the macrobenthos community is dominated by mollusk from gastropods and bivalves taxa. Every organism has a high ability to survive against changes in environmental quality. And the mollusk was able to overcome such conditions to some extent. Therefore the mollusk can be regarded as bio indicator species of seawater pollution. Availability of different species of mollusk only indicated the good conditions of coastal area.

Different macrobenthos species give the response differently to environmental conditions and have different level of tolerance of and sensitivity to pollution levels. The parameters of macrobenthos community such as community structure, dominant species, diversity and biomass can be used to indicate the environmental characteristic. Based on the study, it can be seen that the diversity of macrobenthos at Buli bay was varied. At site BL_1, BL_2, and MRT shows that the velue of Shannon diversity index between 1 and 3, which mean the category of pollution was moderate. While the other sites have a high value of Shannon diversity index (>3) and shows the light pollution category.

Similarly with Shannon index, Margalef index from site MRT has lower than 3. Its mean this site at moderate pollution category. And other sites have the value above of 3, in which the category of pollution level was light pollution. Differ from other index, the value of Pielou index shows that all sites have the value high than 0.5. So, it's indicating that all sites have light pollution category. This result indicates that the area which high human activity such as mining, farming and municipal activity, produce some source of pollution for example nutrients.

Through the diversity index of macrobenthos has evaluated the water quality shows that water quality is light polluted category. Several parameters (nutrients) have been high than quality standard from Indonesia environmental ministry regulation and other parameters still naturally. Therefore, the application of macrobenthos community structure and evaluation of Buli bay water quality was available, and Shannon-Wiener index and Pielou evenness index in evaluation of the water are suitable to evaluate water body.

4.CONCLUSIONS

The increase of human activity had been given impact to coastal area pollution and degradations in habitat quality cause a decrease in number of species and a change in number of individuals of macrobenthos assemblages in coastal. The biodiversity indices and evenness indices in this study reflected the degradations in light pollution category**.**

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Thanks are due to the Environmental Agency of North Maluku Province, Director of Yayasan Pelestari Lingkungan Hidup, Research Centre of Marine Science, Khairun University and Safety and Health Worker Laboratory, Makassar - Indonesia for providing necessary laboratory facilities.

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