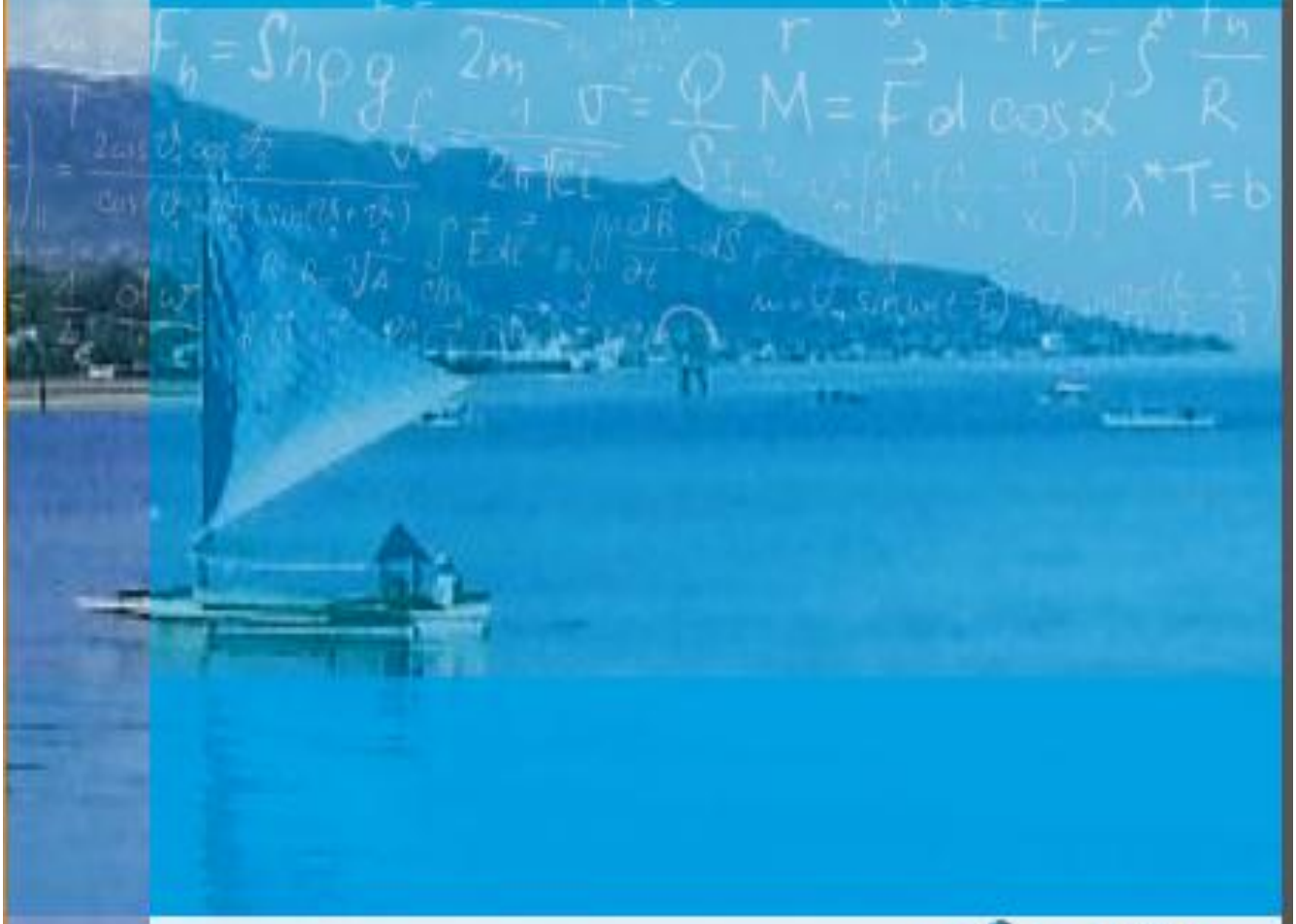
Basic Science
for Sustainable Marine Development

PROCEEDING
INTERNATIONAL SEMINAR 2015

Ambon, 3-4 June 2015



Organized by
Faculty of Mathematics and Natural Sciences
Pattimura University

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

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Welcoming Address by The Organizing Committee

The honorable, the rector of Pattimura University

The honorable, the vice rector of academic affair, Pattimura University

The honorable, the vice rector of administration and financial affair, Pattimura University

The honorable, the vice rector of planning, cooperation and information affair, Pattimura University

The honorable, all the deans in Pattimura University

The honorable, the key note speakers and other guests.

We have to thank The Almighty God for the blessings that allow this International seminar can be held today. This is the first seminar about MIPA Science in which the Faculty of MIPA Pattimura University becomes the host. The seminar under the title Basic Science for Sustainable Marine Development will be carried out on 3 June 2015 at Rectorate Building, the second floor. There are 250 participants from lecturers, research institute, students, and also there are 34 papers will be presented.

This International seminar is supported by the amazing people who always give financial as well as moral supports. My special thanks refer to the rector of Pattimura University, Prof. Dr. Thomas Pentury, M.Si, and the Dean of MIPA Faculty, Prof. Dr. Pieter Kakissina, M. Si. I also would like to express my deepest gratitude to Dr. Kotaro Ichikawa, the director of CSEAS Kyoto University, Prof. Bohari M. Yamin, University of Kebangsaan Malaysia, Prof. Dr. Budi Nurani Ruchjana (Prisident of Indonesian Mathematical Society/Indo-MS), Dr. Ir. A. Syailatua, M.Sc (Director of LIPI Ambon), and Hendry Ishak Elim, PhD as the key note speakers. We expect that this international seminar can give valuable information and contribution especially in developing basic science for sustainable marine development in the future.

Last but not least, we realize that as human we have weaknesses in holding this seminar, but personally I believe that there are pearls behind this seminar. Thank you very much.

Chairman

Dr. Netty Siahaya, M.Si.

Opening Remarks
By Dean of Mathematic and Natural Science Faculty

I express my deepest gratitude to The Almighty God for every single blessing He provides us especially in the process of holding the seminar until publishing the proceeding of International Seminar in celebrating the 17th anniversary of MIPA Faculty, Pattimura University. The theme of the anniversary is under the title Basic Science for Sustainable Marine Development. The reason of choosing this theme is that Maluku is one of five areas in Techno Park Marine in Indonesia. Furthermore, it is expected that this development can be means where the process of innovation, it is the conversion of science and technology into economic value can be worthwhile for public welfare especially coastal communities.

Having the second big variety of biological resources in the world, Indonesia is rich of its marine flora and fauna. These potential resources can be treated as high value products that demand by international market. Basic science of MIPA plays important role in developing the management of sustainable marine biological resources.

The scientific articles in this proceeding are the results of research and they are analyzed scientifically. It is expected that this proceeding can be valuable information in terms of developing science and technology for public welfare, especially people in Maluku.

My special thanks refer to all researchers and reviewers for your brilliant ideas in completing and publishing this proceeding. I also would like to express my gratefulness to the dies committee-anniversary of MIPA Faculty for your creativity and hard working in finishing this proceeding, God Bless you all.

Dean of Mathematic and Natural Science Faculty

Prof. Dr. Pieter Kakisina, M.Si.

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The Effect of Sampling Scheme in The Survey of Deposition of Heavy Metals in Ambon Bay by Using Spons (Porifera) Biomonitoring

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ABSTRACT

The deposition of heavy metals in Ambon Bay was investigated by using sponge species (*Callispongia sp*) as bioindicator. Sampling was done in the dry seasons of summer 2011. Two different sampling schemes are discussed in this paper: a random sampling scheme with 8 sampling sites distributed over the whole territory of Ambon Bay. Unwashed, dried samples were totally the concentrations of metal elements were determined by inductively coupled plasma atomic emission spectroscopy (ICP-AES). Four elements, Pb, Cd, Zn, and Cr). The median concentrations and statistical parameters of elements were discussed by comparing two sampling schemes. The results of both sampling schemes are compared with the results of other the location of the net. Different levels of the contamination valuated by the respective contamination factor (CF) of each element are obtained for both sampling schemes, while the local contamination identified like iron-chromium metallurgy and cement industry, oil refinery, mining industry, and transport have been the same for both sampling schemes. In addition, the natural sources, from the accumulation of these metals in sponge caused by metal-enriched soil, associated with wind blowing soils were pointed as another possibility of local factors.

Keywords: sponge Callispongia sp, elements Pb, Cd, Cr, and Cr

INTRODUCTION

The capital of Maluku province is surrounded by Ambon waters in area about 187 thousand square kilometers, 17% slope, and relatively rugged land area. Its land use will have an impact on the ecological pressures to Ambon Bay waters (Pelasula, 2009). Ambon Bay waters has multiple functions, namely as a regional fisheries and aquaculture, police seaport and Navy bases, PELNI ship port, and out of the traditional boats Ambon and ferry crossing pier, fishing port, Pertamina, ship repair dock space, recreation areas and sports, and electric power by PLN, so that the waters of Ambon Bay is very susceptible to environmental changes because each activity will produce many metal wastes. Island of Ambon is encircled by fringing type coral reefs which grows lengthwise along the shoreline on the north and south bay (Leatemia, 1996).

It is generally recognized that sponges are the animals that always associated with coral reefs. Sponges, in feeding, rely mostly on a constant flow of waters bringing its dissolved organic matters as well as particulate non organics such as metal associated compounds. The sponges also have long been a center of attention from scientists in different countries to look at the possibility using them as metal bioindicator due to its capacity to accumulate metals (Hansen et al.1995; Olesen and Weeks, 1994; Patel et al, 1985; Perez et al., 2005) without sacrifice its growth and survival rate. Copper, lead, and vanadium have been studied and showed a sponge capacity in absorbing them in high concentration (Cebrian, et al., 2003). Also *Petrossian tertudinaria* species have been used as a biomarker for the detection of heavy metals in inshore areas (0.5-1 km) and offshore (5-7 km) in the Gulf of Mannar, India. In fact, sponge heavy metal concentration of inshore was about 64 times higher than the offshore (Rao et al, 2006).

Ability to accumulate heavy metals in the sponge is very important to be known as one of the guidelines in determining the status of water pollution in an area that has a coral reef ecosystem, in which the region is the habitat of a living sponge. This is in line with the opinions Darmono, 1995, Munir et al, 2005 and Rejomon et al 2007, that the metal content in aquatic biota generally increases over time because the metal is expected, so the presence of a sponge in water Hative cycle can be used to determine the heavy metals Pb, Cd , Cr, and Zn in the sponge type callispongia sp, sediments and water in the waters Ambon bay.

MATERIALS AND METHODS

Research materials are: sponges from Hative waters in Ambon bay; Acetone (Merck), HNO_3 (p.A), double distilled water and Whatman filter paper. Sponge samples were collected by diving, cleaned and then placed in a plastic bag and put in the ice box. 0.5 grams of sample was put in beaker glass, add 5 mL HNO_3 and then heated at 150 ^{0}C for 2 hours. After being cooled at room temperature, sample put in 25 mL volumetric flask, match the volume with double distilled water and filtered with Whatman paper and solution is ready to be analyzed by ICP-OES Perkin Elmer 3000. One litre of water sample was taken at the bottom, and immediately filtered with filter paper of cellulose nitrate (0.45 µ) after previously washed with 1N HNO_3 and then preserved in HNO_3 5%. 250 ml water sample is inserted in a Teflon separating funnel, then extracted with APDC-NaDDC/MIBK. The organic phase was extracted again with 5% HNO_3 solution, filtered back, and ready for analysis by ICP-OES Perkin Elmer 3000.

For sediments, they were taken from the bottom with a Van Veen Grab sampler, stored in polyethylene bottles and taken in laboratory put in a Teflon beaker and dried in an oven at a temperature of 105 ^{o}C and after drying, rinsed 3 times with double distilled water then dried again. A total of 5 g sample was destructed in Teflon beaker with solution of HNO_3/HCl (1:3) at 100 ° C for 8 hours. After that, the solution was filtered, and the filtrate is ready to be analyzed by ICP-OES Perkin 3000.

RESULTS AND DISCUSSION

General Situation of sampling locations

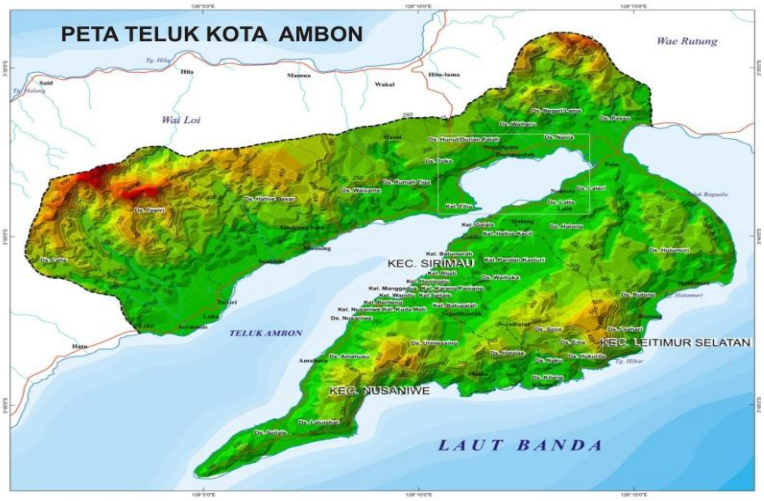

Figure 1. Map of Ambon City and research sites

Sampling was conducted on July 4, 2011, about noon under cloudy weather in Hative waters surrounded by population settlement, estuaries, navy complex, harbour, oil depot of Pertamina, and sago plantation. *Callispongia* sp. ca 50 grams were taken under physical conditions and content analysis as seen in Table-1 below.

Table-1. Physicochemical conditions in Ambon bay and sponge *Callispongia* sp.

Site	Waters conditions			Content (%)		
	Temperature (^oC)	pH	Salinity (0/00)	Water	Ash	Biomass
Ambon Bay	28	6.8	30	78,74	87.00	16.90

The data clearly shows that Hative water quality fits with water condition in general where sponges grow well in tropical and sub-tropical conditions with vertical distribution on coral reefs at low tide up into the area of approximately 50 meters (Manuputty, 2002). Also, water content, ash, and biomass of *Callispongia* sp. represent an integral part of metal content in a biological sample (Darmono, 1995).

Accumulation of Pb, Cd, Cr and Zn *Callispongia* sp. can be seen in Table-2 below as a function of organ as skeleton and tissue. Also ditermined were water and sediment around sponge. Logically before entering into cellular level of sponge, metals will be firstly existed in water and sediment. It seems obvious that each element shows a different partitional pattern where cadmium as the least amount remain largely in sediment (86.4 %). Oppositely, chromium was almost all adsorbed by cellular sponge. It was also clear that majority of elements have stayed in cellular level.

Table 2. Metal content (ppm) in the sponge *Callispongia* sp.

Metal	Total (Skeleton + Tissue)	Skeleton	Tissue	Waters	Sediment
Pb	0.039	0.008	0.031	0.075	0.098
Cd	0.012	0.002	0.01	0.001	0.019
Zn	0.213	0.109	0.104	0.790	1.180
Cr	0.280	0.018	0.262	0.001	0.001

As for zinc as an essential element, its highest concentration revealed that the source might not only come from industrial by products but also from excretion of living system in marine environment. So the total zinc in this *Callispongia* sp. apparently not an abnormal case especially if one looks at a fraction remaining in sediment (54.1%) and consumption level of skeleton and tissue on zinc. Generally the highest metal concentration in sediments is influenced by several processes like sedimentation, flocculation, precipitation, and adsorption (Matalagi et al 1998; Che et al 2003). Another important parameter is bioconcentration factor (BCF) in measuring the capability of organisms to accumulate metals from environment into its tissue. According to Abdullah et al 2007, BCF can be estimated by comparing metal absorption between in sponge tissue and in water (BCF sw) or sediment (BCF ss).

The ability of organisms to accumulate metals from the environment into the tissues of the body can be calculated using the bioconcentration factor (BCF). BCF value can be obtained by comparing the ability of organisms (eg sponges) to absorbsi metals from water and sediment. Therefore there are two BCF values, BCF sponge-sediment (BCFs-s) and BCF-water sponge (BCFs-w). BCFs-s is the value of the ratio between the concentration of the metal absorbed into the sponge tissue with metal concentrations in the sediment, while the BCF sw is the value of the ratio between the concentration of metal that accumulates into the sponge tissue metal concentrations in water (Abdullah, et al., 2007) as found in table-3 below.

Table-3. BCF s-s and BCF sw of Pb, Cd, Zn, & Cr calculated from *Callispongia* sp.

Metal	BCF ss	BCF sw
Pb	0.32	0.41
Cd	0.52	10.0
Zn	0.09	0.13
Cr	262.0	262.0

From the result in table-3 one can find the highest value for BCF is Cr either in water or in sediment. and this indicated that for the case of the location and sponge, Cr is the most appropriate element to be assigned as a bioindicator or biomonitor for *Callispongia* sp. compared to other metals. Some results from several investigations have used the same method (Patel et al 1985; Philip 1999; & Cebrian et al 2007). Linkage concentrations of Pb, Pb,Cd, and Zn in Callispongia sp with physical-chemical parameters, water and sediment at each location described using principal component analysis (PCA).

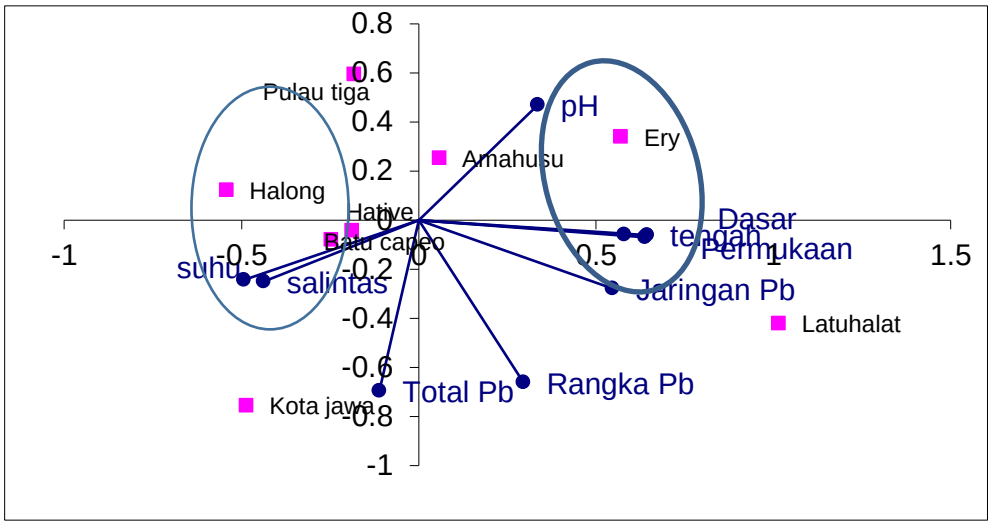

Figure 2. Graph Principal Component Analysis (PCA) which *Callispongia* sp. with environmental factors.

CONCLUSIONS

It can be concluded that *Callispongia* sp. may be assigned as pollutant indicator for metal especially element chromium which is very toxic at certain forms and valences. Metals in the environment also influenced by season, which at the time of the research conducted in the rainy season

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