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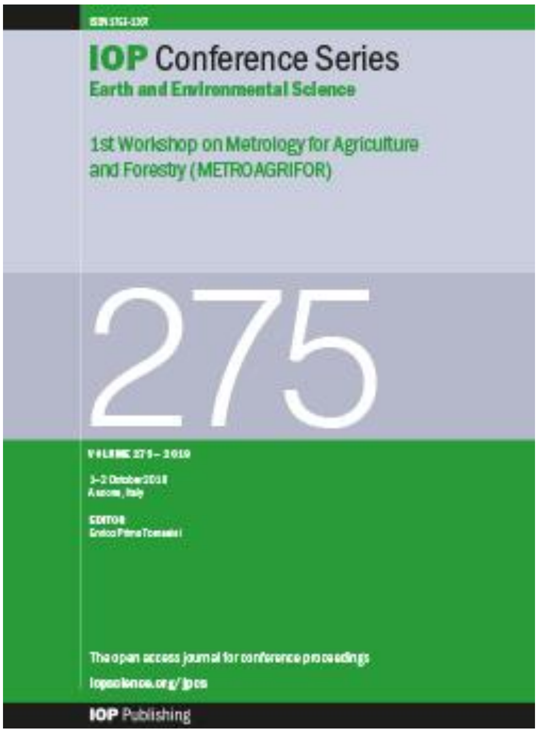

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Biodiversity of Cryptofauna (Decapods) and Their Correlation with Dead Coral *Pocillopora* sp. Volume at Bunaken Island, North Sulawesi

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Molecular Identification and Genetic Diversity of *Acropora hyacinthus* from Boo and Deer Island, Raja Ampat, West Papua

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Effect of Melanin Free Ink Extracted From Squid (*Loligo* sp.) on Proximate and Sensory Characteristics of Soft-Bone Milkfish (*Chanos chanos*) During Storage

Tri Winarni Agustini[1], Hadiyanto[2], Ima Wijayanti[1], Ulfah Amalia[1] and Soottawat Benjakul[3]

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The Effect of Different Feed and Stocking Densities on Growth And Survival Rate Of Blue Swimming Crablets (*Portunus pelagicus*)

R W Ariyati[1], S Rejeki[1] and R H Bosma[2]

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Blue swimming crab is targeted by commercial fisheries because of the high economic value, good taste, and attractive colors. As a result, the stock is overexploited and fisherman catch market also juveniles. The most sustainable solution would be to stop fishing for commercial trade and to culture

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Content Heavy Metal Pb, Cd In *Perna viridis* And Sediments *In Semarang Bay*

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Content Heavy Metal Pb, Cd In *Perna viridis* And Sediments *In Semarang Bay*

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Abstract. Waste disposal from human activities, generally contain heavy metals such as Pb and Cd which derived from industrial activities. The aims of the study were to know the concentration of Pb and Cd heavy metals contained in *Perna viridis* tissue, sediment and water at Semarang Bay. This study was conducted in May 2017 at Semarang Bay. - Samples were collected using purposive sampling method. The heavy metal content in the water and clam was observed using- APHA method and was analyzed using AAS (Atomic Absorption Spectrophotometer). The results showed that concentration of heavy metal of Pb in the water was 0.00-50.5mg/L and the Cd content was of 26.9-51.7 mg/L, whereas the concentration of Pb in the sediment is 445.5-2.053.0mg/L and Cd 963.3-2,150.0 mg/L. Pb content in soft tissue of *Perna viridis* - is 67.1-1.933.9 mg/L and the concentration of Cd was 203.5-5.787.3 mg/L. The analysis of Pb and Cd in seawater, sediment and soft tissue of *Perna viridis* according to Enviroment Ministerial decree (KepMenLH) number 51 of 2004 and applied by NOAA 1999 does not exceed the quality standard, that meant that the *Perna viridis* has been contaminated by metal Pb it is controversial with the above sentence and Cd. It concluded that the metal content of Pb and Cd in *Perna viridis* tissue exceeds the quality standard, so it is not suitable to be consumed, especially in high quantity

Keywords: *Perna viridis*, Pollution, Heavy metal, Sediment.

1. Introduction

Population growth and industrial development along the coast have greatly affected the pollution loads to the coastal zone as well as marine environment [1]. In the case of Indonesia, the high land-based activities are major source of the pollutions of the coastal waters. Based on the studies conducted in coastal areas, heavy metal contaminations are among the persistent issues in the country [2]. These heavy metals have brought the negative impacts to the health of marine living resources and consequently the people who consume seafood products which collected from those areas [3]

Industrial heavy metal pollution as well as from domestic sources can affect coastal waters, while the heavy metals were positively correlated to the organic matter within the local waters [4]. Heavy metals from waste of fuels burning have influenced to the fish production of the fisherman and it seems that, this is due to the Pb contamination [5]. It is likely that the activities in the port basin indicated as the source of heavy metal pollution in the area [6].

Metals are natural constituents of the sediments in the coastal zones and they may be as an oligo-elements, such as zinc, which is the natural element essential for living organisms if present in small amounts, or do not have any known biological roles, as in the case for the lead. However, both can become toxic for living organisms at high concentrations [7]. Much of those human activities located in the fluvial watersheds and in the margins of estuaries being important areas for the concentration of contaminants, due to the coastal industrial activities and human settlement.

Lead, or Plumbum (Pb), has atomic number 82, atomic weight 207.2 which describe as a small size molecule, solid and gray [8]. Lead is widely used in industries such as the production of storage batteries for cars, ammunition, cable coatings, pipes, dyes and blends in the manufacture of ceramic

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coatings and fuels [9]. Lead could penetrate to the human body through inhalation, digestion, skin pores and eyes [8].

Semarang estuary water is narrow and muddy in the bottom, dirty and has high suspended load [10]. These area mostly used as aquaculture activities and disposal of various waste from land. If this conditions occurs in the long term, it will lead to heavy metal pollution. Based on the monitoring of some researchers in 1984/1985 and 1986/1987, it were found that coastal waters of Semarang were polluted by heavy metals such as Pb and Cd [2]. It could be found in the waters of Babon and Seringan estuaries [11].

Pollution of heavy metals in this water can cause heavy metal accumulation in sediments as well as in aquatic biota. Sediments in the waters of Tanjung Emas harbor, Dermaga (harbor) Nusantara, and Pulau Panjang contains Cd, Cr, Cu, Pb and Zn while in the bay of Semarang containing Hg metal that possibly could accumulates in the body of *Perna viridis* [12]. This study aimed to determine the heavy metal concentration in the body/the tissue of *Perna viridis*, in the sediment and in the column of the water.

2. Materials and methods

The samples of water, sediment, and *Perna viridis* tissue were collected at the location of research the waters of Tambak Lorok, Semarang and was conducted in May 2017. There were two replications, where the first was taken at low tide time and the second one was taken at high tide moment. Samples were obtained in two replication, at low tide and high tide.

Water samples were collected using Nansen Bottle Sampler from the bottom of the water column, while the sediment samples were taken using a grab sampler. *Perna viridis* soft tissue samples were classified into - three different shell size i.e. small size (< 2.5 cm), medium size (2.5-3 cm), and large size (3-5 cm).

The level of heavy metal Pb and Cd in those samples were determined by ICP (Inductively Coupled Plasma) [13-14]. Environmental condition variables measured were: water temperature, water salinity, pH, dissolved oxygen, and water depth.

3. Result and discussion

Based on the measurements of heavy metals on water samples during - high -and low tide -, showed that the heavy metal concentration of Pb at 4 stations with 3 replications in waters lorok semarang exceeds the quality standard, as well as -the heavy metal concentration of Cd in all stations (Table 1).

Table 1. Result of heavy Metal concentration of Pb and Cd Measurement in Waters

Station	Pb (mg/L)		Cd (mg/L)	
	Low tide	High Tide	Low Tide	High Tide
I	50.5	34.6	42.8	26.9
II	1.6	-23.5	44.7	28.8
III	-34.1	17,7	36.1	29.8
IV	-31.8	-53.1	51.7	30.6
KepMen LH no. 51	≥0.008	≥0.008	≥0.001	≥0.001

Heavy metals in seawater can be divided into two major components, i.e., metals in soluble form and metals that bound to suspended particles or sediments (phytoplankton, zoo- plankton, debris, clay and silts) [15]. Toxic trace metals in coastal waters, especially Hg, Pb and Cd have been measured in some components of coastal waters but knowledge on other trace metals such as As, Cr and Sn is still very limited [16]. Understanding of toxic metals in water could be mainly represented by measuring metals insolution form which was commonly found to be very low in concentration [17].

The overall result shown that Cd metal contamination was greater than Pb. This is thought to be derived from port and the industrial activities around the port that dumps Cd waste into the waters.

Please give some references to ensure that this is a real situation in the field. This high contamination level can be dangerous for marine life. Since the waters is widely used for fish cultivation, it caused less productive ponds, and consequently the growth rate of fish is not optimal [18]. Heavy metals naturally have low concentrations in the waters. High and low concentrations of heavy metals are caused by the amount of metal waste that enters into the waters as well as the pH, since it will affect the solubility of the heavy metals in the waters [19].

Lead solubility is low in waters so that the level of lead concentration in the water is relatively low [17]. Both the content and toxicity of lead are influenced by hardness, pH, alkalinity, and oxygen concentration. Lead toxicity is lowered down by the increase of hardness as well as dissolved oxygen [20]. It is categorized into IV-A group in periodic table of chemical elements, atom number of 82 with atom weight of 207.2, concentrated in deposit, such as metal ores. In battery industry, lead is used as a grid, compound of bismuth metal (Pb-Bi) with ratio 93:7. Pb compound and Cr, Mo and Cl are widely used as pigment chrome, lead silicate compound (Pb-silicate) used as one of ceramic polished materials, and used as refractory material [21].

Based on the Quick Reference Tables Screening or Squirts [22], should be numbered sediments in coastal waters and the West Flood Canal estuary to identify potential impacts of waste impact on coastal resources and habitats. Pb and Cd metal content in sediment which exceeds the limit will affect the biota. This influence according to [23], in addition can be deadly, also sublethal that inhibits growth, development, and reproduction, causing morphological changes, and change organism behavior.

Table 2. Heavy Metal Pb and Cd Measurement Results in Sediment Samples

Station	Pb (mg/L)		Cd (mg/L)	
	Low tide	High Tide	Low Tide	High Tide
I	651.6	783.2	2150	1614.4
II	1675.7	445.5	1434.1	1254.2
III	633.1	2053	1733.6	1348.8
IV	321.9	683.9	963.3	1546
NOAA 1999	30.24	30.24	0.676	0.676

From the measurement of heavy metal content of Pb and Cd on sediment samples can be seen that both exceed the existing quality standard. In addition, the content of Pb and Cd at the study sites is very high (Table 2). This is generally due to the development of industry in a region. Sediments can be used as an indicator due its role as a sink of various contaminants. Measurement of heavy metals in sediments provided better indicator than those in solute form (in water), and the concentration of heavy metals in sediments was relatively stable. In contrast to the toxic trace metals in solute form, the concentrations of metal in sediments showed an increasing trend during the period of 1985-2000 and concentrations of trace metal such as Pb and Cd were relatively higher compared to background levels, especially in coastal areas bordering the provincial cities in northern coast of Java Island, namely Jakarta, Semarang, and Surabaya [4]. Increasing industrial areas,harbour developments and population growth contribute to the increasing trend of metal contaminants during early 1980s to 1990s [17].

Highly toxic trace metals in sediments indicated that metals in water column might mostly be found to particulate matter and settled not far from the shore. Once contaminants settled in sediments, they are potentially absorbed by benthic organisms that can transfer the metals from sediments to higher trophic levels of food chain [24]. In the long run, this will become potential problems to the quality of pelagic system. Recent studies showed that metal concen- trations in sediments do not fully provide information on metal bioavailability. Metal bioavailability to benthic organ- nisms depends on various factors, such as geochemical his- tory of sediments[25], animal behaviour[5] and exposure duration. Early works on metal speciation in Semarang coastal waters were done by [26] in Semarang harbor.

Based on the measurements of heavy metals that have been done on *Perna viridis* soft tissue, it is found that the heavy metal content of Pb and Cd in all stations exceeds the quality standard (Table 3).

Table 3. Heavy Metal Pb and Cd Measurement Results in *Perna viridis* Soft Tissue Samples

Station	Pb						Cd					
	Low Tide			High Tide			Low Tide			High Tide		
	S	M	L	S	M	L	S	M	L	S	M	L
I	128.6	125.2	188.4	296.6	210.5	318.7	237.7	512.4	498.1	1972.3	1515.8	644.1
II	1933.9	730.7	216	67.1	90.4	239.6	1248.7	5787.3	1233.4	355.7	314.2	422
III	138.1	208.9	131.9	542.8	270.3	124.9	307.7	431.6	219.9	210.6	659.9	244
IV	642.3	286.5	333.1	122.7	101.5	149.3	203.5	3918	5475.6	229.1	242.8	255
SK DirJen POM	2	2	2	2	2	2	0.1	0.1	0.1	0.1	0.1	0.1

- S : Smal (< 2,5 cm)
- M: Medium (2,5-3 cm)
- B : Big (3-5 cm)

Table 4. Environmental Variabels Measurement Results

Station	Temperature (ºC)		pH		Salinity (ppt)		Depth (cm)		DO (ppm)	
	Low Tide	High Tide	Low Tide	High Tide	Low Tide	High Tide	Low Tide	High Tide	Low Tide	High Tide
I	27.8	27.7	7.92	8.12	30	31	350	500	3.29	6.22
II	27.5	27.8	8.05	8.01	30	30	550	700	6.82	7.94
III	27.4	28	8.09	7.96	30	32	550	600	6.3	8.2
IV	27.1	27.9	8.02	8.11	30	35	350	500	7.2	6.2

According to [27], the concentration of Cd accumulated in a shell tissue can reach 100,000 times greater than the concentration in the waters of its habitat. In a normal seawater, the concentration of Cd could range between 0.05 ppb. to 0.1 ppb [28].

Pb can enter into the body of marine life through the food chain, gills and diffusion of the skin surface. The accumulation of Pb metal in shells can occur through the absorption of water, particles and plankton by filtering (filter feeder). Accumulation of Pb metal in the tissue of shell fish is possible because this type of organism can not excrete it well. Consequently it will accumulates continuously in the tissues, corresponding to the increase in metal Pb concentration in the water. In the case of mollusk (the soft animal),the Pb will be accumulated in the tissue of the animals.

According to [29] the accumulation of heavy metals in a shells is influenced by internal (body size) and external factors Spawning). Previous studies, many authors reported a negative relationship between the size of the shell with the accumulation of heavy metal concentration. For example, high levels of Cd, Pb and Zn are found in smaller individuals, and this may be due to the average metabolic activity in different organism ages. The increase in metabolic rate, is influenced by uptake of heavy metal wich depend on the body size [30].

The size of animals will influence the content of heavy metals in the soft tissues of mussels, using measurement of concentration factor. This measures the ability of aquatic organisms in taking direct pollutants from the waters and shows the tendency of organisms to accumulate heavy metals [31]. Smaller animal shown a greater accumulation capability than the larger one [32]. The high content of heavy metals in the body of aquatic organisms, depends on the physiological, inc;luding the absorption and the excretion process of the organism itself.

The temperature and salinity range in all stations in the research location is still within the tolerable for marine life(it is still in the range of quality standards of Ministerial decree 2004) ie. 28-30 °C and and of 0,5-30 ppt. respectively. The heavy metal content of Pb and Cd was higher at low tide than in pairs. This was because the pH value at low tide is higher than at high tide.The degree of toxicity of heavy metals in waters can also be affected by pH., it will increase as the pH increases. It is due to that the metal is difficult to dissolve in the high pH and in turn will be deposited in the bottom of the water [33].

4. Conclusion

There was interaction between type of fish and body part on moisture, protein, ash and carbohydrate content (P <0.05), but no interaction on fat content and energy (P> 0.05). The body of cultured eel had higher protein than cultured one. The wild eel had higher fat content and energy than cultured one, while the fat content and energy in body and tail were higher than in head.

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