Safely Intake Number of Macridiscus sp. (Kerang Ceplos) from Tambak Lorok Waters, Semarang, Central Java, Indonesia.

by Ita Widowati

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Eduard Meirenno Tielman[1], **Jusup Suprijanto**[1], **Ita Widowati**[1]

[1]*Department of Marine Sciences, Faculty of Fisheries and Marine Sciences, Diponegoro Univesity Tembalang, Semarang 50275 Telp/Fax. 024-7474698*

Telp/Email: +62 822 4275 0098 / tielmannino@gmail.com

Abstract. The dynamics pollution that supposed to be derived from industrial activities around Tambak Lorok waters will affect the quality of waters, and also biota such as *Macridiscus* sp. mussels (Kerang Ceplos) that live and accumulate pollutants such as heavy metals (Pb, Cu, Al, Mn and Fe). However, *Macridiscus* sp. mussels which have been contaminated by heavy metals is usually sold for consumption by the people and if they consume it in excess, it will be toxic in the people's body. So that, this study was to analyze Safely Intake Number of *Macridiscus* sp. from Tambak Lorok waters. This study used AAS (*Atomic Absorption Spectrophotometry*) method to analyze the accumulation number of the pollutant (Pb, Cu, Al, Mn and Fe). Safely Intake Number calculation is used MWI (*Maximal Weekly Intake*) and MTI (*Maximal Tolerable Intake*) calculation method. The results of AAS showed that the highest numbers of pollutant was Al (reached 534,51 mg/kg in the body of *Macridiscus* sp. that taken in February, 2016) and has exceeded the safely intake number (MWI Al = 1 mg/kg, based on WHO/FAO) so that it's MTI values was low (0,08 kg/week/person). It means that *Macridiscus* sp. was not safe to be consumed excessively at that time.

Keywords: Ceplos, *Macridiscus* sp., MWI-MTI, Pollution, Tambak Lorok

1. Introduction

Heavy metal distribution in aquatic environments are usually correlated to population density [1] and urbanization [2] via the large uncontrolled input from industrial activates [3]. Heavy metal input to the aquatic environment is also from anthropogenic activities [4]. This problem also happened in marine environments and can affect the life of benthic organisms.

Tambak Lorok is actually one of fisherman village which is located on the shoreline of The Central Java Sea (North Shoreline of Java Sea), Indonesia. One of major function of Tambak Lorok is for the specific trade of fisheries products such as fish, shrimps, and mussels that taken from the Tambak Lorok waters. However, as the time goes by, Tambak Lorok waters are threatened by pollutants such as heavy metals (Pb, Cu, Al, Mn and Fe) from industrial and anthropogenic activities around those waters. Heavy

metal is able to accumulate in marine sediments and may affect human health through the food chain via benthic organisms [2].

Mussels are one of benthic organisms that live in marine environments. There are some variant of mussels. One of them is *Macridiscus* sp. [5] / Kerang Ceplos (local name) that is sold in Tambak Lorok Market for consumption. This organism is one of favorites fisheries product that traded in Tambak Lorok for consumption because they are a good source of protein [6], and also good for bone health [7]. It contains high vitamins (vitamin B6, niacin, thiamine and riboflavin) and essential minerals (such as Ca, Fe) [8].

Meanwhile, mussels are also a potential bioaccumulator of heavy metals such as Pb, Cu, Al, Mn and Fe. Green Mussels (*Perna viridis*) can accumulate heavy metals and suitable as a biomonitor of heavy metals pollution [9]. It means that *Macridiscus* sp. is also a bioaccumulator of heavy metals. It can be dangerous for people health if they don't know safely intake of mussels such as *Macridiscus* sp. which has been contaminated by heavy metals from Tambak Lorok Waters. The heavy metals can be toxic to the human body if they consume in excess and leading to various diseases [10], [11].

A research to analyze heavy metals accumulation and Safely Intake Number of *Macridiscus* sp. from Tambak Lorok waters is important due to get information about how much mussels which have contaminated by heavy metals that can be eaten by people. So that people will not be poisoned by heavy metals.

2. Methods

Sampling of *Macridiscus* sp. were conducted in December 2015 and February 2016. The location of sampling was at Tambak Lorok, Semarang, Central Java. The determination of Sampling Points used Purposive Sampling method [12], due to getting information about the existence/abundance of *Macridiscus* sp in Tambak Lorok waters. There were 3 (three) points we had chosen for sampling and you can see the picture below.

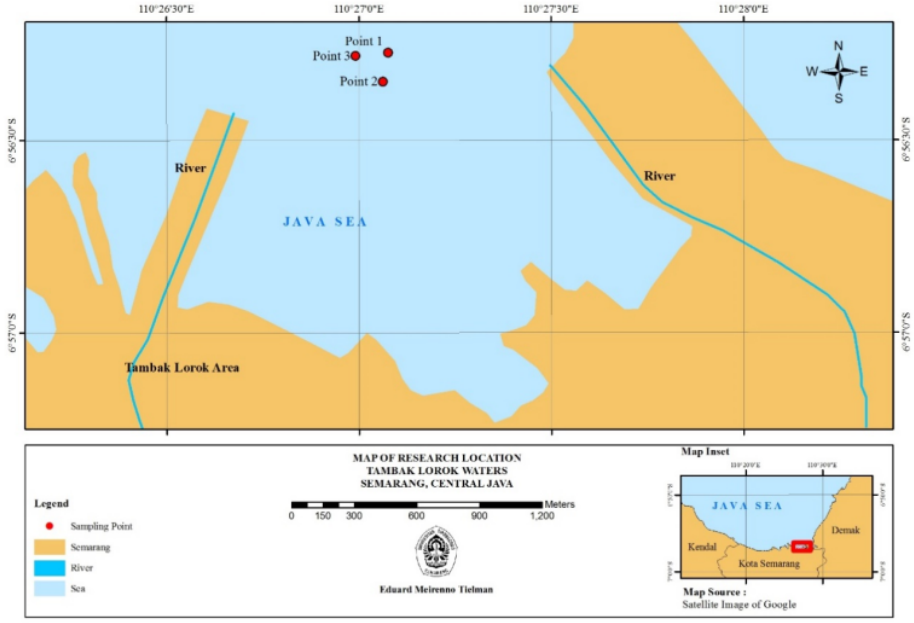


Figure 1. Sampling Point of *Macridiscus* sp.

Other paragraphs are indented (BodytextIndented style). The analysis method of heavy metals in the sample was used AAS (*Atomic Absorption Spectrophotometry*) (APHA, 1995) method at Balai Besar Teknologi Pencegahan dan Pencemaran Industri (BBTPPI), Central Java. Before using AAS, we have to prepare the sample. Put as many as 250 grams sample of *Macridiscus* sp. tissue in the evaporator cup and heated it in an oven at temperature 105°C for 12 hours. Then, grind it until becoming homogeny. After that, use the furnace to heat it with temperature 550°C ± 8 hours. Then, chilled it. Next, take 4 grams of the sample from the sample we got for destruction in beaker glass. After that, filter it with Whatman paper no. 40. Then, pour it into measurement glass as many as 50 ml and let it for a night before analyzing with AAS.

After we got the accumulation number of heavy metals by AAS, we analyzed the Safely Intake Number by using MWI (*Maximal Weekly Intake*) and MTI (*Maximal Tolerable Intake*) [14] calculation method. The formula of MWI is :

$$MWI = Body\ Weight^{a)} \times PTWI^{b)} \quad (1)$$

a. Body weight assumption [45 kg (female) and 60 kg (male)]
b. PTWI (*Provisional Tolerable Weekly Intake*) by Joint FAO [15]: 0.025 mg/Kg

And the formula of MTI :

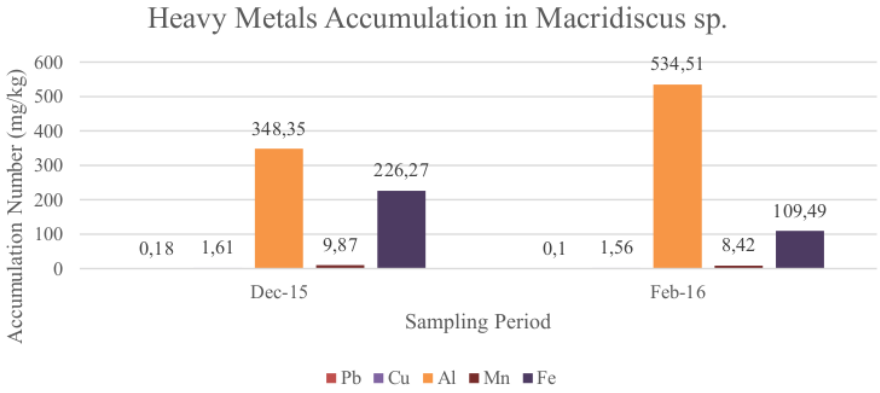
$$MTI = \frac{MWI}{Ct} \quad (2)$$

- MWI : *Maximum Weekly Intake*
- Ct : heavy metal accumulation in the body of *Macridiscus* sp.

3. Result and Discussion

3.1. Result

3.1.1. Heavy Metals Accumulation in the body of Macridiscus sp. The picture below is the results of the analysis of heavy metals (Pb, Cu, Al, Mn and Fe) that has been carried out :



Figures 2. Heavy Metals Accumulation

3.1.2. Safely Intake Number of Macridiscus sp. (MWI and MTI). The table below shows us about the number of MWI and MTI of Macridiscus sp. that can be safe for consumption by the people.

Table 1. Safely Intake Number of *Macridiscus* sp.

No	Heavy Metals	Heavy Metals Accumulation in Biota (mg/Kg)		PTWI (mg/bw based on WHO / FAO)	MWI (mg/week/body)		MTI (Kg/week/body)			
							45 Kg		60 Kg	
		Dec-15	Feb-16		45kg	60 kg	Dec-15	Feb-16	Dec-15	Feb-16
1	**Pb**	0.18	0.1	0.025	1.125	1.5	6.25	11.25	8.33	15
2	**Al**	348.35	534.51	1	45	60	0.13	0.08	0.17	0.11
3	**Fe**	226.27	109.49	5.6 (PTMDI 0.8 mg/bw)	252	336	1.11	2.30	1.48	3.07
4	**Cu**	1.61	1.56	3.5 (PTMDI 0.5 mg/bw)	157.5	210	97.83	100.96	130.43	134.62
5	**Mn**	9.87	8.42	0.98	44.1	58.8	4.47	5.24	5.96	6.98

3.2. Discussion

3.2.1. Heavy Metals in Macridiscus sp. Based on the result above, accumulation average of heavy metals in the body of Macridiscus sp. is decreased from December 2015 to February 2016. It probably caused by precipitation (seasonal factor), temperature and salinity dynamics [16] that happening in December 2015 until February 2016 which affected the accumulation of heavy metals by *Macridiscus* sp.

3.2.2. Safely Intake Number. Every heavy metal has their own standard for being consumed. It determined by MWI and MTI values. MWI values are to determine how much heavy metals contamination in the body of biota that being consumed by the people in a week per body weight (45 kg for female and 60 kg for male). MTI values determine how much mussels you can consume in a week per body weight.

- Lead (Pb)

Exposure to Pb can occur from many sources but usually arises from industrial use that is around Tambak Lorok Waters like Tanjung Mas Harbor [15]. It can occur from fishing vessels which are accidentally shedding their vessels fuel into the waters, too.

Based on the result of the analysis, accumulation of Pb in the body of *Macridiscus* sp. is not exceeding the MWI value yet. MTI values mussels which contaminated by Pb is high. It means the mussels are still safe for Pb consumption.

- Aluminum (Al)

Al is a major component of the earth's crust. It is released to the environment both by natural processes and from anthropogenic sources. We will find Al use in a wide variety of applications including structural materials in construction, automobiles and aircraft, packaging materials, various containers and kitchen utensils and pharmaceuticals [15] .

The result showed us that accumulation of Al in the body of *Macridiscus* sp. is exceeding its MWI value. Therefore, we can only eat *Macridiscus* sp. in a slight amount. FAO/WHO said that Al compound can affect the reproductive system and it will be dangerous if we consume it in excess.

- Iron (Fe)

Fe is one of the essential heavy metals that needed by the human body to produce the enzyme cytochrome oxidation and respiratory pigments/hemoglobin [15]. Fe can occur in waters by the corrosion from ships and piling port that readily rusts.

The result of this study showed that accumulation of Fe in the body of *Macridiscus* sp. is exceeding MWI value. so it's not safe if we consume it in excess. The excess of Fe consumption cause symptoms such as vomiting, damage the intestine, cardiomyopathies and much more.

- Copper (Cu)

Copper is both an essential nutrient and a drinking-water contaminant. It has many commercial uses. It is used to make pipes, valves, and fittings and is present in alloys and coatings [15].

The result of this study showed that Cu accumulation in the body *Macridiscus* sp. is not exceeding the MWI value. However, we must be careful. High levels consumption of mussels that contaminated by Cu can cause symptoms of acute toxicity, including nausea, abdominal discomfort (diarrhea), emesis, hemoglobinuria and/or haematuria, jaundice, oliguria/anuria, hypotension, coma, and death.

- Mangan (Mn)

Mn is one of the important components of the human body in a slight amoun t[15]. Mn can occur from an active substance in battery which had been used and discharged into the river and coastal. It may also caused by people that live at Tambak Lorok Village who discharged it to Tambak Lorok waters. In this study, accumulation of Mn in the body of *Macridiscus* sp. is not exceeding MWI value.

4. Conclusion

This study has provided us that *Macridiscus* sp. that taken from Tambak Lorok water is not safe to be consumed by people at that time. It has contaminated by heavy metals such as Pb, Al, Fe, Cu, and Mn. It can impact to body health if we consume it in excess. Besides that, This study may also provide an evaluation of relevant government policy related to waste and fishing village management environmentally.

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