Jurnal Lahan Suboptimal: Journal of Suboptimal Lands
ISSN: 2252-6188 (Print), ISSN: 2302-3015 (Online, www.jlsuboptimal.unsri.ac.id)
Vol. 8, No.2: 213-219 Oktober 2019
DOI: https://doi.org/10.33230/JLSO.8.2.2019.447

Concentration of Heavy Metals (Pb and Cu) in *Alepes vari* and *Johnius belangerii* from Musi River Estuary, Banyuasin District, South Sumatra

Konsentrasi Logam Berat Pb dan Cu pada Ikan Selar (*Alepes vari*) *dan Ikan Gulamo* (*Johnius belangerii*) *dari Muara Sungai Musi, Kabupaten Banyuasin, Sumatera Selatan*

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(diterima 19 September 2019, disetujui 14 Oktober 2019)

Sitasi: Agustriani F, Purwiyanto AIS, Putri WAE, Fauziyah F. 2019. Concentration of heavy metals (Pb and Cu) in *alepes vari* and *johnius belangerii* from musi river estuary, Banyuasin district, South Sumatra. *Jurnal Lahan Suboptimal: Journal of Suboptimal Lands*. 8(2): 213-219.

ABSTRAK

Muara Sungai Musi memiliki peran penting sebagai salah satu daerah penangkapan ikan. Tingginya aktivitas di muara musi berdampak pada ekosistem di wilayah ini, berupa perubahan ekosistem yang disebabkan oleh logam berat. Tujuan dari penelitian ini adalah untuk menentukan konsentrasi logam berat Pb dan Cu pada ikan Selar (*Alepes vari*) dan ikan Gulamo (*Johnius belangerii*) di muara Sungai Musi. Ikan diperoleh dari nelayan yang menggunakan alat Gillnet Millennium (Ply) pada Juli 2018 dan dianalisis menggunakan Atomic Absorption Spectrophotometer (AAS). Hasil penelitian menunjukkan bahwa konsetrasi logam berat Pb pada *J. belangerii* lebih besar daripada *A. vari*, tetapi kandungan logam berat Cu dalam *A. vari* lebih besar dari pada *J. belangerii*. Berdasarkan BPOM, Pb logam berat telah melampaui batas untuk konsumsi yang aman.

Kata kunci: daerah penangkapan ikan, gillnet millenium, aman konsumsi

ABSTRACT

The Musi river estuary plays an important role as one of the fishing grounds. The high activity in the musi estuary has an impact on the ecosystems in this region, including the negative impact in the form of ecosystem changes caused by heavy metals. The aim of this study was to determine the concentrations of heavy metals (Pb and Cu) in *Alepes vari* and *Johnius belangerii* in the Musi river estuary. Fish were obtained from fishermen who used the Gillnet Millennium (Ply) gear in July 2018 and were analyzed using the Atomic Absorption Spectrophotometer (AAS). The results showed that the concentration of Pb in *J. belangerii* was greater than *A. vari*, but the concentration of Cu in *A. vari* was greater than in *J. belangerii*. Concentration of Pb has exceeded the limit for safe consumption based on National Agency of Drug and Food Control.

Keywords: fishing ground, gillnet millenium, safe consumption

INTRODUCTION

Musi River Estuary plays an important role for the community along the river stream. Community activities in the estuary of the Musi River also vary, including shipping, water transport, fishing areas, agriculture and settlement. Found 48 species of fish in the Musi estuary, including *J. belangerii* and *A. vari* (Fauziyah *et al.* 2019). Gulamo and A. vari spread in the middle of the mouth of the Musi River according to the feeding method (Prianto *et al.* 2012). These fish are economical fish and are often caught by fishermen in the Musi estuary.

The high activity in the Musi estuary has the potential to increase the concentration of pollutants, including heavy metals Pb and Cu. Essential metals such as Cu are needed in the metabolic processes of the body, while non-essential metals such as Pb are not needed because it interferes with the metabolic processes of the body (Gu *et al.* 2017). World Health Organization (2010) explains that metal lead is absorbed by children in the digestive tract by 50%, while only 10% is absorbed by adults. The quality of fish as a source of animal protein should be considered to prevent contaminants, because if a food product contains heavy metals, it will cause poisoning, organ damage and even death (El-Moselhy *et al.* 2014).

The increase in heavy metals in food products is very dangerous for food safety and human health. Research done in the Musi River Muara waters has shown an increase in heavy metals in the food chain, ranging from plankton, shellfish and fish (Putri *et al.*, 2016; Putri and Purwiyanto, 2016). Accumulation in fish will have a long-term effect through the food chain (Gu *et al.* 2015). Water quality is also a limiting factor for the accumulation of heavy metal concentrations in biota. High concentrations of heavy metals reflect the level of pollution of the environment (Hao *et al.*, 2019). Pb concentrations of heavy metals in Tanjung Api-api waters ranged from 0.014 to 0.071 ppm (Agustriani *et al.*, 2016). While in the Musi estuary, the concentration of Cu ranged from 0.001 to 002 mg/L and Pb ranged from 0.003 to 0.01 mg/L (Putri *et al.* 2015).

The concentration of heavy metals in marine life in the mouth of the Musi River is considered to have increased in concentration due to increased human activity. Research into the accumulation of heavy metal concentrations, in particular consumption and economic fish, should be conducted sustainably as an attempt to prevent fish poisoning in food products. This research is important to know the safe consumption limit for the concentration of heavy metals Pb and Cu for the body released by the Food and Agriculture Organization (1983) and the Food and Drug Supervision Agency (2017). The aim of this study was to determine the concentration of heavy metals Pb and Cu in *Alepes vari* and *Johnius belangerii* from Musi river estuary.

MATERIALS AND METHODS

Research Time and Location

This research has been conducted in July 2018 at Muara Musi Banyuasin Regency, South Sumatra and geographically located at coordinates 2° 15'50"-2° 17'30" South Latitude and 104° 56'40"-105° 3'30" Eastern longitude (Figure 1).

RESULTS

Pb and Cu Concentration of heavy metals in fish meat

The average concentrations of Pb and Cu heavy metals in the *A. vari* and *J. belangerii* fish meat organs obtained from the Musi River Muara waters ranged from 6.76 - 8.25 mg/kg for Pb and 0.85 - 0.03 mg/kg for Cu (Figure 3 and 4). The results showed that the concentration of Pb in *J. belangerii* was higher than in *A.vari* While the concentration of Cu in *A. vari* is higher than *J. belangerii*.

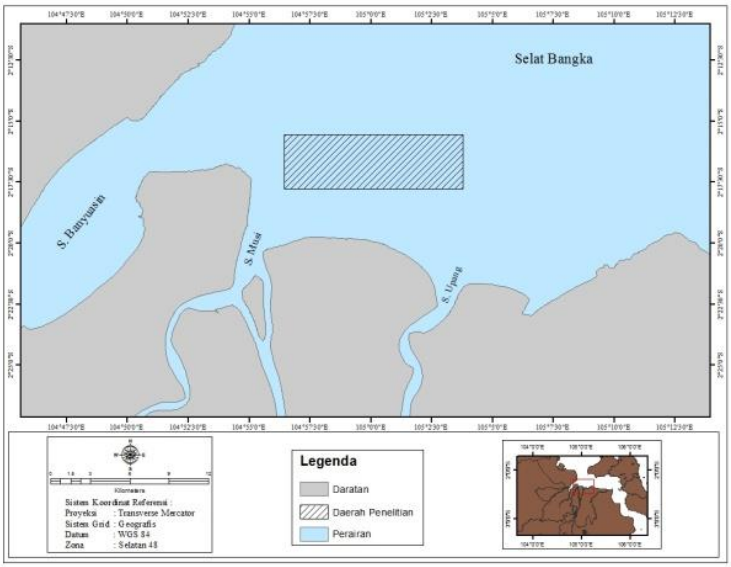

Figure 1. Research location

Sampling and Analysis of Samples

Samples were obtained from fishermen who were arrested in the Musi river estuary using a gillnet millenium (Ply) gear with a capacity of <10 GT. The catches are sorted and only *A.Vari* and *J.belangerii* are selected by identifying using www.fishbase.org (Figure 2). The sample is then stored in a cool box for further analysis. *A. Vari*and *J. belangerii* are caught in the laboratory. The meat sample is then placed in an evaporating cup and heated in the oven at 105° C for 12 hours after the sample has cooled to make it homogeneous. Samples of meat taken up to 4 grams were broken down in beaker with 10 ml of concentrated HNO_3 on a hot plate at 85° C for 8 hours. An hour before the destruction process ends, 3 ml of H_2O_2 is added to the meat sample. In the liquid phase, the sample is transferred to a volumetric flask and the volume is adjusted to 20 ml by adding ion-free distilled water and allowing to stand overnight, then analyzed with Atomic Absorption Spectrophotometer (AAS) type A-20 Variant Spectra plus a mixture of air acetylene (Arifin, 2011). The detection limit of the AAS SpectrAA-20 Plus variant for Cu was 0.003 µg/kg and Pb 0.01 µg/kg.

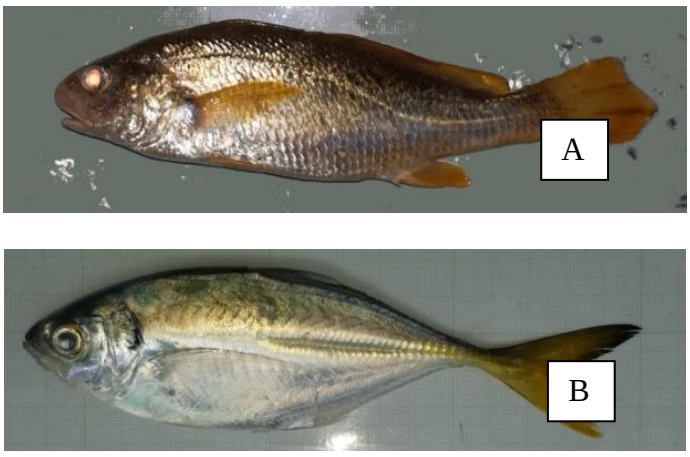

Figure 2. *Johnius belangerii* (A) and *Alepes vari* (B)

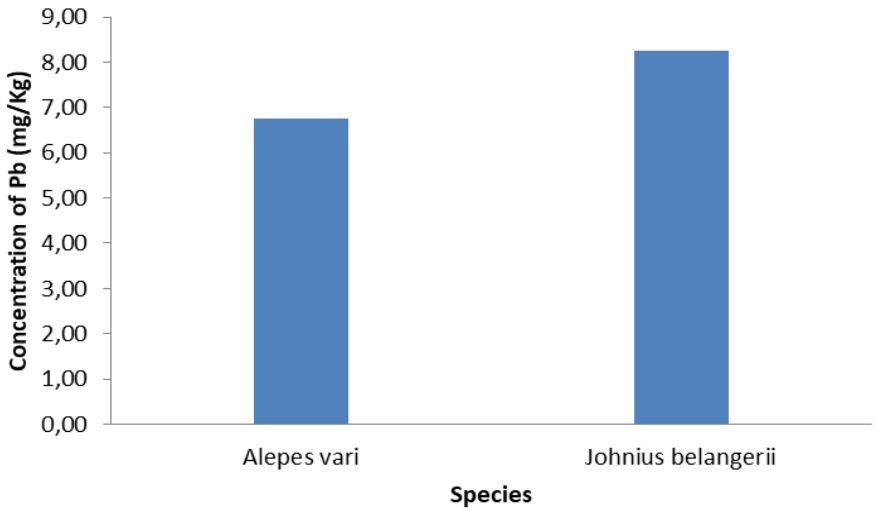

Figure 3. Concentrations of Pb in *A. vari* and *J. belangerii*

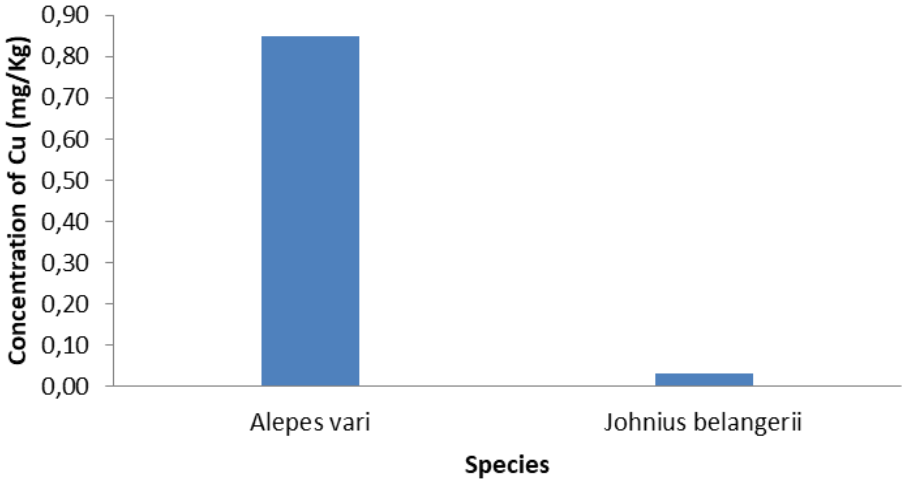

Figure 4. Concentrations of Cu in *A. vari* and *J. belangerii*

DISCUSSIONS

The results of Pb and Cu studies with heavy metals in fish meat are higher than the results of research conducted by Putri *et al.* (2016) on Seluang and Belanak fish in the Musi River Estuary, namely 201.5 µg/g and 271, 3 µg/g. Similarly, Harteman and Aunurafik (2013) found that Pb in fish meat from Kahayan River Estuary and the Katingan River, South Kalimantan were lower, ranging from 1-17 µg/g. However, this study is lower than the results of the Alturiqi *et al*. (2012) study on fish meat in markets from different regions of Saudi Arabia, showing that thePb and Cu values range from 3.24-9.17 µg/g and 2.3–12, µg/kg. The level of Pb toxicity depends on the chemical form, with the content of organolead being more toxic than the inorganic Pb form. Pb is at sea in the form of solutions with a large proportion (50-70%) in organic form (Bosch *et al.*, 2015).

Pb concentrations in *J. belangerii* are higher than A. vari. The high content of Pb in *J. belangerii* is caused by *J. belangerii*, including demersal fish, while A. vari is pelagic fish. The habit of *J. belangerii* foraging on muddy substrates can increase the concentration value of heavy metals. (El-Moselhy *et al.* 2014) explained that demersal fish have higher concentrations of

heavy metals compared to pelagic fish because demersal fish are directly related to sediments where one of the food sources of *J. belangerii* is biota that lives in waters such as crustaceans. Increasing the concentration of heavy metals in fish and other marine biota is also highly dependent on environmental conditions such as waters quality, sediment and food, where environmental changes can affect the concentration of heavy metals in the body of fish and biota. (Agustriani *et al.* 2016) reported that the concentration of Pb in Banyuasin waters had exceeded the quality standard of 0.008 mg/L. Putri *et al.* (2015), however, explained that the heavy metals (Cu and Pb) dissolved in the Musi River stream were still below the quality standard. However, research (Putri and Purwiyanto 2016) has shown that heavy metals Pb and Cu have accumulated in plankton in the waters of the Musi estuary, ranging from 1,046-2,430 mg/kg Cu and 0.673-1.283 mg/kg Pb. It is feared that the concentration of heavy metals in plankton will continue to increase and accumulate at higher tropical levels.

Cu is an essential metal that is needed in the body's metobolism, but if the concentration increases, it has a negative impact, such as liver and kidney damage. The concentration of Cu in *J. belangerii* is lower than that of *A. vari*. According to (Miller *et al.* 1992) the distr*ibuti*on and accumulation of heavy metals in the body of the fish is influenced by the growth of fish, sex, age and habitat. The high concentration of Cu in *A. vari* because of pelagic fish, so it requires more Cu. (Canli *et al.,* 2003) explained that fish that actively swim will influence the high concentration of Cu in fish organs. Concentration of Cu in the anchovy at the study site was higher than that of the red anchor fish that was 0.36 µg/g (El-Moselhy *et al.* 2014). While the *J. berangerii* from Musi River Estuary is lower than the *Otolithoidespama* from the Meghana River Estuary of 4.94 mg/kg (Ahmed *et al.* 2019).

Safety of Consumption

Concentrations of Pb in *A. Vari* and *J. belangerii* from the Musi River Estuary have exceeded the safe consumption limit of more than 1.5 mg/kg according to the Food and Agriculture Organization (1983) and 2.0 mg/kg according to National Agency of Drug and Food Control (2017) (Table 1). Pb is a non-essential heavy metal where this metal is not needed by the body because it will affect the body system. World Health Organization (2010), Pb is a cumulative poison that affects many body systems and is very dangerous for children. While Cu concentration in the research results is still below the safe consumption limit. The high concentration of Pb heavy metals in *A. vari* and *J. belangerii*meat must be given attention to the local government in environmental management.

Table 1. Maximum limits for heavy metals in food

Species	Heavy Metals (mg/kg)	
	Pb	Cu
Alepesvari	6,76	0,85
Johnius belangerii	8,25	0,03
Maximum consumption limit (mg/kg weight body)	1,5[1], 2,0[2]	10[1]

[1]FAO (1983)
[2]National Agency of Drug and Food Control (2017)

CONCLUSION

The concentration of Pb in *J. belangerii* is higher compared to *A. vari*, but the concentration of Cu in *A. Vari* is greater than *J. belangerii*. Based on National Agency of Drug and Food Control and Food and Agriculture Organization, concentrations of Pb have exceeded the safe consumption limits.

ACKNOWLEDGMENTS

This research is part of a science, technology and art grant number: 0179.151 /UN9/SB3.LP2M.PT/2018 through the PNBP Budget. The author also thanks to the Banyuasin team.

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