35. Jurnal RJOAS_DS dkk_2023.pdf

by 1 1

Submission date: 15-Jun-2024 06:01AM (UTC-0400)
Submission ID: 2402907385
File name: 35._Jurnal_RJOAS_DS_dkk_2023.pdf (422.08K)
Word count: 5675
Character count: 28080

RJOAS: Russian Journal of Agricultural and Socio-Economic Sciences
ISSN 2226-1184 (Online) | Issue 10(142), October 2023

UDC 630; DOI 10.18551/rjoas.2023-10.18

HEAVY METAL LEVELS IN THE MANGROVE ENVIRONMENT OF PAGATAN BESAR VILLAGE LOCATED IN TAKISUNG DISTRICT OF TANAH LAUT REGENCY, SOUTH KALIMANTAN PROVINCE, INDONESIA

Sofarini Dini[1]*, **Asmawi Suhaili**[1], **Khasanah Ruly Isfatul**[2], **Rahman Saiful**[1], **Merchiyanti Gusti Emilia**[1], **Muhajir**[1]
[1]Department of Aquatic Resource Management, Faculty of Fisheries and Marine, Lambung Mangkurat University, Banjarbaru, South Kalimantan, Indonesia
[2]Program Study of Marine Science, Faculty of Science and Technology, State Islamic University of Sunan Ampel, Surabaya, East Java, Indonesia
*E-mail: dini.sofarini@ulm.ac.id

ABSTRACT
Mangrove waters in Pagatan Besar Village are an important ecosystem for the life of living creatures and the surrounding environment. The number of species of organisms in a body of water can provide an overview of the complex community in that water. However, heavy metal pollution poses a threat to ecosystems and even humans. Heavy metals in the waters will one day fall and settle to the bottom of the waters, forming sedimentation, this will cause demersal biota that search for food at the bottom of the waters (shrimp, crabs, crabs or shellfish) will have a great probability to be exposed to heavy metals. The objectives of this research are: (1) Analyze the concentration of heavy metals (Hg, Cu, Zn, Cd, Fe and Pb) in water and sediment in mangrove waters; (2) Confirming the types of heavy metals (Hg, Cu, Zn, Cd, Fe and Pb) which have the highest concentrations in the demersal biota of mangrove waters; (3) Analyzing the level of pollution in the Mangrove Waters of Pagatan Besar Village. The results showed that the concentration of the heavy metals Hg and Cu had exceeded water quality standards at all stations, and Cd at station 3. The levels of the heavy metal Fe in the sediment were high at all stations, while in the flesh of the kapah mussel (*Polymesoda erosa*), the heavy metals Cu and High Fe for all stations. The heavy metal content in shellfish meat will have a bad impact on humans if consumed. Non-essential metals (Pb, Cd, Hg) that enter the body will cause a decline in health and can even result in the emergence of chronic diseases such as dysfunction of the nerves, liver, kidneys and reproductive system.

KEY WORDS
Mangrove, heavy metals, water, sediment, kapah mussel.

South Kalimantan is a province rich in natural resources. Tanah Laut Regency is one of the districts in South Kalimantan Province which is rich in natural potential. Some of the natural area. Most of the residents in Tanah Laut Regency make their living as fishermen. Mangrove waters are one of the areas that produce fish resources and other aquatic biota in Tanah Laut Regency, especially in Pagatan Besar Village.

Based on the results of previous research, the average content of the heavy metal lead (Pb) in the waters of Takisung Beach is 0.67 ppm, while the average content of the metal Cd in these coastal waters is 0.06 ppm and 0.074 ppm (Rahman, 2016). From the existing results it is clear that they have passed the quality standards established based on Republic of Indonesia Government Regulation No. 82 of 2001 and based on the Decree of the Governor of South Kalimantan No. 28 of 1995, namely that the metal content for lead (Pb) and cadmium (Cd) must not exceed 0.03 ppm and 0.01 ppm in waters. For the Pb metal content in the sediment at Takisung Beach, the average concentration is 204.5 ppm, while the average Cd metal content in the sediment at the beach is 0.669 ppm. According to Afrizal (2000), the concentration of heavy metals in sediment naturally ranges between 0.1 - 2 ppm for Cd and 10 - 70 ppm for Pb, based on a comparison with the natural concentration that should be the metal concentration of Pb and Cd is above the natural concentration.

The metals in the waters will one day fall and settle to the bottom of the waters, forming sedimentation, this will cause demersal biota that search for food at the bottom of the waters (shrimp, crabs, crabs and shellfish) will have a great opportunity to be exposed to heavy metals that have bound to the bottom of the water and forming sediment. Aquatic products such as crustaceans and bivalves need to be wary of heavy metal pollution. Moreover, this type is widely popular as an ingredient consumed by the public. So this research is important to carry out, related to the concept of food safety.

METHODS OF RESEARCH

The research was conducted in the mangrove waters of Pagatan Besar, Takisung District, Tanah Laut Regency, South Kalimantan. Sampling was carried out twice in June-July 2023. Sampling was carried out at three stations (Figure 1).

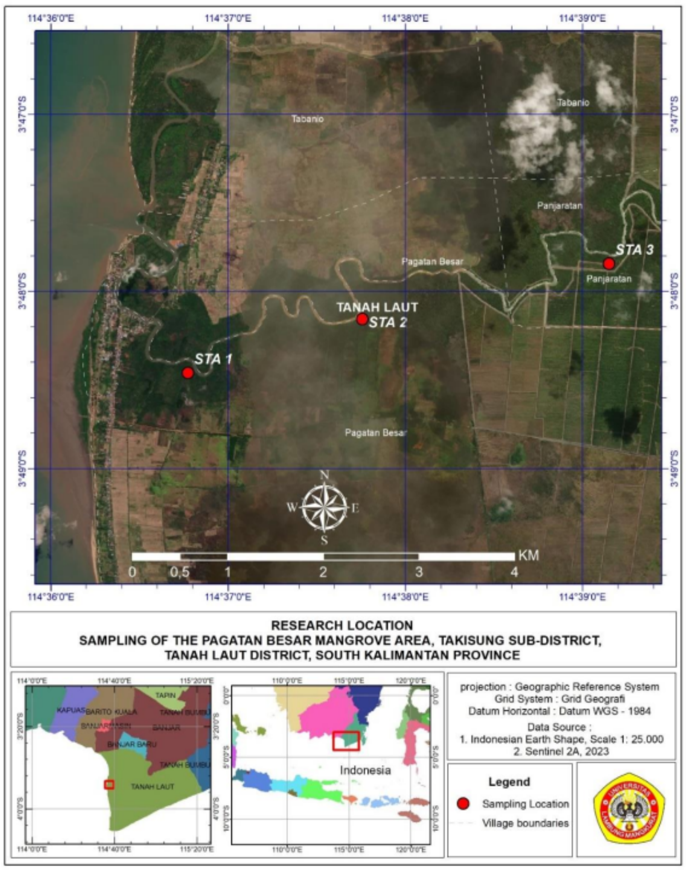

Figure 1 – Research Location Map

The method used is purposive sampling, namely determining locations in areas that are considered to represent mangrove waters. Water sampling is carried out in the same locations as biota and sediment sampling, namely in locations close to river mouths, in the middle of mangrove waters and locations far from river mouths.

All water quality parameters taken were carried out in situ at the sampling location. Meanwhile, water samples for heavy metal analysis are carried out by placing the water sample in a sample bottle, then giving it the preservative HNO3 and cooling it in a cold box.

Sampling of tapah clams (*Polymesoda erosa*) using demersal biota fishing gear. Caught shellfish are then identified in the field based on identification books. Meanwhile, shellfish samples for heavy metal analysis are carried out by placing the meat sample in a plastic bag after weighing it with a minimum weight of 100 gr/sample. After that, the sample is given a formalin solution to be preserved and placed in a plastic bag and cooled in a cold box.

Sediment samples were taken using a Ponar grab and put in a plastic bag and given a sample code. All samples will be analyzed for heavy metal content using the Atomic Absorption Spectrophotometer (AAS) method for identification at the Center for Standardization and Industrial Services Laboratory (BSPJI).

The primary data that has been obtained is then processed in the form of tabulations and graphs, then compared with several water quality standards, such as PP No. 22 of 2021 for water quality standards for in situ parameters and heavy metals in water, Sediment Quality Guideline Values for Metals and Associated Levels of Concern to be used in Doing Assessments of Sediment Quality (2003), National Sediment Quality Survey US EPA (2004) and ANZECC Interim Sediment Quality Guidelines (2000) for water quality standards for heavy metals in sediment and aquatic biota.

RESULTS AND DISCUSSION

The mangrove ecosystem in South Kalimantan is spread across river estuaries and coastal coastlines; this research is in the mangrove ecosystem of Pagatan Besar village. Mangrove forests are located close to residential areas, rice fields and oil palm plantations, anthropogenic activities have increased the flux of nitrogen and phosphorus from terrestrial areas into aquatic ecosystems, causing nutrient enrichment (Wong et al., 2015). The coastal area in Pagatan Besar Village is one of the many beaches in South Kalimantan with the characteristics of a sloping and flat beach. Observation results show that there are three types of ecosystems found in Pagatan Besar Village, namely; estuaries, mangrove forests and straight beaches. The estuary there is the estuary of the Pagatan River which is connected to the mangrove ecosystem as an ecotourism area developed by the Tanah Laut Regency Fisheries and Maritime Service. West Pagatan waters are also a coastal area that has marine biological resources such as mangroves, algae, molluscs and others. Water quality testing was carried out twice, namely on 19 June 2023 and 05 July 2023 in situ, namely direct testing in the field with results as in Table 1.

Table 1 – Water quality test results

Parameter	unit	Sample Code					
		Station 1		Station 2		Station 3	
		T1	T2	T1	T2	T1	T2
Waktu	WITA	11.14	10.50	11.33	11.05	12.51	12.07
Suhu	°C	30.2	29.0	30.3	30.5	30.1	29.2
Salinitas	mg/l	18	20	18.0	20	20	18
pH		6.24	6.06	6.58	6.37	6.71	6.64
DO	mg/l	6.8	7.1	4.8	6.8	6.4	6.9

Information: T1 = Sampling 1; T2 = Sampling 2.

Temperature is one of the factors limiting the growth of mangrove ecosystems which influences the distribution of aquatic biota and their metabolic activities. The test results as shown in Table 1 show that the highest temperature was at station 2 for both T1 and T2 tests. However, test results at all stations show values between 28 0C – 31 0C, which is the general surface water temperature. A good temperature for mangrove growth is not less than 20 0C with an average surface water temperature tolerance value ranging from 28 0C – 31 0C (Firdaus, 2018). Water temperature has an important role for mangrove growth, namely in the processes of photosynthesis and respiration. Temperature itself is influenced by various things such as season, water depth, sampling time, water flow, as well as cloud cover or other vegetation, which if extreme changes occur can cause disruption to the life of organisms and even death (Schaduw, 2018). According to Amri and Baharuddin (2018), the type of mangrove that is often found in Pagatan Besar Village, South Kalimantan is the api-api type (Avicennia sp) which has a greater ability to tolerate changes in average temperature. Apart from these types, other types of mangroves were also found, namely Rizophora and Sonneratia.

Salinity which is the concentration of a salt solution, has an influence on osmotic pressure, that is, osmotic pressure will be high if the salinity level of seawater is high. The test results as shown in Table 1 show that the salinity level at the research location ranges from 18 - 20 ppt at all stations. Salinity in mangrove ecosystems generally ranges from 10 - 30 ppt, where if the salinity is high it will cause the composition of available species to be reduced so that the conditions at the research location are ideal for mangrove growth (Wantasen, 2013). This is related to each root system of each species so that salinity has a significant influence on mangrove zonation. Salinity also affects the level of mangrove litter production, that is, if the salinity is higher, the level of mangrove litter production will also increase (Firdaus, 2018). Salinity conditions are influenced by sampling time and sea tides, namely salinity will increase if the water temperature is high and tide conditions will also increase salinity (Iman, 2014).

The results of testing the degree of acidity of the waters show values ranging from 6.06 – 6.71 and are included in the category suitable for the growth of the mangrove ecosystem. The optimum sea surface pH value is 7.0 – 8.5 with a tolerance range of 6.0 – 9.0. The pH condition of a body of water greatly influences the biochemical processes that occur in a body of water. One of the consequences of this is the dissolved oxygen concentration of a body of water with a positive correlation, namely if the pH level of a body of water is low it will cause the dissolved oxygen content to decrease (Wantasen, 2013). pH also affects the life of aquatic biota, namely if the pH value is high it will cause the dominance of plankton types which affect the level of primary productivity of waters (Musbihatin, 2020).

Dissolved oxygen in waters has an important role in the process of absorbing food by aquatic biota. The measurement results in Table 1 show values ranging from 4.8 – 7.1 mg/l with the lowest value being Station 2 T1 with a value of 4.8 mg/l. This value is lower when compared to the quality standards based on Attachment VIII PP Number 22 of 2021 which states that the value of dissolved oxygen in waters is more than 5 mg/L. This low value is thought to be influenced by mass movement activities and water mixing processes. This is as stated by (Schaduw, 2018) that the dissolved oxygen content in waters will experience fluctuations either daily or seasonally which is influenced by the movement of water masses and their mixing. Apart from that, dissolved oxygen in the mangrove ecosystem is also influenced by the level of mangrove density, photosynthesis and respiration activities, as well as pollution that enters water bodies due to human activities. These low oxygen levels will affect the level of food absorption by aquatic biota and allow the appearance of unpleasant odors due to the anaerobic degradation process (Firdaus, 2018).

Testing for heavy metals in the Pagatan Besar mangrove environment was carried out on water samples taken from the mangrove waters. Based on the results of heavy metal testing at the Center for Standardization and Industrial Services Laboratory (BSPJI), Banjarbaru, South Kalimantan using the *Atomic Absorption Spectroscopy* (AAS) method, the results for each sample are as follows:

Table 2 – Data on Heavy Metals in Water at Station 1

Parameter	unit	Test results		Maritime Tourism Quality Standards PP No 22/2021
		T1	T2	
Hg	μg/L	0.469*	<0.075	0.002
Cu	mg/L	0.057*	0.025	0.05
Zn	mg/L	0.043	<0.006	0.095
Cd	mg/L	0.00032	0.000074	0.002
Fe	mg/L	0.249	1.184	-
Pb	mg/L	<0.00095	0.004077	0.005

**: exceeds quality standards.*

RJOAS: Russian Journal of Agricultural and Socio-Economic Sciences
ISSN 2226-1184 (Online) | Issue 10(142), October 2023

The results of testing water samples at station 1 showed that the dissolved mercury content exceeded the quality standards permitted during the first or second tests. Apart from the mercury (Hg) content, the dissolved copper (Cu) content in the water also exceeded the quality standard during the first test, and then decreased during the second test so that it was below the permitted quality standard. Apart from that, 4 other types of heavy metals zinc (Zn), cadmium (Cd), iron (Fe) and lead (Pb) experienced fluctuations but were still within reasonable limits permitted by PP No. 22/2021 for marine tourism.

Table 3 – Data on Heavy Metals in Water at Station 2

Parameter	unit	Test results		Maritime Tourism Quality Standards PP No 22/2021
		T1	T2	
Hg	μg/L	0.243*	<0.075	0,002
Cu	mg/L	0.058*	0.029	0,05
Zn	mg/L	0.023	<0.006	0,095
Cd	mg/L	0.00023	0.000179	0,002
Fe	mg/L	0.155	1.020	-
Pb	mg/L	<0.00095	0.002874	0,005

**: exceeds quality standards.*

The test results at station 2 also showed the same results, namely the mercury content (Hg) had a value that exceeded the quality standard in the first and second tests, while the copper (Cu) content had a value that exceeded the quality standard in the first test but not in test 2 The heavy metal content in water bodies mostly decreased during the second test, both at station 1, station 2, or station 3 which had lower rainfall so that water discharge slowed down. This low flow rate causes an increase in the deposit of heavy metals at the bottom of the waters so that the metal content in the body becomes lower (Blaggi, 2022).

Table 4 – Data on Heavy Metals in Water at Station 3

Parameter	unit	Test results		Maritime Tourism Quality Standards PP No 22/2021
		T1	T2	
Hg	μg/L	0.216*	<0.075	0.002
Cu	mg/L	0.051*	0.022	0.05
Zn	mg/L	0.024	<0.006	0.095
Cd	mg/L	0.00269*	0.000071	0.002
Fe	mg/L	0.149	0.082	-
Pb	mg/L	<0.00095	0.002304	0.005

**: exceeds quality standards.*

The next test, namely at station 3, showed results that were not much different compared to stations 1 and 2, namely the mercury (Hg) content exceeded the quality standard in tests 1 and 2 while the copper (Cu) content exceeded the quality standard in test 1. However At station 3, the cadmium (Cd) content has a high value that exceeds the quality standard, namely in the first test.

The high content of heavy metals in the waters will impact the quality of marine biota, especially the benthic group which tends to settle in the waters like shellfish. This is as stated by Lestari (2018) and Caksana et al. (2021) that heavy metal pollution that occurs in water bodies will continue to accumulate in water and sediment. Apart from that, the high level of heavy metals in the waters will cause a decrease in the quality of marine biota, namely accumulation through the food chain process and then moving to humans.

The existence of mangrove forests greatly influences the quality of waters including being able to absorb heavy metals that contaminate sea water. According to research conducted by Heriyanto and Subiandono (2011), the stems and leaves of mangrove plants can absorb Hg and Pb content from waters well. This is proven by the test results that station 3, which is at the mouth of the river with a greater number of mangrove plants, has the lowest Hg and Pb content when compared to other stations.

Table 5 – Heavy Metal Data in Sediment at Station 1

Parameter	Test results		Quality standards	
	T1	T2		
Hg	0.058	<0.001	0.66	*Washington Development of Ecology (2017)*
Cu	9.478	16.746	65	*ANZECC Interim Sediment Quality Guidelines (2000)*
Zn	84.194	93.284	200	*ANZECC Interim Sediment Quality Guidelines (2000)*
Cd	<0.001	0.200	1.5	*ANZECC Interim Sediment Quality Guidelines (2000)*
Fe	50,416.584*	53,573.413*	20,000	*Sediment Quality Guideline Values for Metals and Associated Levels of Concern to be used in Doing Assessments of Sediment Quality (2003)*
Pb	6.897	26.294	220	*ANZECC Interim Sediment Quality Guidelines (2000)*

*: *exceeds quality standards.*

Heavy metal content testing was also carried out on sediment in the same location. Based on the results of the tests carried out, it shows that the heavy metal type iron (Fe) has a high value exceeding the quality standards in both test 1 and test 2. The high content of heavy metals in a location is due to an accumulation process that has occurred over many years (Supriyantini and Hadi, 2015).

Table 6 – Heavy Metal Data in Sediment at Station 2

Parameter	Test results		Quality standards	
	T1	T2		
Hg	0.032	<0,001	0,66	*Washington Development of Ecology (2017)*
Cu	6.524	33,393	65	*ANZECC Interim Sediment Quality Guidelines (2000)*
Zn	53.946	109,167	200	*ANZECC Interim Sediment Quality Guidelines (2000)*
Cd	<0.001	0,010	1,5	*ANZECC Interim Sediment Quality Guidelines (2000)*
Fe	42,004.578*	57.008,189	20.000	*Sediment Quality Guideline Values for Metals and Associated Levels of Concern to be used in Doing Assessments of Sediment Quality (2003)*
Pb	5.539	26,070	220	*ANZECC Interim Sediment Quality Guidelines (2000)*

*: *exceeds quality standards.*

The same results were shown at station 2, namely that of the 6 heavy metal parameters tested, the iron (Fe) content had a value that far exceeded the specified quality standards. Fe is the main metal element that makes up the earth's crust so it is naturally found in many waters. However, Fe content that exceeds quality standards is considered to be harmful to the environment, including the biota that live in it (Savitri, 2019). Supriantini and Hadi (2015) stated that the high content of heavy metals in sediment can also be caused by erosion processes that occur on the land surface and are carried to water bodies and concentrated in the sediment. Apart from that, high iron (Fe) content can also be produced by residential/household waste located around river flows. Mangrove roots which can trap sediment also play a role in the heavy metal accumulation process, namely if the sediment carried by water contains heavy metals, it will cause high levels of heavy metals contained in the sediment around the mangrove.

Table 7 – Heavy Metal Data in Sediment at Station 3

Parameter	Test results		Quality standards	
	T1	T2		
Hg	0.007	<0.001	0.66	*Washington Development of Ecology (2017)*
Cu	5.288	26.905	65	*ANZECC Interim Sediment Quality Guidelines (2000)*
Zn	14.297	79.610	200	*ANZECC Interim Sediment Quality Guidelines (2000)*
Cd	<0.001	0.050	1.5	*ANZECC Interim Sediment Quality Guidelines (2000)*
Fe	32,840.467*	49,955.175*	20.000	*Sediment Quality Guideline Values for Metals and Associated Levels of Concern to be used in Doing Assessments of Sediment Quality (2003)*
Pb	1.497	22.964	220	*ANZECC Interim Sediment Quality Guidelines (2000)*

*: *exceeds quality standards.*

Tests carried out at station 3 also showed results that were not much different compared to the other 2 stations, namely the iron (Fe) content value had the highest value which exceeded the quality standard. The results shown in test 1 showed a decrease from station 1 to station 2 and decreased again at station 3. Meanwhile in test 2 the heavy metal content increased at station 2, and then decreased again at station 3. There was a decrease in the heavy metal content at station 3 (estuary) is an indication that the many mangrove plants found at this station are able to absorb the metal content found in their environment. These results are related to the ability of mangrove plants as phytoremediators and biofilters, namely they can absorb heavy metal content in nature and control environmental pollution, including heavy metals (Manikasari and Mahayani, 2018).

The results shown in test 2 were also higher when compared to test 1 at all stations. This result is thought to be partly influenced by the rainfall that occurred at the research location. According to Murraya et all, (2018) that rainfall has an influence on the concentration level of heavy metals, namely if the rainfall is high then the heavy metals will dissolve into the open sea, but if the rainfall is low then the heavy metal content will be concentrated which causes an increase in metal concentrations both in water and sediment. This is in accordance with the rainfall map issued by the Secretary General of the Ministry of Agriculture (2023) that rainfall in July (T2) ranges from 51 – 100 mm/month, while in June (T1) rainfall ranges from 101-150 mm/month.

Table 8 – Heavy Metal Data in Shellfish Meat at Station 1

Parameter	Test results		Quality standards	
	T1	T2		
Hg	<0.00004	<0.00004	0.5	SNI 2729: 2013
Cu	3.326*	10.240*	1.0	Widowati *et al.*, 2003
Zn	12.684	15.105	100	Ditjen POM Depkes RI No 03725/SK/B/VII/89
Cd	<0.001	0.089	0.1	SNI 2729: 2013
Fe	113.363*	56.848*	1.0	SNI 7387: 2009
Pb	<0.001	<0.001	0.3	SNI 2729: 2013

*: *exceeds quality standards.*

Based on the test results, it shows that the heavy metal content of copper (Cu) and iron (Fe) contained in shellfish meat exceeds the specified quality standards. Naturally, Cu and Fe can be produced through erosion of mineral rocks around waters. These two materials are also essential heavy metals whose presence is really needed by living creatures which play a role in the formation of blood vessels, collagen, hemoglobin and myelin. However, if the metal content exceeds the limit, it will actually cause poisoning and cause various other diseases (Supriyantini & Soenardjo, 2015). Table 8 also shows that the heavy metal content increased during the second test (T2) except iron (Fe). It is suspected that the heavy metal Fe content has been concentrated in the sediment as evidenced by the high levels of Fe in the sediment so that the metal levels concentrated in the biota tend to be lower.

Table 9 – Heavy Metal Data in Shellfish Meat at Station 2

Parameter	Test results		Quality standards	
	T1	T2		
Hg	<0.00004	<0.00004	0.5	SNI 2729: 2013
Cu	3.571*	10.285*	1.0	Widowati *et al.*, 2003
Zn	4.681	17.890	100	Ditjen POM Depkes RI No 03725/SK/B/VII/89
Cd	<0.001	0.008	0.1	SNI 2729: 2013
Fe	111.391*	45.612*	1.0	SNI 7387: 2009
Pb	<0.001	<0.001	0.3	SNI 2729: 2013

**: exceeds quality standards.*

The test results at station 2 were also relatively the same, namely that the heavy metals Cu and Fe had contents that exceeded the quality standards. In addition, most heavy metal concentrations increased in the second test. The high level of heavy metals contained in shellfish in test 2 is thought to be due to decreased rainfall compared to test 1. Low rainfall will cause the flow of water to flow smaller and more stable so that the deposition process occurs more quickly. The same results were also presented by Pandey J., Singh R. (2015) that rainfall will have a significant influence on water discharge, namely if the rainfall is high then the water discharge will be faster while when the rainfall is low the water discharge will slow down, and accelerate the process of deposition of heavy metal content in waters which will later accumulate at the bottom of the waters.

Table 10 – Heavy Metal Data in Shellfish Meat at Station 3

Parameter	Test results		Quality standards	
	T1	T2		
Hg	<0.00004	<0.00004	0.5	SNI 2729: 2013
Cu	3.314*	8.431*	1.0	Widowati, *et al*., 2003
Zn	10.871	15.467	100	Ditjen POM Depkes RI No 03725/SK/B/VII/89
Cd	<0.001	<0.001	0.1	SNI 2729: 2013
Fe	174.084*	31.516*	1.0	SNI 7387: 2009
Pb	<0,001	<0.001	0.3	SNI 2729: 2013

*: *exceeds quality standards.*

Tests at station 3 also showed similar results with the heavy metal content Cu and Fe exceeding the quality standards used. This result is thought to be because this type of metal has properties that easily bind with organic components that exist in nature. According to Biaggi (2002), high levels of Cu can be caused by the high stability of Cu-organic components so that it is easy to bond with organic components that exist in nature, including shells and sediments. Apart from that, iron metal in water is generally in the form of ferrous (Fe^{2+}) or ferric (FE^{3+}) and when it comes into contact with air or dissolved oxygen it will change into Fe(OH)x which quickly settles to the bottom of the water (Hastiningrum, et al., 2015).

Shellfish are benthic animals that have low and limited mobility so they are easily affected by pollution in water bodies, including heavy metals. Excessive heavy metals in waters will very quickly affect the conditions of the surrounding environment. In addition, the nature of eating shellfish which are included in the filter feeder category causes the accumulation of heavy metals in the shellfish's body to accelerate and make them unfit for human consumption (Yusup et al., 2018). The heavy metal content in shellfish meat will have a bad impact on humans if consumed. According to Wardani et al. (2014) the heavy metal content contained in shellfish will be dangerous if it enters the human body. Non-essential metals (Pb, Cd, Hg) that enter the body will cause a decline in health and can even result in the emergence of chronic diseases such as impaired function of the nerves, liver, kidneys and reproductive system.

CONCLUSION

Various community activities around the Mangrove Waters area of Pagatan Besar Village cause high levels of Hg, Cu and Cd in the water. The high levels of Fe in the sediment are due to the condition of the river estuary in Pagatan Besar Village which is pyrite and acidic. In addition, Fe is relatively easier to sediment than to dissolve. High levels of Cu and Fe in the meat of kapah mussel (Polymesoda erosa) are a further effect on the food chain process and is an early warning regarding the safety of food products sourced from the Mangrove Waters of Pagatan Besar Village.

ACKNOWLEDGMENTS

Acknowledgments are conveyed to the Institute for Research and Community Service at Lambung Mangkurat University (LPPM ULM) which has funded this research through the PNBP Research Grant Fund on the skin of the 2023 Compulsory Lecturer Program.

REFERENCES

1. Afrizal, I. 2000. Kandungan Logam Berat Cd, Pb, Cu and Zn Dalam Air, Sedimen and Beberapa Organisme Bentos di Muara Sungai Asahan, Sumatera Utara. IPB University.
2. Baharuddin and Amri Ulil. 2020. PkM Pemetaan Partisipatif Kawasan Ekowisata Mangrove di Desa Pagatan Besar Kabupaten Tanah Laut Provinsi Kalimantan Selatan. Jurnal Manajemen Riset and Teknologi. Vol 1 (2): 59-67
3. Biaggi Muhammad A. 2022. Pengaruh Hujan terhadap Konsentrasi Logam dalam Sedimen Sungai Code. Program Studi Teknik Lingkungan Fakultas Teknik SIpil and Perencanaan. Universitas Islam Indonesia Yogyakarta.
4. Caksana, M. U., Aritonang, A. B., Risko, Muliadi, & Sofiana, M. S. J. (2021). Analisa Kandungan Logam Berat Pb, Cd, and Hg pada Ikan di Pantai Samudra Indah Kabupaten Bengkayang. Jurnal Laut Khatulistiwa. Vol 4(3), 109-118
5. Firdaus Muhammad R. 2018. Analisis Kondisi Ekosistem Mangrove sebagai Upaya Restorasi Ekosistem di Kawasan Pesisir Desa Sekotong Barat, Kabupaten Lombok Barat – NTB. Skripsi. Fakultas Perikanan and Ilmu Kelautan Universitas Brawijaya. Malang.
6. Hastiningrum, dkk. (2015). Penurunan Kadar Besi (Fe) and Mangan (Mn) Dalam Air Tanah Dengan Metode Aerasi. Pengembangan Teknologi Kimia Untuk Pengolahan Sumber Daya Alam Indonesia. 16-23
7. Heriyanto, N. M. and E. Subiandono. 2011. Penyerapan Polutan Logam Berat (Hg, Pb, and Cu) oleh Jenis Mangrove. Jurnal Penelitian Hutan and Konservasi Alam. Vol 8 (2) ; 177-188.
8. Iman Akhzan N. 2014. Kesesuaian Lahan untuk Perencanaan Rehabilitasi Mangrove dengan Pendekatan Analisis Elevasi di Kuri Caddi, Kabupaten Maros. Skripsi. Fakultas Ilmu Kelautan and Perikanan Universitas Hasanuddin. Makassar.
9. Lestari, I. (2019). Analisis Konsentrasi Logam Berat pada Kerang Simping (Placuna Placenta) and Air sebagai Indikator Kualitas Perairan Muara Sungai Indragiri. Jurnal Ilmu Lingkungan. Vol 13 (1), 45-54.
10. Manikasari, G. P., and Mahayani, N. P. D. 2018. Peran Hutan Mangrove sebagai Biofilter dalam Pengendalian Polutan Pb and Cu di Hutan Mangrove Sungai Donan, Cilacap, Jawa Tengah. Jurnal Nasional Teknologi Terapan. Vol 2 (2): 105-117.
11. Murraya, Taufiq Nur, and Endang S. 2018. Kandungan Logam Berat Besi (Fe) dalam Air, Sedimen, and Kerang Hijau (Perna viridis) di Perairan Trimulyo, Semarang. Journal of Marine Research. Vol 7 (2): 133-140.
12. Musbihatin Aswenty. 2020. Keanekaragaman Mangrove di Kawasan Ekowisata Hutan Mangrove Petangoran, Gebang, Teluk Pandan, Pesawaran. Skripsi. Fakultas Tarbiyah and Keguruan Universitas Islam Negeri Raden Intan. Lampung.
13. Pandey. J., Singh. R. 2015. Heavy Metals in Sediment of Ganga River: Up- and Downstream Urban Influences. Appl Water Sci, 1669-1678.
14. Peraturan Pemerintah Nomor 22 Tahun 2021 tentang Penyelenggaraan Perlindungan and Pengelolaan Lingkungan Hidup.
15. Rahman, M. 2016. Produktivitas Primer Perairan Pantai Kawasan Hutan Mangrove Desa Pagatan Besar Kecamatan Takisung Kabupaten Tanah Laut Propinsi Kalimantan Selatan. Fish Scientiae Vol 6(11):11-24.
16. Savitri Ria W. 2019. Analisis Kandungan Logam Berat Besi (Fe) pada Sedimen and Akar Mangrove Avicennia marina di Desa Kandang Semangkon Kecamatan Paciran Kabupaten Lamongan Jawa Timur. Skripsi. Fakultas Perikanan and Ilmu KElautan Universitas Brawijaya. Malang.
17. Schaduw J. N. W. 2018. Distribusi and Karakteristik Kualitas Perairan Ekosistem Mangrove Pulau Kecil Taman Nasional Bunaken. Majalah Geografi Indonesia. Vol 32 (1) ; 40-49.
18. Sekretariat Jenderal Kementrian Pertanian. 2023. Peta Sebaran Curah Hujan BUlan Juni-Desember 2023 di Indonesia. Pusat Data and Sistem Informasi Pertanian. Jakarta.
19. Sofarini, D., Herawati, E.Y., Mahmudi, M., Hertika, A.M.S., Amin, M. 2019. Lais Fish Stomach Content Composition (Cryptopter, spp) and Characteristic of Rawa Danau

panggang South Kalimantan. Russian Journal of Agricultural and Socio- Economic Sciences Vol 85 (1): 533-539.

20. Sofarini, D., Rahman, A., Ridwan, I. 2010. Studi Analisis Pengujian Logam Berat pada Badan Air, Biota and Sedimen di Perairan Muara DAS Barito. Jurnal BumiLestari Vol 12 (1): 32-44.
21. Sofarini, D., Rahman, A., Ridwan, I. 2012. Pemodelan Uji Logam Berat pada Badan Air, Biota and Sedimen di Perairan Muara DAS Barito. Jurnal Bumi Lestari Vol 10 (1): 28-37.
22. Supriyantini, E. and Hadi Endrawati. 2015. Kandungan Logam Berat Besi (Fe) pada Air, Sedimen, and Kerang Hijau (Perna Viridis) di Perairan Tanjung Emas Semarang. Jurnal Kelautan Tropis. Vol 18 (1): 38-45.
23. Supriyantini, E. and N. Soenardjo. 2015. Kandungan Logam Berat Timbal (Pb) and Tembaga (Cu) pada Akar and Buah Mangrove Avicennia marina di Perairan Tanjung Emas Semarang. Jurnal Kelautan Tropis. Vol 18 (2): 98-106.
24. Wantasen Adanan S. 2013. Kondisi Kulaitas Perairan and Substrat Dasar Sebagai Faktor Pendukung Aktivitas Pertumbuhan Mangrove Di Pantai Pesisir Desa Basaani Kabupaten Minahasa Tenggara. Jurnal Ilmiah Platax. Vol 1(04): hal. 204-209. ISSN: 2302- 2589.
25. Wardani, D. A. K., N. K. Dewi. and N. R. Utami. 2014. Akumulasi Logam Berat Timbal (Pb) pada Daging Kerang Hijau (Perna viridis) di Muara Sungai Banjir Kanal Barat Semarang. J. of Life Science. 3 (1): 1-8
26. Yusup D. S., Gede Surya I., and I Wayan A. 2018. Kandungan Logam Berat Timbal (Pb) pada Kerang di Kawasan Perairan Serangan Bali. Jurnal Metamorfosa. Vol (2): 144-150.

35. Jurnal RJOAS_DS dkk_2023.pdf

ORIGINALITY REPORT

0%	0%	0%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

Exclude quotes	On	Exclude matches	< 100%
Exclude bibliography	On		

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Article Error You may need to use an article before this word. Consider using the article **the**.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Article Error You may need to remove this article.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

Article Error You may need to use an article before this word. Consider using the article **the**.

Article Error You may need to use an article before this word.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

PAGE 2

Article Error You may need to remove this article.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

PAGE 3

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Article Error You may need to use an article before this word. Consider using the article **the**.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Article Error You may need to use an article before this word.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Wrong Article You may have used the wrong article or pronoun. Proofread the sentence to make sure that the article or pronoun agrees with the word it describes.

Wrong Article You may have used the wrong article or pronoun. Proofread the sentence to make sure that the article or pronoun agrees with the word it describes.

Prep. You may be using the wrong preposition.

PAGE 4

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

PAGE 5

Proofread This part of the sentence contains an error or misspelling that makes your meaning unclear.

Missing "," Review the rules for using punctuation marks.

Missing "," Review the rules for using punctuation marks.

Missing "," Review the rules for using punctuation marks.

Missing "," Review the rules for using punctuation marks.

Run-on This sentence may be a run-on sentence.

Missing "," Review the rules for using punctuation marks.

Missing "," Review the rules for using punctuation marks.

Article Error You may need to use an article before this word. Consider using the article **the**.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

PAGE 6

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

PAGE 7

Missing "," Review the rules for using punctuation marks.

Article Error You may need to use an article before this word.

Article Error You may need to remove this article.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Run-on This sentence may be a run-on sentence.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Confused You have used either an imprecise word or an incorrect word.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Article Error You may need to use an article before this word.

Article Error You may need to remove this article.

Article Error You may need to use an article before this word. Consider using the article **the**.

PAGE 8

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Missing "," Review the rules for using punctuation marks.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

P/V You have used the passive voice in this sentence. You may want to revise it using the active voice.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Article Error You may need to remove this article.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Missing "," Review the rules for using punctuation marks.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Dup. Did you mean to repeat this word?

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

Sp. This word is misspelled. Use a dictionary or spellchecker when you proofread your work.

PAGE 9

PAGE 10
