European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 09, 2020

Microplastic Levels in Sediments and Shellfish at Fish Auction (Beba) in North Galesong, Takalar Regency, Indonesia

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ABSTRACT

Coastal waters are one of the places that are susceptible to pollution, because these waters are the place where rivers disembogue and pollutants carried by river flows being deposited. Shellfish is a marine biota that settle permanently and associates in coastal areas thus it can accumulate substances contained in sediments or waters including microplastics. To determine the microplastic content in sediments at the coastal areas of North Galesong around the auction (Beba). To find out microplastic level of abundance in shellfish at the coastal area of North Galesong around the auction (Beba). The results of this study can be a solution for these areas to avoid pollution in coastal areas. The output of this research will be held in the coastal auction area (Beba), Takalar Regency and will be published in the form of journals and IPR. It is recommended that local government of Takalar Regency carry out a public health education program to broaden people's knowledge about the dangers of microplastics that have contaminated marine products and Badan Pengendalian Dampak Lingkungan (Environmental Impact Management Agency) to be more intensive in periodically monitoring the quality of coastal areas and monitoring of waste and plastic waste pollution from Fish Auction (Beba) in North Galesong, Takalar Regency.

Keywords: Microplastic levels, Marine Pollution, Sediment, Shellfish

INTRODUCTION

Coastal area is an important area seen from various planning and management perspectives. In line with population growth and increase in socio-economic development activities, the value of coastal areas continues to increase. As a result of human activities in coastal areas, it is not uncommon for various types of waste and pollutants to be found in sea,

which can cause environmental degradation in coastal areas and the surrounding ecosystem. Excessive entry of organic and inorganic substances into water bodies has a negative impact on marine waters and causes a decrease in the quality of sea water physically, chemically and biologically (Hamuna et al., 2018).

Coastal waters are one of the places that are prone to pollution hazards, because these waters are a place where rivers disembogue and pollutants carried by river flows such as sediments or waters including microplastics being deposited.

Marine debris according to National Oceanic Atmospheric Administration (NOAA) of the United States 2013, can be defined as solid objects, produced or processed by humans, directly or indirectly, intentionally or accidentally, dumped or left in marine environment, estimated that 10% of all newly produced plastic is disposed of through rivers and ends up in sea (Dewi et al., 2015).

Microplastics were first identified around 1970. The presence of microplastics has been found in seawater, sediments and even in seafood such as fish, shrimp, and shellfish. The discovery of microplastics in seafood makes it a new contaminant (Novel Food Contaminant). Its discovery in the body of traded fish can pose a threat to domestic food security. Moreover, Indonesia is known as one of the maritime countries that has great potential in the fisheries sector where in the final quarter of 2015 the total production of Indonesian marine products reached 14.79 million tons (Ministry of Marine Affairs and Fisheries, 2015).

Based on research conducted by Van Cauwenberghe et al (2015) on microplastics in cultivated shells that are consumed by humans, they identified microplastics in two shellfish species, Mytilus edulis and Crassostrea gigas and found that M. edulis contains an average plastic content of 0.36 ± 0.07. particles (wet weight), while a plastic charge of 0.47 ± 0.16 particles was detected in C. Giga.

Research conducted by Rochman et al (2015) on Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption conducted in Makassar (Indonesia) and California (United States) found that marketed commercial or consumption fish for Indonesia, 76 fish from 11 species produced as much as 55% containing plastic particles and filaments found in their digestive tract, while for California (United States) 64 fish from 12 species and 12 shellfish from 1 species including 16 fish (25%) and 4 shellfish (33%) were contaminated with plastic particles in their digestive tract.

The microplastic contained in digestive tract can cause a false sense of fullness, so that fish and other biota experience a decrease in appetite. There is also the fact that microplastics can facilitate the transport of chemical contaminants. Non-food objects that enter the digestive tract of fish can injure their digestive system. Therefore, the amount of microplastic that may enter into the body of fish is important to be studied deeper (Hapitasari, 2016).

Based on preliminary observations, the North Galesong Coastal area around the auction (Beba) has a lot of waste which is the result of auction activities and neighborhood around the coast where the most visible is plastic waste. These plastic wastes get sedimented and is absorbed by marine life, including shellfish.

Some people use the coastal area for pond cultivation such as shrimp, fish salt and seaweed where seaweed cultivation uses bottles and mineral nets as buoys which they call "tumba-tumba". In addition, there is still a lot of plastic waste in the coastal area because people in the coastal area of North Galesong still throw their waste into the marine environment. This allows microplastic pollution in airborne biota, considering that plastic waste can be degraded by sunlight, undergo oxidation and mechanical abrasion into small particles. Based on this background, the researchers wanted to see whether the shells in the coastal area of North Galesong Coast around the auction (Beba) contained microplastics.

METHODS

This type of research is an observational study with descriptive approach to describe the microplastic content found in sediments and shellfish with different sampling points. This study includes sampling and continued examination in the laboratory, data analysis and making the reports. The sediment and shellfish populations in this study were all sediments and shellfish in the North Galesong Coastal Area around the auction (Beba).

The location of this research is in the coastal area of North Galesong around the auction (Beba). Testing of microplastic content in sediment and shellfish was carried out at the Marine Ecotoxicology Laboratory, Department of Marine Science, Faculty of Marine and Fisheries Sciences, Hasanuddin University, Makassar. (1) Preparation stage, including secondary data collection took time in December 2019. (2) The implementation stage includes research activities took time from April to November 2020.

The sediment samples in this study were all sediments around the North Galesong Coast around the auction (Beba) which were taken at three different points. The shellfish samples in this study were all types of shells around the North Galesong Coast auction (Beba) which were taken at three different points.

The data was collected by conducting observation in the coastal area of North Galesong around the auction (Beba) and examination of sediment and shellfish samples at the Laboratory of the Faculty of Fisheries, Hasanuddin University Makassar. taken at three points with a sample of five shells at each point. The data obtained from the results of field and laboratory sampling are presented in tabular form and then described in narrative form.

RESULTS

This research was conducted in the coastal area of North Galesong around the auction (Beba). Testing of microplastic content in sediment and shellfish was carried out at the Marine Laboratory, Department of Marine Science, Faculty of Marine and Fisheries Sciences, Hasanuddin University Makassar. At point one it is located in the auction area (Beba) with the sampling depth of ± 1 m.

At the first point, we could find waste from human activities at the auction place and the number of repeated ship activities in the water area of the auction. The second point is located ±

50 M south from the first point with sampling depth of ± 1 M. At the second point, we could find domestic waste being disposed from nearby households directly to waters and the ship docking waste. The third point is located north of the North Galesong Coast around the auction (Beba) with sample depth at sea of ± 1M

Table 1
Distribution of Microplastics in Sediment Based on the amount in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Station	Sample Code (T)	Amount (Item)
Station I	1	6
	2	2
Station II	3	4
	4	3
Station III	5	5
	6	3
Station IV	7	16
	8	1
	9	2
Station V	10	5
	11	2
Station VI	12	16
	13	2
Total		**67**

Table 2
Distribution of Microplastics in Sediment Based on the Abundance in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Station	Abundance (Item/kg)
I	80
II	70
III	80
IV	190
V	70
VI	180

Table 3
Distribution of Microplastics in Sediment Based on the Type in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Type of MP	Station I	Station II	Station III	Station IV	Station V	Station VI	Jumlah
Line	6	4	5	16	2	2	35
Fragmen	2	3	3	2	5	16	31
Film	0	0	0	1	0		1
Total							67

Table 4
Distribution of Microplastics in Sediment Based on the Color in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Color	Station I	Station II	Station III	Station IV	Station V	Station VI	Jumlah
Black	3	2	2	2	1	1	10
Transparent	1	1	0	2	0	0	4
Blue	4	4	4	11	3	11	37
White	0		0	2	2	1	5
Brown	0	0	2	0	0	0	2
Red	0	0	0	2	1	1	4
Green	0	0	0	0	0	4	4
Total							66

Table 5
Distribution of Microplastics in Shellfish Based on the Amount in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Station	Sample Code (T)	Amount (Item)
Station I	A	4
	B	4
	C	1

Station II	A	0
	B	0
	C	0
Station III	A	0
	B	2
	C	2
Station IV	A	1
	B	0
	C	1
Station V	A	1
	B	2
	C	4
Station VI	A	1
	B	0
	C	0
Total		**23**

Table 6

Distribution of Microplastics in Shellfish Based on the Abundance in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Station	Abundance (Item/individu)
I	3
II	0
III	1,33
IV	0,67
V	2,33
VI	0,33

Table 7

Distribution of Microplastics in Shellfish Based on the Type in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Type of MP	Station I	Station II	Station III	Station IV	Station V	Station VI	Jumlah
Line	8	0	4	2	7	1	22
Frag	1	0	0	0	0	0	1

men							
Total							21

Table 8
Distribution of Microplastics in Shellfish Based on the Color in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Color	Station I	Station II	Station III	Station IV	Station V	Station VI	Jumlah
Blue	9	0	3	2	4	0	18
Brown	0	0	0	0	1	0	1
Red	0	0	0	0	2	1	3
Total							22

Table 9
Shellfish Species in the Coastal Areas of Fish Auction (Beba) in North Galesong, Takalar Regency

Station	Repetition	Species
1	A	*A. antiquata*
	B	*A. antiquata*
	C	*A. antiquata*
2	A	*G. tumidum*
	B	*G. tumidum*
	C	*G. tumidum*
3	A	*G. tumidum*
	B	*G. tumidum*
	C	*G. tumidum*

4	A	*G. tumidum*
	B	*G. tumidum*
	C	*G. tumidum*
5	A	*A. antiquata*
	B	*A. antiquata*
	C	*A. antiquata*
6	A	*A. antiquata*
	B	*A. antiquata*
	C	*A. antiquata*

DISCUSSION

This research was conducted in the coastal area of North Galesong around the auction (Beba). Samples are determined using incidental sampling, according to the existing conditions in the field with a depth of ± 1 M at 3 different points. Secondary data collection took time in December 2019. Implementation of research activities took time from April to November 2020.

The sediment and shellfish populations in this study were all sediments and shellfish in the North Galesong coastal area around the auction (Beba). The sediment samples in this study were all sediments in the North Galesong Coast around the auction (Beba) which were taken at three points. The samples of shells in this study were all types of shells in the North Galesong Coast around the auction (Beba) which were taken at three points.

Testing of microplastic content in sediment and shellfish was carried out at the Marine Ecotoxicology Laboratory, Department of Marine Science, Faculty of Marine and Fisheries Sciences, Hasanuddin University, Makassar. This type of research is an observational study with a descriptive approach in order to describe the microplastic content found in sediments and shellfish with different sampling points.

The results of microplastic content were tested at the Marine Ecotoxicology Laboratory, Department of Marine Science, Faculty of Marine and Fisheries Sciences, Hasanuddin University, Makassar. The number of abundance is obtained from the number of microplastics at each station divided by the number of samples in each station.

Sediment is a process of material deposition transported by water, wind, ice, or glaciers in a basin. Sedimentary rocks occur as a result of deposition of eroded material. Erosion products consist of various types of particles, could be fine, coarse, heavy or light. The highest number of microplastics was found at station 4, 19 items. This is because station 4 is still used for fish

auctions and is located close to local residence so that the amount of accumulated microplastic is the largest compared to other stations. While the second highest number of microplastic was found at station 6 where the microplastic content is 18 items. This is also because station 6 is a place not far from local residence. Meanwhile, the lowest number of microplastic particles was in the sediment, at stations 2 and 5, as much as 7 items of microplastic. This is indicated by the distance from the sediment sampling point which is far from the residential area, and there are only fishing activities.

The highest number of microplastics at the sampling point or the station is marked because they are an active place for the local community to trade and transact, this involves a lot of materials which, if not handled properly, will be a source of high microplastics in the auctions (Beba).

The abundance of microplastics with highest number was found at station IV with 190 items / kg. This abundance is affected by the location of Station IV itself which is the centre for the local community to trade and transact in the auction area. The types found were line types and fragment types. The shape of the fragments is assumed to have originated from the fragmentation of plastic packaging such as beverage bottles, plastic bags and pieces of pipe. The number of fragments that dominates is influenced by fishing related activities around the station, such as fishing using fishing line or nets as the main fishing tool.

The number of fragments is influenced by the amount of plastic waste due to tourism and household activities such as the use of plastic bottles, mica packaging, and other objects with a strong plastic texture.

Shellfish (*Bivalva*) are molluscs that typically have two valves, and the two halves are more or less symmetrical. The skeleton is composed of calcified valves on the right and left sides of the body. The valves are closed along the dorsal edge called the hinge, and are connected by elastic limestone structures called ligaments. They are closed by the pulling action of one or two (sometimes three) adductor muscles. Byssus is the leg protrudes from the anterior of the skeleton, while posterior of the skeleton is where the siphon protrudes. Most shellfish are filter feeders, but some are scavenger or even predators. There are 10 000 species of shellfish known worldwide (Bugis, 2014).

The highest number of microplastics found inside the shellfish are at station 4 and 5. This is because station 4 and 5 are used for trading places or fish auctions and are located close to local residence hence the amount of microplastic accumulated is the highest compared to other stations. Meanwhile, the lowest number of microplastic particles was found in the sediment, which is at station 2. This is low number assumed caused by the far distance between the sediment sampling point and the residence area.

If we refer to the growth patterns of animals both living in land and sea, especially shellfish, we will find that the small shellfish (young) has a greater growth rate than those of larger organisms. In order to meet their natural needs, to grow, smaller shellfish absorb more

food than the large ones. Along with this filtration or absorption, beside eating plankton, microplastics are also present in the water and get eaten. Therefore it is commonly accepted that the concentration of microplastics in small shellfish is higher than the concentration of microplastics in the larger one.

Another mechanism that needs to be considered in explaining the concentration of microplastics in the shellfish is depuration process or the process of removing pollutants from the shellfish. Depuration takes place in two ways, first one is through excretion of feces and pseudofeces. The first way is a common pathway found in all marine organisms. The food enters their digestive tract and ends up in the anus or similar disposal body part.

The results of microplastic analysis in the Beba fish auction area found three types of microplastics, namely fragment, line, and film. The fragments are literally the fragments of larger plastic. The line is thin and long like synthetic fibers. The film particles also form very thin plastic shards. If the microplastics found cannot be identified as fibers, pellets, film or stryrofoam, they can be identified as fragments. The source of microplastics is assumed come from synthetic cloth, fishing boat waste and fishing gear such as fishing nets and fishing lines, and food packaging. Most of these microplastic sources come from human activities and are influenced by currents and tides.

The results above are related to the main distribution of microplastics in the waters, divided into two, namely primary microplastics and secondary microplastics. Primary microplastics come from spills during plastic production or recycling, sand blasts from shipyards and also cleaning particles in beauty products. All primary microplastics have the same properties that are designed to be small during the production process. Secondary microplastics consist of larger pieces of plastic, waste in sea, industrial shipwrecks, fishing gear made of plastic, waste from landfills, paint flakes on ship hulls, synthetic fibers from washing water disposal, plastic fragments from packaging industrial or agricultural sources. Until now, the entry route of secondary microplastics and their possible mitigation measures is very difficult to define (Siagian, 2018; Smith et al., 2018).

Microplastics can cause serious problems for the survival of marine life and their associative ecosystems. The accumulation of microplastic particles in intestinal organs of fish can cause inflammation, physiological disorders (eating disorders, swimming ability, reproduction time). These factors believed may lead to high mortality before regeneration. (Setiawan & Fithrah, 2018).

The waste accumulated on ocean floor will also affect marine life. Sea animals such as fish, turtles, dolphins, and others will also be polluted. This is because these marine animals might consider the wastes as food and eat them eventually. Admitting that there is a possibility that plastic waste is made of chemicals that can be absorbed by animals which can poison them and will result in death. When the animals die at sea, these animals will become carcasses in which inside their body contained plastic waste that cannot be decomposed. Hence this will also

poison other animals. So that the sustainability of sea animals will decrease and even threaten to extinct, included the decomposer and other animals in the food chain (Manalu et al., 2017).

Microplastics have tendency to absorb harmful chemicals and release them in the digestive system. The release of toxic chemicals into digestive tract can cause various problems related to digestive system and can hinder digestive process. Microplastic particles can irritate intestinal wall. Phthalates, chemicals used to provide comfort to plastics that are linked to the growth of breast cancer cells, are found in plastics. These chemicals cause cancer to multiply and grow more. Another study conducted on mice revealed that when microplastic is consumed, the particles accumulate in kidneys, liver and intestines. Microplastics also cause oxidative stress in liver and increase levels of oxidative molecules.

Analysis of microplastics level in human body revealed that around 87 percent of respondents had the presence of fiber in their lungs. It can enter your lungs through the air we breath because microplastics are all around us (which has been scientifically proven). Microplastic particles that present in air can cause inflammation in lungs. BPA or Bisphenol A is a chemical commonly found in food storage containers and plastic packages used to cover food. These chemicals can affect reproductive hormones, especially for women. The absorption ability of microplastics results in the absorption of toxic chemicals which will be released into digestive system. If the microplastics obtained have a size of less than 0.3 mm or have a size of more than 5 mm, both are still declared as contaminants. If microplastic enters human body, it will be retained in the organs and difficult to be secreted. As result, the organs can be hampered. The chemicals that accumulate in body are also a contributing factor to the growth of cancer.

CONCLUSION

Research conducted in the Coastal Area of fish auction (Beba) at Galesong, Takalar Regency show that the highest amount of microplastic found at station IV near the market and domestic sewage with 16 microplastic particles in sediment and 19 in the shellfish. Research conducted in the Coastal Area of fish auction (Beba) at Galesong, Takalar Regency show the lowest amount of microplastic was found at stations I, II, III & VI located far from the markets and domestic sewage or the fish auction area. It is recommended that local government of Takalar Regency carry out a public health education program to broaden the public's insight about the dangers of microplastics that have contaminated marine products and recommended that Environmental Impact Management Agency to be more intensive in periodically monitoring the quality of coastal areas and monitoring of waste and plastic waste pollution from Fish Auction (Beba) in North Galesong, Takalar Regency.

REFERENCES

Ahmed, M. M. E., A., I. ., & M., A. E.-R. . (2020). Microbiological and Immunological Studies

on Brucellosis in a Hospital in Al-Madinah Al-Munawarah. *Journal of Scientific Research in Medical and Biological Sciences*, *1*(2), 24-44. https://doi.org/10.47631/jsrmbs.v1i2.103

Bugis, R. (2014). *Keanekaragaman Kerang (Bivalva) Yang Terdapat Di Sungai Meureubo, Sungai Alue Raya Dan Sungai Arongan Lambalek.* Thesis, Fakultas Perikanan dan Ilmu Kelautan, Universitas Teuku Umar.

Dewi, I. S., Budiarsa, A. A., & Ritonga, I. R. (2015). Distribusi mikroplastik pada sedimen di Muara Badak, Kabupaten Kutai Kartanegara. DEPIK Jurnal Ilmu-Ilmu Perairan*, Pesisir dan Perikanan, 4*(3).

Hamuna, B., Tanjung, R. H., & MAury, H. (2018). Kajian kualitas air laut dan indeks pencemaran berdasarkan parameter fisika-kimia di perairan Distrik Depapre, Jayapura. *Jurnal Ilmu Lingkungan, 16*(1), 35-43.

Hapitasari, D. N. (2016). *Analisis Kandungan Mikroplastik pada Pasir dan Ikan Demersal: Kakap (Lutjanus Sp.) dan Kerapu (Epinephelus Sp.) di Pantai Ancol, Palabuhanratu, dan Labuan*. Thesis, Fakultas Matematika dan Ilmu Pengetahuan Alam. Institut Pertanian Bogor.

Manalu, A. A., Hariyadi, S., & Wardiatno, Y. (2017). Microplastics abundance in coastal sediments of Jakarta Bay, Indonesia. *Aquaculture, Aquarium, Conservation & Legislation, 10*(5), 1164-1173.

Ministry of Marine Affairs and Fisheries, (2015). *Kelautan dan Perikanan dalam Angka Tahun 2015 (Marine And Fisheries In Figures 2015).* Data Pusat, Statistik dan Informasi. Available from:http://sidatik.kkp.go.id/files/src/b74413c54e10ed63e28e4ae5cbdf6fa5.pdf

Rochman, C. M., Tahir, A., Williams, S. L., Baxa, D. V., Lam, R., Miller, J. T., & Teh, S. J. (2015). Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. *Scientific reports, 5*, 14340.

Setiawan, B., & Fithrah, D. S. (2018). Kampanye Gerakan Indonesia Diet Kantong Plastik Dalam Membentuk Persepsi Masyarakat Bandung. *Jurnal Manajemen Komunikasi, 2*(2), 102-117.

Siagian, B. D. M. (2018). *Analisis Perbandingan Kandungan Mikroplastik Menggunakan Metode Sampling Plankton Net Dan Manta Net Di Perairan Selatan Selat Bali.* Thesis, Universitas Brawijaya.

Smith, M., Love, D. C., Rochman, C. M., & Neff, R. A. (2018). Microplastics in seafood and the implications for human health. *Current environmental health reports*, *5*(3), 375-386.

Van Cauwenberghe, L., & Janssen, C. R. (2014). Microplastics in bivalves cultured for human consumption. *Environmental pollution, 193*, 65-70.