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Identification of Microplastic in Tilapia Fish (*Oreochromis mossambicus*) at Tallo River in Macassart

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ABSTRACT

This aim of this study was to identify microplastic pollution in the Tallo River Makassar City. The analysis technique used in this research is statistical analysis technique and microplastic spatial distribution. Statistical analysis using the average abundance of microplastics is presented in tables and graphs, then analyzed descriptively quantitatively at each station. Data showing the mean ± standard deviation were analyzed using SPSS software. The results showed that the number of microplastics found in samples of tilapia fish at station 1 was 11 MP with an average abundance of 2.20 ± 1.924 MP / individual. The sample of tilapia fish at station 2 was 11 MP with an average abundance of 2.20 ± 1.095 MP / individual. While the sample of tilapia fish at station 3 was 15 MP with an average abundance of 3.00 ± 2.121 MP / individual. Total microplastics in tilapia fish (Oreochromis mossambicus) in the Tallo River was 37 MP with an average abundance of 2.47 ± 1.685 MP / individual. It can be concluded that the number of microplastics found in tilapia fish in the Tallo River was 37 particles. The microplastic forms identified were fragments and lines. The colors of the microplastics identified were purple, black, blue, red, and brown. The microplastic sizes identified were <1 mm and 1.00-4.75 mm.

Keywords: Microplastic, Tilapia fish, Abundance, Identification.

INTRODUCTION

Plastics have penetrated everyday life. Cheap, durable, lightweight, and easy-to-carry plastic results in greater losses. Plastic waste that starts to enter rivers and exits has a bad effect on marine ecosystems.[1] The issue of marine pollution by microplastic particles has opened the eyes of many people about the potential dangers targeting marine life and humans due to the careless disposal of plastic waste into the sea.[2] Without realizing it, the use of plastic packaging and other materials containing plastic has triggered the accumulation of plastic waste in the ocean due to the absence of good waste management.[3]

Some microplastics are released directly into the environment while others are damaged by environmental processes. Land and sea sources can contribute to the release of microplastics into the marine environment and marine transportation can move microplastics over long distances.[4,5] Based on data from the World Bank, global plastic production is currently estimated at around 300 tons per year. Meanwhile, plastic pollution in the marine environment including the coast is estimated at 9.5 tons per year. This is the equivalent of a plastic dump truck entering the ocean every minute. [6,7]

Microplastics are generally classified as particles smaller than 5 mm.

Microplastics are used in some cosmetic and personal care products and can be generated accidentally, for example from clothing fibers and tire particles.[8,1] Microplastics are also produced from the breaking of larger plastic objects in the oceans (House of Commons). Microplastics are plastic particles measuring 5 mm to 100 nm. regarding microplastics following the standard nomenclature differentiation of international units, namely 5 mm to 1 µm 9,10,11.

Indonesia is one of the largest sources of plastic waste in the oceans. However, the abundance data measured directly from seawater in Indonesia is still lacking[4]. Most of the microplastics were found at a depth of less than 100 m in the thermocline area of Peraian Sumba, East Nusa Tenggara. These findings confirm that plastics have invaded the marine environment in various parts of the oceans and oceans including pristine, remote and unknown areas10. Based on data from the Ministry of Finance in 2015 Indonesia was one of the five countries responsible for plastic waste in the oceans. The total plastic waste in Indonesia that ends up in the sea is known to have reached 187.2 million tons.[4, 12,13]

Makassar City as one of the big cities in Indonesia, nearly 60% of the population spread over the coastal area has the potential to cause plastic waste pollution through the Tallo River and drainage which empties into Makassar City waters. Found around 12 types of colors grouped by station[5]. The color of microplastics that was commonly found was blue as much as 28% (594 pieces). The proportion of brightly colored microplastics is easier for fish to consume. White, clear, and blue are plastic colors commonly digested by fish.[14]

Based on the results of research conducted in Jeneponto, 41 microplastic items were observed in 10 sediment samples. The sampling location was found to be the location with the highest microplastics in the water. Surface water in the Tallo River has been contaminated by MP microplastics. Microplastics in surface water have accumulated in fish that are consumed by humans and can threaten food safety and human health. The Tallo River is one of the main rivers in Makassar City which flows into the Makassar Strait. The waters of the estuary of the Tallo River are under high pressure due to the presence of settlements, Makassar Industrial Area (KIMA), PLTU, plywood factory industry, aquaculture and agriculture.

MATERIALS & METHODS

This type of research is descriptive observational to examine, identify the microplastic content found in fish in the Tallo River. The research location was carried out on the Tallo River, Makassar City in June 2020. The samples were tested and identified at the Marine Ecotoxicology Laboratory, Faculty of Marine Sciences and Fisheries, Hasanuddin University Makassar.

The population in this study were all ecosystems in the Tallo River, Makassar City. While the sample of this research is tilapia fish (Oreochromis mossambicus). Fish samples are fish that are often consumed by people in South Sulawesi. Fish samples were 5 fish at each station so that the total fish was 15 fish. While sediment samples were taken as much as 1 kg / point at each station. The number of points per station is 3 points.

Statistic analysis

The average abundance of microplastics is presented in tables and graphs, then analyzed descriptively quantitatively at each station. Data showing the mean ± standard deviation were analyzed using SPSS software.

Microplastic Laboratory Analysis of Fish

Fish samples were taken to the laboratory for surgery and identified. All equipment was sterilized with distilled water. The fish is dissected and their digestive tract is taken to extract the microplastic. The digestive tract is inserted into the sample bottle and given a 10% KOH solution mixed with aquabidest up to 3 times the volume of the tissue. The sample is left to stand for 14 days or until the digestive tract of the fish has been destroyed. Then the sample is filtered using filter paper with the help of a vacuum pump. The filter results were observed using a stereo microscope

RESULT

The results of measuring the abundance of microplastics in samples of tilapia fish (Oreochromis mossambicus) can be seen in table 1 below.

Table 1: Abundance of Microplastics in Tilapia Fish (Oreochromis mossambicus)

Stasiun	Total fish	Total MPs	mean+SD (MP/person)
Stasiun 1	5 Tail	11 MP	2,20±1,924
Stasiun 2	5 Tail	11 MP	2,20±1,095
Stasiun 3	5 Tail	15 MP	3,00±2,121
Total	**15 Ekor**	**37 MP**	**2,47±1,685**

Based on table 1, the number of microplastics found in samples of tilapia (Oreochromis mossambicus) has the same abundance, namely 11 MP at station 3 as much as 15 MP with an average abundance of 3.00 ± 2.121 MP / individual.

Table 2: Analysis of the Effect of Body Weight and Length of Fish on the Number of Microplastics in Tilapia Fish (Oreocrhomis mossambicus)

Simultan test			R	Adj R^2
F_{Hitung}	F_{Tabel}	Sig.		
1,303	3,885	0,303	0,422	0,041

Based on table 2, the calculated F value is 1.303, namely the calculated F value is smaller than the F table value of 3.885 and a significant value of 0.303 is greater than 0.05, it is concluded that the body weight and body length of tilapia fish (Oreochromis mossambicus) have no significant effect; simultaneously to the amount of microplastics in the fish body. The R value of 0.422 or 42.2%, it can be concluded that the correlation between variables is weak. While the Adjusted R2 value is 0.041, this value illustrates that the percentage effect of body weight and height of fish on the number of microplastics has a value of 4.1% while the remaining 99.59% is another factor not examined in this study.

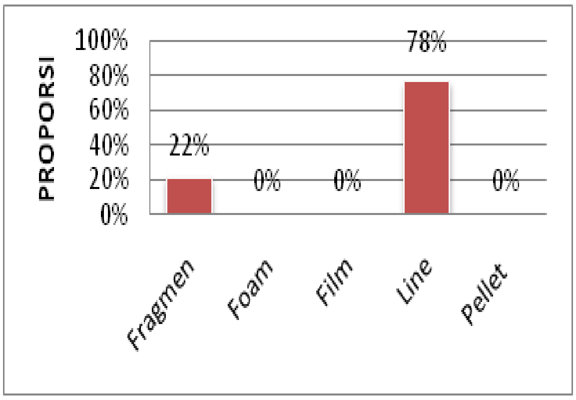

Figure 1 ": Number of Microplastics in tilapia Fish (Oreochromis mossambicus) based on its shape

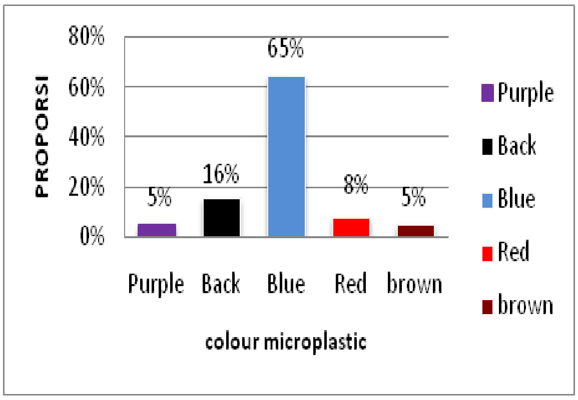

Figure 2": Number of Microplastics in Tilapia Fish(Oreochromis mossambicus) by color

Based on Figure 2, the proportion of the number of microplastics in tilapia fish (Oreochromis mossambicus) in the Tallo River is based on its color, namely 5% purple, 16% black, the highest color is blue 65% while passing with period, 8% red and 5% brown.

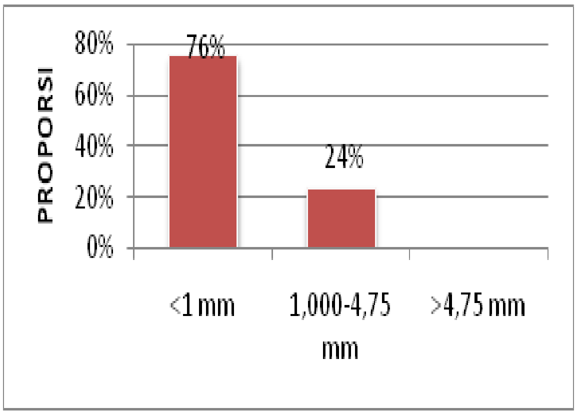

Figure 3: Proportion Data of Microplastic Amounts in Tilapia Fish Based on the size

Based on Figure 3, the proportion of the number of microplastics in tilapia fish

(Oreochromis mossambicus) in the Tallo River based on its size is <1 mm by 5%, 1,000-4.75 mm by 76%, and no microplastics> 4.75 mm size are found.

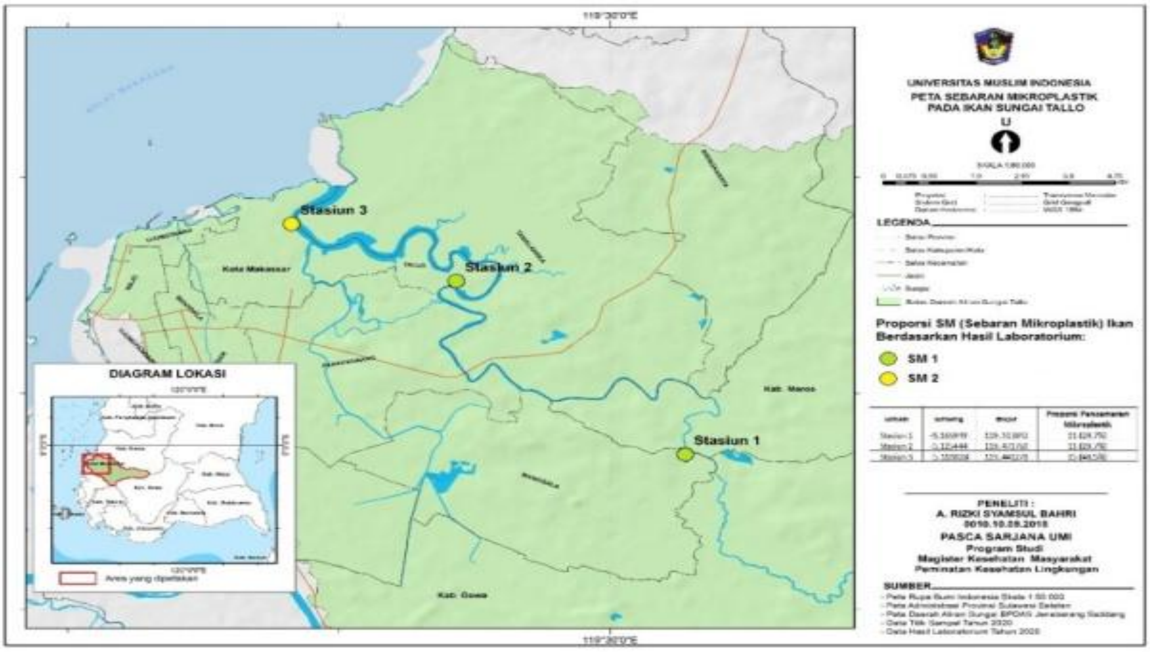

Figure 4:Distribution of Microplastic Pollution on Tilapia Fish (Oreochromis mossambicus) in the Tallo River

Based on Figure 4 the distribution of microplastic pollution in tilapia fish (Oreochromis mossambicus) in the Tallo River at station 1 is 11 MP (29.7%), station 2 is 11 MP (29.7%) and point 3 is 15 MP (40.5 %).

DISCUSSION

Based on the results of this study, the number of microplastics found in samples of tilapia (Oreochromis mossambicus) was 37 MP from 15 fish. The average abundance of microplastics in tilapia (Oreochromis mossambicus) in the Tallo River is 2.47 ± 1.685 MP / individual. Based on the results of statistical tests in this study, it was concluded that the body weight and body length of tilapia fish (Oreochromis mossambicus) did not simultaneously affect the number of microplastics in the fish body. The percentage effect of body weight and height of fish on the number of microplastics has a value of 4.1% while the remaining 99.59% is another factor not examined in this study. This study is in accordance with research conducted by De Vries, et.al. who stated that there is no relationship between microplastics in the intestines of two commercial fish species in Iceland and weight, length and condition index (CI) in fish.[15]

The microplastics that accumulate in the fish's body can clog the digestive tract of the fish, disrupt the digestive process and block the absorption process. The microplastic content in the digestive tract can cause a false sense of fullness so that fish experience a decrease in appetite. In addition, microplastics can facilitate the transportation of chemical contaminants and become carriers of harmful organic and inorganic contaminants14. This can result in the accumulation of chemical contaminants in the fish's body so that they can accumulate in the human body when humans consume the fish.[5,16]

The plastic polymers used in fishing gear such as nets, traps, hooks and fishing lines are Polyamide (PA) and Polyetylen (PE) which have low density. This polymer density level causes the polymer to float easily and is consumed by fish. Based on the identification results of this study, the shape of the line is the shape found more in the Tallo River as much as 29 MP (78 %%) with an average abundance of microplastics

1.93 ± 1.486 MP / individual. While the shape of the fragments was 8 MP (22%) with an average abundance of fragments of 29 MP with an average abundance of microplastics 0.53 ± 0.640 MP / individual. The line form was found to be most abundantly swallowed by fish related to human activities around the Tallo River, namely aquaculture and fishing activities.[8,10]

Most of the microplastics in the form of colored fibers or lines are made of cellulose (cotton), semisynthetic cellulose (rayon), and polyethylene terephthalate (polyester) from textiles, nylon fibers are widely used in the fishing industry, while styrene / acrylic and polyacrylate polymers are waterproof polymers, which are often used in paints and coating products for marine activities. [11,17] These plastic polymers can be dangerous when they enter the human body through the consumption of fish or other biota.

One of the plastic additives commonly used as an antioxidant is bisphenol A (BPA). This polymer can come out of the polycarbonate to follow food or drinks so that it can be ingested by humans. Bisphenol A can cause endocrine disrupting effects, obesity, affects hormone levels, causes breast and prostate cancer. Likewise, other plastic polymers such as Polyvinyl chloride, PAHs, PCBS, OCPs, and PBDEs can be carcinogenic, mutagenic and disrupt the endocrine system. [18]

The highest microplastic color found in the Tallo River from the results of this study is a blue color of 24 MP (65%) with an average abundance of microplastics 1.60 ± 1.595 MP /individual. Followed by black as much as 6 MP (16%) with an average abundance of microplastics 0.40 ± 0.632 MP / individual, red as much as 3 MP (8%) with an average abundance of microplastics 0.20 ± 0.414 MP / individual, purple color as much as 2 MP (5%) with an average abundance of microplastics 0.13 ± 0.352 MP / individual, brown color as much as 2 MP (5%) with an average abundance of microplastics 0.13 ± 0.352 MP / individual.

The highest microplastic size found in the Tallo River in this study was <1 mm as much as 28 MP (76%) with an average abundance of microplastics 1.87 ± 0.389 MP / individual. While the size of 1.00-4.75 mm is 9 MP (24%) with an average abundance of microplastics 0.60 ± 0.163 MP / individual. Microplastic size 1.00-4.75 mm is a fishing line or line, this shows that one of the sources of microplastic in the Tallo River comes from fishing gear and equipment used in fish farming. In addition, the size most dominant consumed by fish is <1 mm. This shows that macroplastics have been degraded for a long time.

Based on the identification results in this study, there were no microplastics> 4.75 mm in size which were consumed by tilapia fish (Oreochromis mossambicus). This shows that tilapia fish (Oreochromis mossambicus) only consume microplastics measuring ≤4.75 mm. The results of this study indicate that microplastic pollution in the Tallo River has threatened the safety of seafood, one of which is fish. This can threaten the health of people who consume the fish. So risk management is necessary. However, until now, microplastics have not been determined as toxic compounds with certain safe limits.

CONCLUTION

The number of microplastics found in tilapia fish (Oreochromis mossambicus) in the Tallo River was 37 particles. The microplastic forms identified were fragments and lines. The colors of the microplastics identified were purple, black, blue, red, and brown. The microplastic sizes identified were <1 mm and 1.00-4.75 mm.

REFERENCES

1. Boucher D. Primary Microplastics in the Oceans a Global Evaluation of Sources. (Sousa CGL and JM de, ed.). Gland, Switzerland: IUCN, Gland, Switzerland; 2017. doi: dx.doi.org/10.2305/IUCN.CH.2017.01.en
2. Widianarko B, Inneke H. Microplastics in Seafood from the North Coast of Java.

Semarang: Soegijapranata Catholic University; 2018.
3. Karthik R, Robin RS, Purvaja R, et al. Science of the Total Environment Microplastics along the beaches of southeast coast of India. Total Environ Sci. 2018, 645: 1388-1399. doi: 10.1016 / j.scitotenv.2018.07.242
4. Ayuningtyas WC, Yona D, S SHJ, Iranawati F. Abundance of Microplastics in Waters in Banyuurip, Gresik, East Java. J Fish Mar Res. 2019; 3: 1-5.
5. Vries D, Govoni D, Halldór S, Carlsson P. Microplastic ingestion by fish: Body size, condition factor and gut fullness are not related to the amount of plastics consumed. Mar Pollut Bull. 2020; 151 (January): 110827. doi: 10.1016 / j.marpolbul.2019.110827
6. Syahrir, S., Soekendarsi, E. and Hasyim, Z., 2017. Comparison of nutritional content of tilapia fish Oreochormis mossambica Lake Hasanuddin University Makasasar and Mawang Lake Fish Gowa. BIOMA: Makassar Biology Journal, 1 (1).
7. Tahir, A., et.al. Microplastics in Water, Sediment and Salts from Traditional Salt Producing Ponds. Department of Marine Science, 2019.Hasanuddin University, Makassar, Indonesia.
8. Verschoor, A.J. Towards a definition of microplastics Considerations for the specification of physico-chemical properties. Ministry of Health, Welfare and Sport, National Institute for Public Health and the Environment.2015.
9. Yudhantari S, Hendrawan IG, Puspitha N. Microplastic Content in the Digestive System of Lemuru Protolan Fish (Sardinella Lemuru) Catched in the Bali Strait. J Mar Res Technol. 2019; 2.
10. Joesidawati MI. Microplastic Pollution along the Coast of Tuban Regency. Ronggolawe PGRI Univ. 2018; (September).
11. WHO, Microplastics in Drinking-Water. World Health Organization, 2016.
12. GESAMP. Sources, Fate and Effects of Microplastics in The Marine Environment: Part 2 of a Global Assessment. (Peter J. Kershaw and Chelsea M. Rochman, ed.). International Maritime Organization; 2016. www.imo.org.
13. Zhang Y, Kang S, Allen S, Allen D, Gao T.Earth-Science Reviews Atmospheric microplastics: A review on current status and perspectives. Earth-Science Rev. 2020; 203 (February): 103118. doi: 10.1016 / j.earscirev.2020.103118
14. Scientific Advice Mechanism (SAM). Environmental and Health Risks of Microplastic Pollution. Group of Chief Scientific Advisor, Directorate-General for Research and Innovation, European Commission. 2019.
15. Shahul Hamid, F., Bhatti, M.S., Anuar, N., Anuar, N., Mohan, P. and Periathamby, A., 2018. Worldwide distribution and abundance of microplastic: how dire is the situation ?. Waste Management & Research, 36 (10), pp. 873-897.
16. Su, L., Sharp, S.M., Pettigrove, V.J., Craig, N.J., Nan, B., Du, F. and Shi, H., 2020. Superimposed microplastic pollution in a coastal metropolis. Water research, 168, p. 115140.
17. Cordova MR, Hernawan UE. Microplastics in Sumba Waters, East Nusa Tenggara. IOP Conf Ser Earth Environ Sci. 2018.doi: 10.1088 / 1755-1315 / 162/1/012023
18. Afdal M, Werorilangi S, Faizal A, Tahir A. Studies on Microplastics Morphology Characteristics in the Coastal Water of Makassar City, South Sulawesi, Indonesia. Int J Environ Agric Biotechnol. 2019; 4 (4): 1028-1033.

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