Jurnal ILMU DASAR. vol 26 no 1 Januari 2025. Hal. 72-81

Jurnal ILMU DASAR (JID)
https://jurnal.unej.ac.id/index.php/JID

Early Detection of Microplastic Contamination in Fishes In The Sukamade Shoreline, Meru Betiri National Park

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Article info

Keywords
Abundance,
Conservation,
Gills,
Gastrointestinal tract,
Waste,

Article history
Received 10-04-2024.
Accepted 25-12-2024

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ABSTRACT
Microplastics (< 5 mm) have the potential to be a threat to organisms. However, the study of microplastic contamination in conservation areas, especially in Indonesia, is still limited. The Sukamade is a conservation area that is potentially contaminated by microplastic. This study aims to detect microplastic contamination in fish caught in the Sukamade shoreline as an early warning of the potential threat to biodiversity. The study was conducted from September to December 2022. The methods used include: 1). Fish sampling, 2). Dissection and removal of the gills and gastrointestinal tract; 3). Microplastic characterization based on sizes, shapes, and colors; 4). Data analysis. This is the first report that 451 microplastic particles were detected in four fish caught from the Sukamade shoreline: two individuals of Senangin fish (*Eleutheronema* sp.), one individual of Lemuru fish (*Sardinella* sp.), and one individual of Lowang totol fish (*Trachinotus* sp.). The presence of microplastic in the gastrointestinal tract of fishes shows the possibility of microplastic translocation in tissue and another tropic level, causing health problems in organisms and the community as a constituent of biodiversity.

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INTRODUCTION

Plastic waste has been Indonesia's second-largest type of waste for the last 5 years, after domestic waste (SIPSN, 2024). The very strong character of plastic makes it very difficult to degrade so it is persistent in the environment. Various environmental pressures are only enough to change the size of plastic into smaller forms, known as microplastics and nanoplastics. Plastic degradation into microplastics through physical, chemical, and biological processes takes a long time, even hundreds of years. Microplastics are plastic particles smaller than 5 mm (Emmerik & Schwarz, 2020; Syberg *et al*., 2015). The main sources of microplastics in the environment generally come from human activities, such as industry, household waste, and fisheries. There are two types of microplastics; primary microplastics are plastics produced for cleaning and cosmetic purposes, and secondary microplastics result from pieces or fragmentation of plastic from a larger to a smaller size (GESAMP, 2015; Widianarko & Hantoro, 2018). The characterization of microplastics can be seen from the color, shape, and size of microplastics (*Cordova et al*., 2019; Rahim *et al*., 2022). Fragment forms can come from fractures or plastic fragmentation. Fiber comes from cloth fibers, ropes, and fishing nets. Foam usually comes from styrofoam waste. The form of granules, namely the form of granules, usually comes from treatment or cosmetic waste (GESAMP, 2015; Sandra & Radityaningrum, 2021).

The abundance of microplastics poses a severe threat, especially for organisms at lower trophic levels. Microplastics can be ingested by marine biota because their characteristics, such as their small size, shape, and color are look like a natural food for marine animals. Microplastic in fish's digestive tract can cause a false feeling of fullness (Erlangga *et al*., 2022; Heshmati *et al*., 2021). Microplastic contamination in the gill racker filaments can inhibit the fish's breathing. This microplastic inhibition occurs because water-carrying oxygen cannot enter the gills (Erlangga *et al*., 2022; Rofiq & Sari, 2022; Yona *et al*., 2020). Microplastics can facilitate the transportation of chemical contaminants and become carriers because they can absorb organic and inorganic contaminants, which are hazardous to the environment (Huang *et al*., 2020). In addition, microplastics in the form of tiny particles can enter the food chain and impact humans as the top predators of the food chain (Syberg *et al*., 2015).

The shoreline area is a confluence area of land and sea, causing this area to be vulnerable to plastic waste pollution. Coastal areas also often face the phenomenon of postal waste; this waste originates from various external areas and ends up in coastal areas due to currents (Gündoğdu *et al*., 2019; Mauludy *et al*., 2019). Exposure to direct sunlight of plastic waste on the beach causes the decline of the integrity of the plastic structure, making it easily brittle. Plastic waste on beaches is also vulnerable to fragmentation due to seawater abrasion, waves, and turbulence. This process continuously makes the plastic waste smaller, reaching micrometers (Lie *et al*., 2018). Microplastics have been reported in fish on several coasts in Indonesia. (Hastuti *et al*., 2019) reported that microplastics were detected in the digestive tract of *Sardinella fimbriata* (20 particles/individual) and *Oreochromis mossambicus* (4.9 particles/individual) from Pantai Indah Kapuk coast, Jakarta. The most common characteristics of microplastics found in the two fish species include fiber shape (89.63%), transparent color (79.20%), and various sizes (<20-1000 micrometers). The study also concluded that fish characteristics, such as body length and length, weight and length of the digestive tract, and length and width of the mouth did not influence the microplastics detected in fish. (Yona *et al*., 2021) also reported that microplastics were detected in the gills, gastrointestinal tract, and muscle of Sardinella lemuru, obtained at Sendang Biru Harbor, Malang. The dominant characteristics of identified microplastics in the research were fiber (54%), fragment (43%), and film (3%), respectively. The research also concludes that the presence of microplastics in the gills and digestive tract of fish is related to direct interaction between fish and the environment through respiration and the feeding process. Moreover, the accumulation of microplastics in fish muscles proves the existence of a translocation process of microplastics between organs. However, a study of microplastic contamination in the conservation area is still limited, as it can potentially thread biodiversity through the food chain.

The Sukamade is a conservation area of Meru Betiri National Park. It has a shoreline area that often receives waste consignments that are potentially contaminated by microplastic. As a conservation area, National Park must ensure the sustainability of the area and the biota in it. One of the many aquatic organisms found in the Sukamade shoreline is fish. Fish on the coast of Sukamade are natural food for shorebirds and are consumed by local residents. It does not rule out the possibility of microplastic contaminants in fish in the region. So far, there has been no research on the diversity of fish on Sukamade Beach, and there have also been no reports of microplastic contamination on the Sukamade shoreline. Therefore, detecting contaminants in fish, one of which is microplastics, needs to be done to estimate the potential danger if consumed by the trophic level above.

This study aims to detect microplastic contamination in fish caught in the Sukamade shoreline as an early warning of the potential threat to biodiversity, especially in conservation areas. So, it is necessary to know the presence of microplastics through the abundance of microplastics in fish's gills and digestive tract. In addition, microplastic characterization is also needed to identify potential origins of contamination. Hopefully, this first finding can inform society that even in the protected area, microplastics from human activity and plastic usage on land can move through the food chain and potentially negatively affect the aquatic ecosystem.

MATERIALS AND METHODS

Fish sampling

This is a descriptive study. The research was conducted from September to December 2022. The fish sampling was conducted in early September 2022. Using a fishing rod, the fish sample was obtained from the Sukamade shoreline (Figure 1). Fish were obtained randomly (not determined by specific criteria) so that the samples obtained represented fish in the fishing areas of traditional fishermen. The number of fish between 5-12 fish per location. The collected samples were placed in a cool box and stored at -18^{o}C until further preparation (Tobing *et al*., 2020).

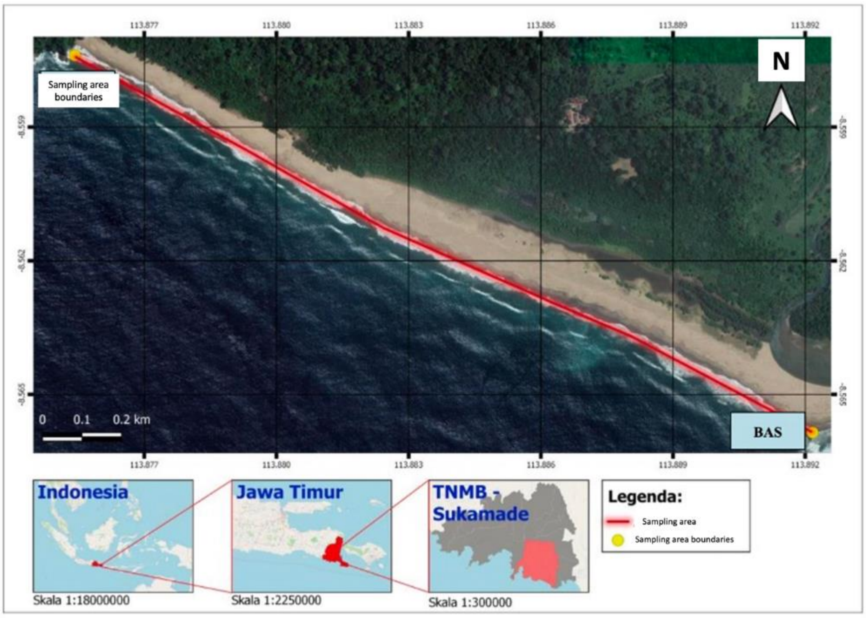

Figure 1. Sampling area in the Sukamade shoreline : the red line show the limit of sampling area

Dissection and removal of the gills and gastrointestinal tract

The fish's stomach is dissected using a dissecting set, and the body parts of the fish, namely the digestive tract, are removed, and the intestines and stomach are separated from other parts. Then, the gill cover was cut using surgical scissors, and the gill arch was cut on the right and left sides of the gill arch. Then, the digestive tract and gills were weighed using a digital scale and placed in an Erlenmeyer tube (Barboza *et al*., 2018; Ismail *et al*., 2019).

Sample preparation

Each tube containing fish organs (gills and gastrointestinal tract) was added with a KOH 10% solution until the sample of the body part of the fish was submerged; then, the tube was covered with aluminum foil and incubated for 24 hours at 60°C. Microplastic observation of gills was carried out in two stages: 1) Fish gill samples were immediately identified under a microscope by observed each filament, where the left and right gills each had 4 gills; 2) The gill sample is subjected to a destruction process such as in the intestine and stomach. Destruction is carried out to destroy substances or organic compounds from the body parts of the fish. After that, the sample was filtered using Whatman paper with a pore size of 45 µm. Furthermore, the dried microplastic filter paper can be identified under a stereo microscope (Barboza *et al*., 2018; Ismail *et al*., 2019; Rofiq & Sari, 2022). Potassium hydroxide (KOH) is an alkaline solution that is often used to destroy organic materials in microplastic studies because its alkaline properties do not cause significant changes in plastic character so as not to bias the observations (Gulizia *et al*., 2022). Use stainless steel and glass tools during sample preparation in the laboratory and close the petridish for particle storage after digestion is carried out to avoid microplastic contamination.

Microplastic identification and characterization

Characterization of microplastics in fish samples was carried out using a stereo microscope. The characterization of microplastics is grouped based on the shape, namely fiber, fragment, granule, and foam, the size from 0,3-0,5 mm, 0,5-1 mm, 1-5 mm, and more than 5 mm, the color is transparent, black, and color (Ariyunita *et al*., 2020; Cordova *et al*., 2019),

Data analysis

Characterizations of identified microplastics were analyzed descriptively by calculating the percentage of each character. Microplastic abundance analysis was calculated using a method based on research conducted by, namely: (a) particle per individual and (b) particle per wet weight of organ (Ariyunita *et al*., 2020; Sulistyo *et al*., 2020). Particle calculations per organ wet weight are used to determine the ability of organs to accumulate microplastics. Particle calculations per individual are used for comparing the abundance of microplastics between individuals, which are obtained from the average abundance of microplastics in the observed fish organs. The calculation results are discussed descriptively accompanied by supporting sources.

RESULTS AND DISCUSSION

According to the literature study that has been done, this is the first study that report the microplastic contamination in fishes caught from the Sukamade shoreline as a part of the conservation area. However, the bad weather during the sampling schedule prevented the number of fish samples obtained from reaching the target. The heavy rain and high waves have become obstacles for local fishermen in their fishing activities. However, the results of this research are still reported and described, accompanied by supporting theories, so that the results of this research can be used as initial information regarding the presence of microplastics in biota caught in the Sukamade shoreline. The fish collection is carried out by fishing in the Sukamade beach area to ensure the fish have a beach habitat.

The passive biomonitoring research character is that the samples obtained are random; the fish species taken and the size and age of the fish in the research area cannot be determined. In this case, research results must still be described according to conditions in the field. Four fish samples originated from the waters along the Sukamade shoreline in this research, including three species, namely two individuals of Senangin fish (*Eleutheronema* sp.), one individual of Lemuru fish (*Sardinella* sp.), and one individual of Lowang totol fish (*Trachinotus* sp.). Microplastic characterization in this study was observed on gills and fish digestive tract. The digestive tract is limited to the intestines and stomach. There were 451 microplastic particles in the entire sample studied. Herewith is the result of microplastic characterization based on size, shape, and colors (Figure 2 and Figure 3). It shows that the dominant character of identified microplastic was 1-5 mm in size with 219 particles (48.55%), fragment shape with 246 particles (54,54%), and black color with 219 particles (48,55%).

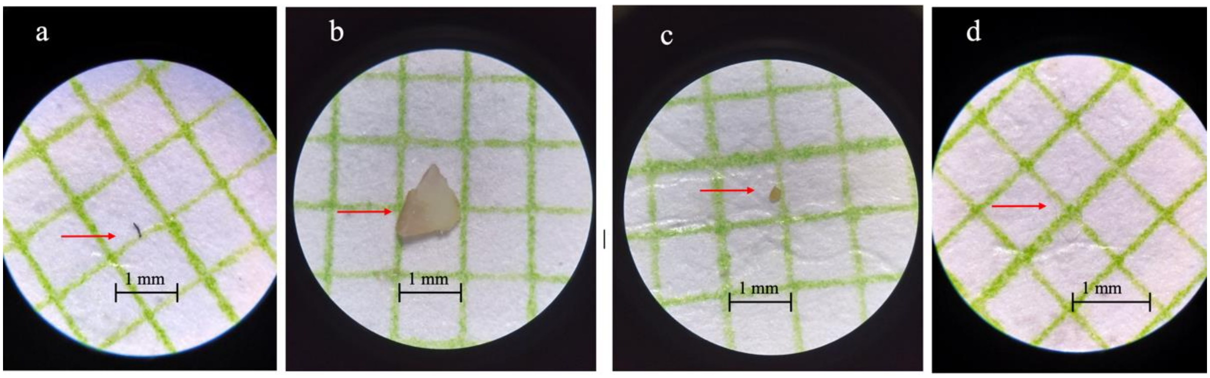

Figure 2. Sample of the identified microplastic in fishes caught from Sukamade shoreline: a. 0,3-0,5 mm in size, fiber, and color (blue); b. 1-5 mm in size, fragment, color (white); c. 0,3-0,5 mm in size, granule, color (white); d. > 5 mm, fiber, transparent.

Microplastic characterization

Microplastic characterization based on size

Figure 3 shows that the highest number of microplastic particles is 1-5 mm (48.55%), 0,5-1 mm (33.48%), 0,3-0,5 mm (14.63%), and >5 mm (3, 32%), respectively. These results indicate that the Sukamade shoreline is most likely contaminated by various sizes of plastic debris, reaching micro-sized plastic particles due to various processes. In coastal waters, plastic can drift or float, causing the plastic to be torn apart and degraded by UV light, oxidation, and mechanical abrasion, resulting in micro-sized plastic particles (Jang *et al*., 2020). (Erlangga *et al*., 2022) reported that microplastics (3.5-583.1 μm) were found in mackerel on the Belawan Coast. However, research conducted by (Safitri *et al*., 2022) found microplastic particles of less than 1 mm to 5 mm in pelagic fish in the waters of the Bali Sea. The differences in the range of microplastic particle sizes from these studies show that microplastics can vary due to the degradation process over different periods.

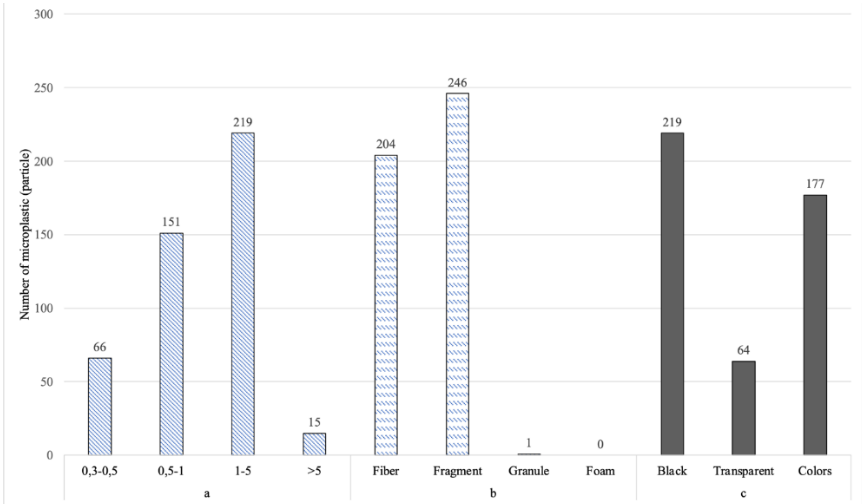

Figure 3. Microplastic characterization based on: a. size, b. shape, c. Colors

The presence of microplastics in aquatic organisms can be from entanglement, ingestion, and interaction (Huang *et al*., 2020). The tiny size of microplastics makes the particles easily get stuck in the gills of fish by being attached to the gill organs (Rofiq & Sari, 2022). In addition, the size of microplastics, which is almost the same as phytoplankton and zooplankton, makes fish accidentally ingest microplastics (Heshmati *et al*., 2021; Safitri *et al*., 2022). (Rahmayanti *et al*., 2022) also reported that microplastic particles were detected in zooplankton collected in the inlet and outlet networks of Rawa Jombor Reservoir, Klaten, East Jawa. The study found that the microplastic abundance in Copepode zooplankton reflects the microplastic abundance in a water sample. The Ostracoda and Copepod plankton sizes are similar to the microplastic particles in this study. Plankton Ostracoda has a body size of approximately 1 mm, while Copepoda has a size of 1.5-5 mm. Based on this, fish can easily ingest microplastics because they think they are one of the organisms' natural foods (Heshmati *et al*., 2021; Huang *et al*., 2020; Ismail *et al*., 2019).

Microplastic characterization based on shape

The shape of microplastic found in fish (gills, stomach, and intestines) include fibers (45.23%), fragments (54.54%), and granules (0.22%). The results of this study are relevant to the research by (Prameswari *et al*., 2022), which revealed that fragment is the dominant shape of microplastics in mullets caught from Mangunharjo Beach and Sayung Beach, Demak, Indonesia. However, this study's relative abundance of fragment and fiber shapes doesn't seem much different.

The fragment's shape is generally sourced from broken plastics used in consumer products, such as discarded broken jars, pieces of mica plastic, pieces of gallons of water, and small pieces of water pipe (Ariyunita *et al*., 2020; Prameswari *et al*., 2022; Yona *et al*., 2020). The fiber-type microplastics can come from fabric fibers. Fabric fibers can come from polyester materials used to make clothes, such as chiffon, tile, and organza. The washed clothes can shed large amounts of fibers, becoming a source of microplastics (Browne *et al*., 2011). In addition, fiber-type microplastics found in fish organs can also come from fishing activities using nets and fishing lines at that location (Ariyunita *et al*., 2020; Browne *et al*., 2011; Ismail *et al*., 2019; Syberg *et al*., 2015). Microplastics in granule form showed the least amount, while foam was not found in the research samples. Granules are generally produced for cosmetics. Meanwhile, foam, which is widely used for food containers or wrappers, has a light density, so it is very easily carried away by currents with a fast distribution time, thereby lowering the possibility of fish ingesting foam-form microplastics compared to other types of microplastics (Sandra & Radityaningrum, 2021; Yona *et al*., 2021).

The domination of fragment and fiber microplastics in fishes caught from the Sukamade shoreline informs the origin of microplastic leakage of debris plastic waste from human activities into the waters. Fish are vulnerable to plastic waste pollution in the area because of the pollutant transport process from waters as medium entering body fish. Microplastic contamination in the Sukamade shoreline could possibly originate from (1). Microplastics in the open sea are carried by waves toward the Sukamade shoreline (2). The location of the Sukamade shoreline, which is close to the estuary, allows for the transfer of plastic debris carried by river currents from upstream, through densely populated areas to the estuary, towards the Sukamade shore and the Indian Ocean; (3). Macro and meso plastics accumulating in coastal areas are degraded into smaller sizes, reaching micrometers.

Microplastics' fiber shape and small size have more potential for translocation to other tissues in the organism. The distribution and translocation of microplastic particles is highly dependent on particle size. Particles measuring 0.42 -1.2 μm were found in fish livers. Microplastic particles > 10 μm in size cannot move (translocation) from the digestive tract to intestinal tissue (Zitouni *et al*., 2021).

Microplastic characterization based on colors

The colors of the microplastics found in this study consisted of three categories: black (48.55%), transparent (14.19%), and colors (37.25%). The results of this study are by (Tobing *et al*., 2020), who reported the presence of microplastics in marine fish from Bali coastal waters was dominated by black color. According to (Heshmati *et al*., 2021), colored microplastics have a higher probability of being ingested by fish due to their similarity in color to natural feeds. However, the small size allows tiny microplastics to be accidentally ingested by fish, thus allowing black and transparent colors to be found in fish bodies.

Black microplastics can come from the fragmentation of black plastic bags, broken flower pots, broken buckets, net ropes, fishing lines, and raffia ropes and are thought to contain pollutants. Colored microplastics have a high ingestion potential because they are natural prey for fish, namely plankton, crustaceans, and others, which have a variety of colors. Microplastics in the colored category included green, gray, red, light blue, dark blue, orange, and purple. The brightly colored microplastics such as green, red, brown, and so on come from plastics of the same color (Heshmati *et al*., 2021; Tobing *et al*., 2020). The transparent color can be from the same color product, such as food wrappers, and also can indicate the longer the microplastic has been degraded by ultraviolet light (Erlangga *et al*., 2022).

Microplastic abundance

Microplastic abundance per individual

The abundance of microplastics was calculated from the number of microplastics found in each sample and calculated from the number of microplastics found in each fish organ. Microplastic abundance in fishes caught from the Sukamade shoreline is presented in Table 1. Based on the table, the relative abundance of microplastic was 112.75 particles/individual. In comparison, the relative abundance in the gills was 78.72 particles/wet weight (gram), in the stomach was 57.56 particles/wet weight (gram), and in the intestine reached 28.81 particles/wet weight (gram.The four samples have different body lengths and weights of the targeted organ, which may also affect the ability of each fish to accumulate microplastics in the body. This condition often occurs in field research, where size, species, and other factors are not uniform and cannot be controlled. Therefore, discussing various aspects that can influence research results, such as habitat and eating habits, is necessary under these conditions.

Table 1. Microplastic abundance in fishes in the Sukamade Shoreline

Sample	Body Length (cm)	Organ	Wet weight (gram)	Number of identified microplastic	Abundance	
					particle/wet weight (gram)	particle/ individual
Senangin 1 (*Eleutheronema* sp. 1)	28,20	intestine	3,03	76,00	25,08	124,00
		stomach	1,20	7,00	5,83	
		gills	1,32	41,00	31,06	
Senangin 2 (*Eleutheronema* sp. 2)	41,00	intestine	5,07	10,00	1,97	84,00
		stomach	3,09	12,00	3,88	
		gills	5,70	62,00	10,88	
Lemuru (*Sardinella* sp.)	11,00	intestine	0,17	14,00	82,35	83,00
		stomach	0,07	15,00	214,29	
		gills	0,22	54,00	250,00	
Lowang totol (*Trachinotus* sp,)	57,20	intestine	6,32	37,00	5,85	160,00
		stomach	2,72	17,00	6,25	

Both experimental and field studies reported that plankton and macroinvertebrates such as mussels, crabs, and other aquatic organisms had been contaminated by microplastic (Fitria *et al*., 2021; Pedersen *et al*., 2020; Rahmayanti *et al*., 2022; Setälä *et al*., 2014). Therefore, the presence of microplastics in fishes caught from the Sukamade shoreline can be from (1). The microplastic-contaminated waters enter the body through gills and mouth; (2) eat the microplastic-contaminated prey through feeding activities. In addition, feeding habits influence the abundance of microplastics in fish (Erlangga *et al*., 2022; Heshmati *et al*., 2021; Rofiq & Sari, 2022). Some characteristics of the fish were compared in Table 2. The table shows that the three fishes have different types of feeding habits. Senangin and Lowang totol fish is most likely pelagic and carnivorous fish, and the Lemuru fish is mostly pelagic and planktivorous fish.

Table 2. The comparison of distribution range and feeding habits of the caught fishes

Fish	Distribution range	Feeding habit	Source
Senangin (*Eleutheronema* sp.)	Marine; freshwater; brackish; pelagic-neritic; depth range 0 - 23 m. Tropical	Feed on prawn, fish, with occasional polychaetas	https://www.fishbase.se/summary/Eleutheronema-tetradactylum.html
Lemuru (*Sardinella* sp.)	Marine; pelagic-neritic; oceanodromous; depth range 15 - 100 m. Tropical	Feed on phytoplankton and zooplankton, chiefly copepods	https://www.fishbase.se/summary/Sardinella-lemuru.html
Lowang totol (*Trachinotus* sp.)	Marine; brackish; reef-associated. Tropical	Adults feed on crabs, mussels, and worms	https://www.fishbase.se/summary/Trachinotus-botla.html

The fiber and other debris plastic with light density (< 1 g/cm^3) float passively on the surface of the sea and are distributed depending on currents, seawater density gradients, and wind (Rummel *et al*., 2016). These conditions make it possible that microplastics will be ingested by fish, especially pelagic fish such as Senangin (*Eleutheronema* sp.) and Lowang totol (*Trachinotus* sp.), either because they are similar to natural prey or accidentally ingested because of their small size. As a carnivorous fish, microplastic contamination in Senangin fish can also come from their prey, which previously contained microplastics. Unlike Senangin and Lowang totol, the lemuru fish is a filter feeder (Sartimbul *et al*., 2023). The filter feeder fish also have a high probability of ingesting the microplastic. Because of their non-selective feeding habits, they filter the water passively (Rummel *et al*., 2016). This character can be seen in Table 2, where even the Lemuru has the shortest body length and the light wet weight of organs among the sample; it contains 83 microplastic particles.

Microplastic abundance in gills

Table 1 shows that the abundance of microplastic in gills is higher than in the other organs in all fish samples. This study's results align with the study (Yona *et al*., 2020) that microplastic abundance in gills is higher than in the gastrointestinal tract of reef fish caught around Papua Island. Microplastics in the gills of fish are sourced directly from the water as part of the fish respiration process. In the process of gas exchange, fish filter water from the environment to get oxygen, and when this process takes place, the microplastics that are in the water can get trapped on the gills. The higher presence of microplastics in the gills compared to the digestive tract can also be caused by the complex structure of the gills, which allows more microplastics to be trapped (Barboza *et al*., 2018; Huang *et al*., 2020; Jabeen *et al*., 2018; Yona *et al*., 2020). However, this does not rule out the possibility that the microplastics only get stuck on the gill filaments. Observations under a stereo microscope showed that microplastic was attached to the gills. The harmful compounds in microplastics originating from aquatic waste can also cause harmful effects, such as a decrease in the work function of fish gills. In addition, exposure to microplastics can increase mucus secretion in fish gills. Damage to gills and excessive mucus secretion can cause hypoxia, which causes anorexia in fish (Barboza *et al*., 2018; Liang *et al*., 2023).

Microplastic abundance in the gastrointestinal tract

The microplastic relative abundance in the intestine is higher than in the stomach of Senangin fish. On the contrary, the Lemuru and Lowang totol show that microplastic in the stomach was more abundant than in the intestine. The shape of the stomach is like a bag, with a narrow hole leading to the intestine holding more microplastics (Jabeen *et al*., 2018). In addition, microplastics accumulate in the digestive tract of the fish's body. Various microplastic-contaminated foods consumed by fish result in varying abundances of microplastics in the digestive tract of fish (Ismail *et al*., 2019; Safitri *et al*., 2022; Yona *et al*., 2020). The high abundance of microplastics in the digestive tract can be fatal because if microplastics accumulate for an extended period, the harmful pollutants in microplastics will eventually be absorbed. Microplastics in the digestive tract of fish can affect fish life, including injuries, blockage of the digestive tract, impaired food capacity, and death. Internalization of microplastics into the body of fish can damage the digestive tract, inhibit growth, reduce the need for steroid hormones, interfere with the formation of enzymes, affect reproduction, and result in higher exposure to harmful plastic additives (Bhuyan, 2022; Hastuti *et al*., 2019).

This is the first report that 451 particles of microplastics were detected in the gills and gastrointestinal tract of four fishes caught from the Sukamade shoreline, Meru Betiri National Park. Based on the characterization result, the dominant microplastic was 1-5 mm in size, fragment shape, and black color. The size range showed that plastic waste from human activity on land cannot be removed from the environment, but it just becomes smaller and smaller, reaching the micro and nanometer in size. It is also proved that plastic waste is very difficult to degrade, so make it persistent in the environment. The fragment shape indicates that the source of the identified microplastic is highly likely the plastic fragmentation process from human activities on land and fishery activities in marine. Actually, the detected microplastics in this study were found in various colors. It is reflected that the main sources of microplastic in the fish body come from using plastic in humans' daily activities. The black domination of the detected microplastic informs that this color is the common type of plastic used by humans. (Huang & Xu, 2022) explained that black plastic is the plastic most commonly used in anthropogenic activities. However, the methods and technology currently used to sort plastic cannot recognize black plastic, so this color is difficult to recycle. Low recycling rates mean that the amount of black plastic is greater and more likely to end up as waste in the environment so that it may become a greater source of total microplastics than white plastic over time.

The detected microplastic in the gills and gastrointestinal tract of fish in this study informs society that unmanaged plastic waste from human activities will end up in the water. It can harm aquatic organisms, even in remote areas. Even though the gills and the gastrointestinal tract of fish are parts that humans do not eat, it is possible that small microplastics and also nanoplastics are transported into the fish muscles. (Putri *et al*., 2023) reported that microplastic was detected in the muscle of fish collected from the coastal waters of Baru and Trisik Beach, Yogyakarta. In this case, the presence of microplastics in the body of fish can affect the health of fish and humans that consume the fish. The detected microplastics in fish also show that there was a transport process of microplastics from the water's environment entering the fish body and potentially disturbing the biota life in the conservation area. Further and comprehensive studies are needed to determine the microplastic threat to biota, especially in the Meru Betiri National Park.

CONCLUSIONS AND SUGGESTION

The 451 particles of microplastics were detected in the four fishes caught from the Sukamade shoreline. This first finding is an early warning for the community to increase their involvement in reducing plastic waste leakage into the waters. Further comprehensive research to detect microplastics in sediment, water, and biota, as well as the relationship between microplastics and other pollutants, especially in conservation areas, is needed to determine the risk level of pollutant threats to the sustainability of biota in conservation area.

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