

**Study of Potential Microplastics on Surabaya River Fishes**  
**Studi Potensial Fragmen Plastik di Lambung Ikan Kali Surabaya**  
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**Background**

Surabaya River is downstream tributary of Brantas River, the longest river in East Java. The new issue pollutants at Surabaya River, plastic waste and chemical associated with it, have attracted for us at ecoton (*Ecological Observation and Wetlands Conservation*) and become our concern. Plastics are the most versatile materials invented by human. The use of plastic materials has brought great convenience to our daily lives but inappropriate disposal of wasted plastics has caused serious environmental problems. The presence of plastic debris in the environment not only affects the aesthetical and recreational values of ecosystems but may also present a persistent pollution problem that will continue to accumulate into future generations.

There are 5 paper industries at Surabaya River, use imported paper waste that contain plastic as raw material for their production, and they dispose wastewater directly into Surabaya River. The river pollution by Javanese traditional perception that consider and utilize river as dumping site for house waste and garbage. Most people now still believe that the river is dumping site for their waste.

Once entering the environment, plastics are subject to physical, chemical, and biological weathering processes, which act to slowly break large pieces of plastic into smaller fragments. Plastics less than 5 mm are considered as “microplastics”<sup>1</sup>. Microplastics can be ingested by aquatic organisms, which might cause potential adverse effects and arouse food safety concerns<sup>2 3</sup>. As a result, microplastic pollution has become an issue of emerging concern and is drawing increasing attention from both the public and scientific community.

There is a few studies have addressed the issue of microplastic pollution in terrestrial environments and inland waters in contrast to the vast amount of research in marine environments. These studies suggest inland waters, Surabaya River, are facing similar microplastic accumulation problems as found in the oceans. Surabaya River are habitats for aquatic species that have important ecological and economic value and provide services for recreation, aquatic products, and water resources.

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Therefore, it is important to understand the occurrence data of microplastics in Surabaya River Fishes.

### **Purpose**

The research's purposes were to see and collect data of potential microplastic in Surabaya river's fish. This research was held in July 2018 until October 2018 which took place along Surabaya river, started from Kedung Klinter village, Mojokerto to Gunung Sari bridge, Surabaya.

### **Method**

Sample fish were collected by fisherman at July 2018 until October 2018 at Surabaya River is downstream tributary of Brantas River. Fish were preliminarily identified in the field and 103 sample fish collected. Guts intestine (GI) fish were preserved in 70% ethanol at glass bottles and processed for potential microplastic gut content at ecoton laboratory. All methods were carried out in accordance with Marine Plastic in Fish a citizen science dissection & analysis protocol approved by the Civic Laboratory for Environmental Action Research (CLEAR) <https://civiclaboratory.nl>.

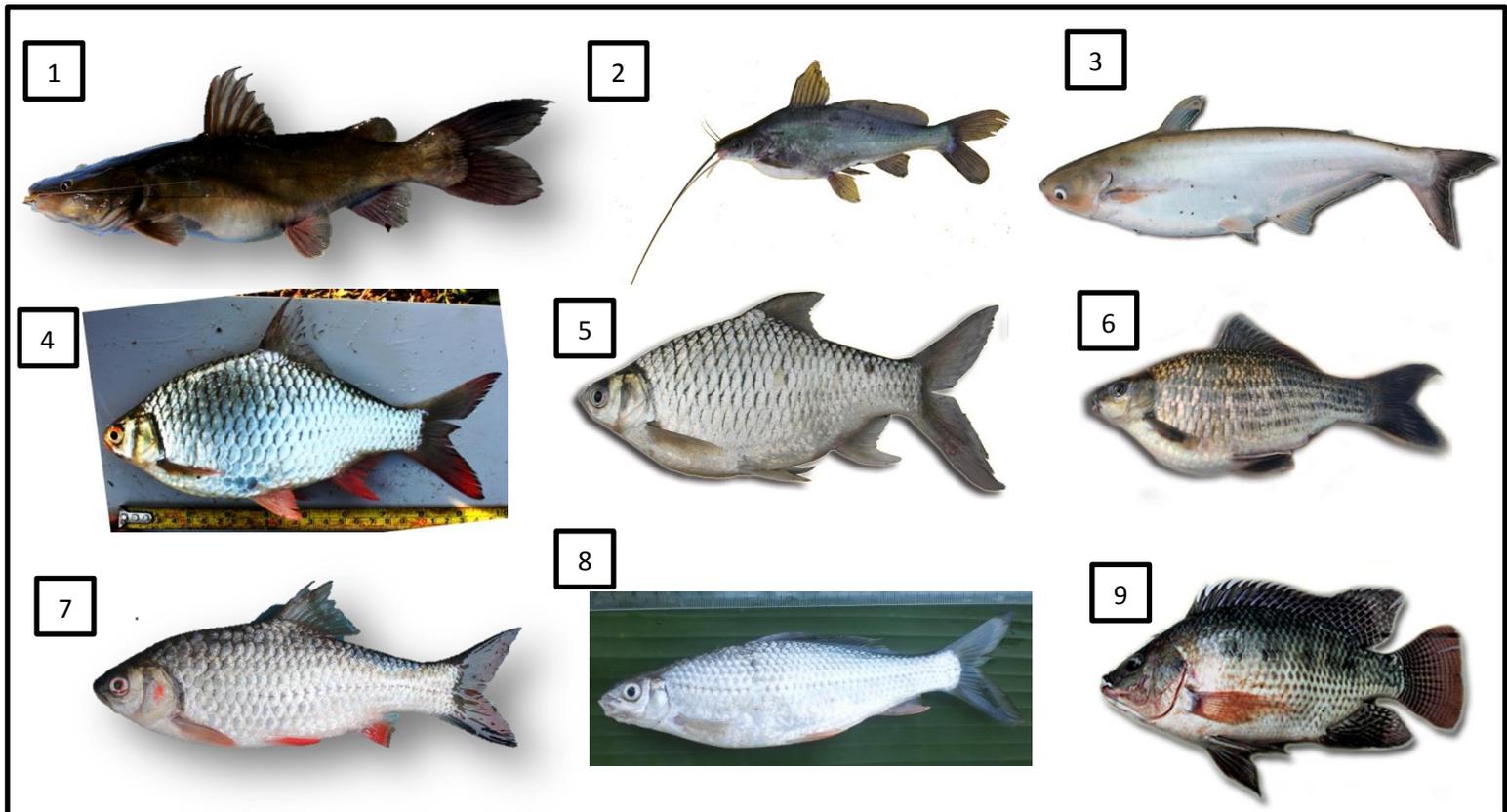
In the laboratory, the digestive tracts were dissected, and the tissue was placed in individual clean beakers. Content of GI examined at 10×/23 magnification under dissecting stereo microscopes and checked two separate times to confirm microplastic counts were consistent and conservative. Microplastic was categorized as either fiber, fragment, bead, foam, filaments or film and classified into a color category.

### **Result**

**Surabaya River Fish.** In this research, 103 sample fishes collected from Surabaya river at July 2018 until October 2018. Location sample started from Kedung Klinter village, Mojokerto to Gunung Sari bridge, Surabaya. This fishes sample was catch by fisherman and collected 9 species on 103 sample fishes.

No	Species			Sample
	Local Name	Scientific name	Group/Other name	
1	Rengkik	<i>Hemibagrus nemurus</i>	Catfish	15
2	Keting	<i>Mystus planiceps</i>	Catfish	8
3	Jendil	<i>Pseudolaia pleurotaenia</i>	Catfish	12
4	Bader Merah	<i>Barbodes balleroides</i>	Barb/Craps	23
5	Bader Putih	<i>Barbodes gonionotus</i>	Barb/Craps	31
6	Monto	<i>Osteocillus baseltii</i>	Barb/Craps	3
7	Muraganting	<i>Puntius orphoides</i>	Barb/Craps	4
8	Lokas	<i>Labiobarbus leptocheilus</i>	Barb/Craps	1
9	Nila	<i>Orbeochromis niloticus</i>	Tilapia	6
			<b>Total</b>	<b>103</b>

Table 1. Species Fish Sample at Surabaya River



Picture 1. Species Fish Sample at Surabaya River

**Feeding and Microplastic.** The richness and variety of riverine habitats provide a wide range of possible food organisms and substrates. These originate either from within the river system itself (*autochthonous* food sources) or from outside the river system (*allochthonous* food sources). Feeding preferences of Surabaya river fishes that collected in this research can be classified into herbivorous,

carnivorous and polyphagus. The groups of herbivorous prefer plant materials (phytoplankton and higher plants) such as *Barbodes balleroides*, *Barbodes gonionotus*, *Osteocillus baseltii*, *Puntius orphoides* and *Labiobarbus leptocheilus*. The groups of carnivorous prefer animal food such as insects, crab, shrimp and smaller fish. In this study are *Hemibagrus nemurus* and *Mystus planiceps*. The groups of polyphagus eat a mixture of various natural foods, can be fauna, flora or both of them. In this study found on *Pseudolais pleurotaenia* and *Orbeochromis niloticus*.

All of fish species at Surabaya river containing microplastic on guts intestines fish. In this research 72 % Surabaya river fishes sample positive microplastic on guts intestines. 33% - 38% of the group carnivorous fishes sample containing microplastic on their guts intestines, 67% – 100% of the group herbivorous fishes sample containing microplastic on their guts intestines and 72% - 83% of the group polyphagus fishes sample containing microplastic on their guts intestines.

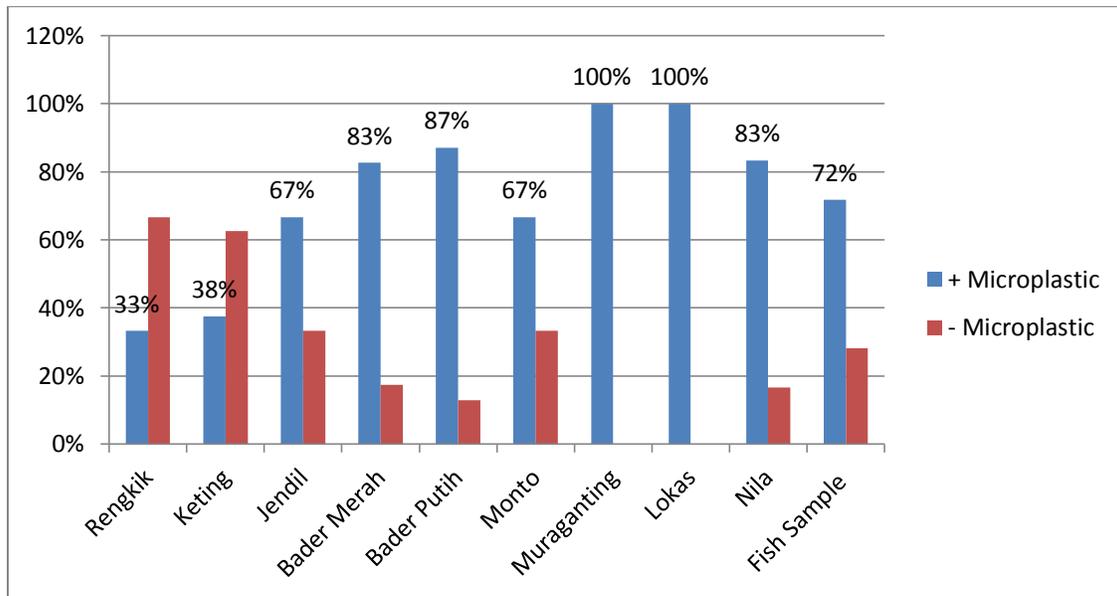
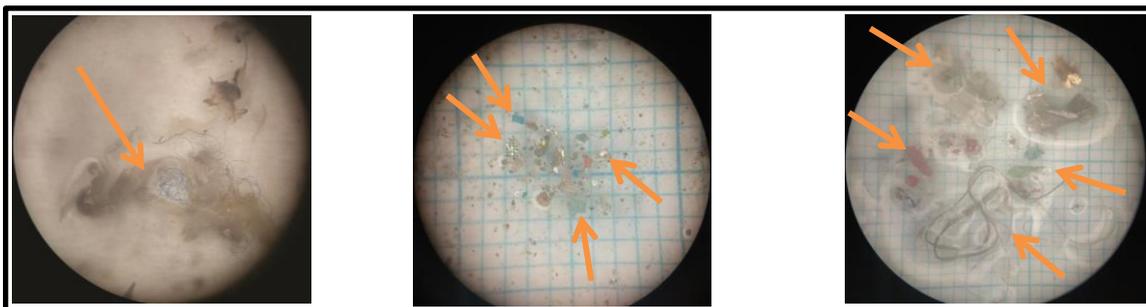


Table 2. Percentage of Microplastic at Fishes Sample



Picture 2. Microplastic on the Guts Intestines Fish Sample

Microplastics come from a variety of sources, including from larger plastic debris that degrades into smaller and smaller pieces. Microplastics are tiny solid plastic particles (smaller than 5 millimetres). This definition covers a very wide range of particle sizes including nano-sized. The research usually focuses on particles that are still visible. Currently, the categories “large microplastic” (1 millimetres to 5 millimetres) and “small microplastic” (<1 millimetres) have been introduced<sup>4</sup>. Four types of microplastic in the fishes samples were found: fibers, fragments, filaments and pellets, which allows it to be digested by river organisms<sup>5</sup> (picture 2).

Analysis of Guts intestine contents of nine fishes species from 103 sample during in the study showed the groups of herbivorous and polyphagus fish in this study was the most abundance microplastic where it occurred in more than 67.0% - 100% of the examined fish (table 2). This ingestion of microplastic probably happens during the normal feeding activity of fish. Feeding habits and habitat play important roles in the ingestion of debris, and an increase in the abundance of plastics also increases the bioavailability of plastics in Surabaya river. This evidence also supports the relationship between plastics ingestion, feeding behavior and plastic pollution at Surabaya River.

## Conclusions

1. Microplastic in 103 Surabaya river fish sample was found highly at herbivorous and polyphagus fish.
2. All of fish species at Surabaya river fishes sample containing microplastic on guts intestines fish.
3. Surabaya River as raw material for drinking water Surabaya, Gresik and Sidoarjo was polluted by microplastic from industry and domestic waste

## References

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<sup>1</sup> Arthur C, Baker J, Bamford H (eds) (2008) Proceedings of the international research workshop on the occurrence, effects and fate of microplastic marine debris. NOAA technical memorandum NOS-OR&R-30, 9–11 Sept 2008

<sup>2</sup> Rochman CM, Hoh E, Kurobe T, Teh SJ (2013) Ingested plastic transfers hazardous chemicals to fish and induces hepatic stress. *Sci Rep* 3:3263

<sup>3</sup> Browne MA, Dissanayake A, Galloway TS, Lowe DM, Thompson RC (2008) Ingested microscopic plastic translocates to the circulatory system of the mussel, *Mytilus edulis* (L.) *Environ Sci Technol* 42(13):5026–5031

<sup>4</sup> Imhof, H. K. et al., 2012. A novel, highly efficient method for the separation and quantification of plastic particles in sediments of aquatic environments. *Limnology and Oceanography - Methods*. 10, 524–537.

<sup>5</sup> Claessens M., Meester S. D., Landuyt L. V., Clerck K. D., Janssen C. R., 2011 Occurrence and distribution of microplastics in marine sediments along the Belgian coast. *Marine Pollution Bulletin* 62(10):2199-2204.