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Occurrence of Suspected Microplastic Fibres in Pooled Digestive-Tract Samples of Manggaba'i Fish (*Glossogobius giuris*) from Lake Limboto

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ABSTRACT

Microplastic ingestion by freshwater fish is an emerging concern, but evidence for *Glossogobius giuris* in Lake Limboto remains limited. This descriptive study examined visually suspected microplastic particles in pooled digestive-tract samples from 20 wild fish obtained directly from Lake Limboto fishers. Fish were assigned to two length groups (10-12 cm and 12.5-14 cm; n = 10 fish per group). The digestive tracts within each group were pooled, digested with 30% H2O2 and 0.05 M FeSO4, incubated for 24 h, heated at 75 degrees C for 30 min, vacuum-filtered, and examined microscopically. Two fibre-like particles were observed in the pooled 10-12 cm sample and three in the pooled 12.5-14 cm sample. Normalising these pooled counts by the number of fish yielded 0.2 and 0.3 suspected particles per fish sampled, respectively. Because tissues were pooled, the study cannot estimate individual prevalence or variability, and the difference between length groups is descriptive rather than inferential. Polymer composition was not confirmed spectroscopically; therefore, the observations should be interpreted as suspected microplastic fibres.

Keywords: *digestive tract; fibre-like particles; freshwater fish; Lake Limboto; microplastics; pooled sample*

INTRODUCTION

Lake Limboto supports fisheries used by surrounding communities, including the demersal manggaba'i fish (Glossogobius giuris). Freshwater fishes can ingest microplastics through water, prey, and sediment-associated feeding, although exposure varies with habitat, trophic ecology, particle availability, and sampling design (Galafassi et al., 2021; Parker et al., 2021). This species is locally important and is associated with the lake bottom, where it may encounter particles present in sediments and prey. Its diagnostic morphology has been described by Koniyo and Juliana (2018); however, evidence concerning suspected microplastic ingestion by this species in Lake Limboto remains scarce.

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Figure 1. Manggaba'i fish (Source: Koniyo & Juliana, 2018)

Field studies have reported anthropogenic particles in the digestive tracts and gills of marine and freshwater fishes across diverse environments (Jaafar et al., 2021; Parvin et al., 2021; Buwono et al., 2022; Frank et al., 2022). Indonesian studies likewise report fibres, fragments, and films in fish from marine, riverine, and lacustrine settings (Nurdhiana, 2021; Senduk et al., 2021; Mardiansyah et al., 2022; Simbolon et al., 2025). Comparable findings in freshwater commercial fish from Thailand and Bangladesh show that fibres frequently dominate recovered particles, although abundance differs among species and sites (Seetapan & Prommi, 2023; Kittichai et al., 2023; Khan et al., 2024). These studies establish ingestion as the observation of particles in the digestive tract; they do not, by themselves, demonstrate tissue bioaccumulation or food-web biomagnification. Those processes require evidence of retention in tissues or increasing concentrations across trophic levels and are outside the scope of the present study.

Microplastic studies commonly classify particles by morphology, including fibres, fragments, films, foams, and pellets. Fibres are elongated, thread-like particles with relatively uniform thickness; fragments are irregular rigid pieces; films are thin and flexible; foams have a cellular appearance; and pellets are rounded industrial particles (Laksono et al., 2021; Aryani et al., 2023). Morphological screening is useful for preliminary sorting, but visual identification alone is vulnerable to false positives from cellulose, hair, and other natural materials. Imaging FTIR and micro-FTIR studies demonstrate the importance of polymer-specific confirmation and validated spectral procedures (Uurasjärvi et al., 2021; Yang et al., 2023).

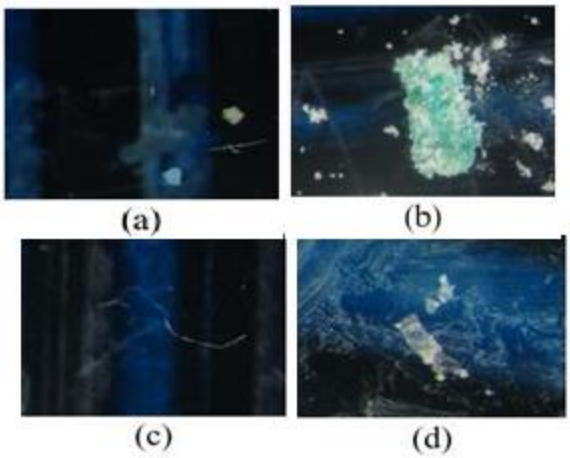

Figure 2. Microplastic shapes: (a and b) fragments, (c) fibres, and (d) films (Source: Aryani et al., 2023)

In this study, morphology was recorded using the categories shown in Figure 2. Only elongated fibre-like particles were observed. Classification was based on microscopic

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appearance; no polymer-specific identification was performed. Consequently, the term suspected microplastic fibre is used consistently, in line with recommendations that visually screened particles should not be presented as confirmed plastics without spectroscopy (Uurasjärvi et al., 2021; Yang et al., 2023).

Particle colour was recorded only as a descriptive characteristic. Environmental weathering, staining, illumination, and observer judgement can alter apparent colour, while experimental evidence also suggests that colour may affect ingestion and gastrointestinal retention in some fishes (Fitriyah et al., 2022; Okamoto et al., 2022). Colour alone was therefore not used as evidence of polymer composition. The colour categories in Figure 3 were retained only to standardise descriptive recording (Sandra & Radityaningrum, 2021).

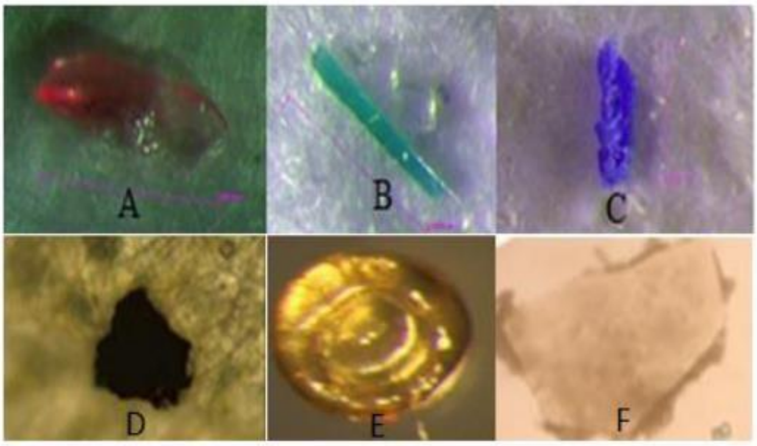

Figure 3. Microplastic colours: a) red, b) green, c) blue, d) black, e) yellow, and f) white/transparent (Source: Sandra & Radityaningrum, 2021)

RESEARCH METHODS

Twenty wild manggaba'i fish (Glossogobius giuris) were obtained directly from fishers operating in Lake Limboto and divided by total length into two groups: 10-12 cm and 12.5-14 cm (n = 10 per group). The available field record did not specify the sampling date or season, exact coordinates or stations, fishing gear, capture condition, or contamination-control measures during purchase and transport. These omissions restrict spatial and temporal interpretation and are acknowledged as methodological limitations.

Each fish was measured and dissected from the cloaca toward the abdomen using scissors. The digestive tract was removed and placed in a Petri dish. The 10 digestive tracts within each length group were combined into one pooled sample because the investigators considered the material from an individual tract insufficient for the digestion and filtration procedure. The pooled tissue was homogenised, weighed, submerged in approximately 15 mL of 30% H_2O_2, and treated with five drops of 0.05 M $FeSO_4$. After 24 h at room temperature, the mixture was heated in a water bath at 75 °C and 120 rpm for 30 min, vacuum-filtered through fine Whatman filter paper, and examined microscopically. Suspected particles were classified visually by morphology and colour. Contemporary fish studies increasingly combine digestion and filtration with FTIR-based polymer confirmation (Uurasjärvi et al., 2021; Mardiansyah et al.,

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2022; Yang et al., 2023). No FTIR or Raman spectroscopy was used here; consequently, the observed fibres are reported as suspected rather than polymer-confirmed microplastics.

The unit of laboratory analysis was the pooled length group, not the individual fish. The pooled count for each group was divided by the 10 fish contributing to that pool to provide a descriptive normalised count (suspected particles per fish sampled): $A = P/n$, where P is the number of suspected particles in the pooled sample and n is the number of fish contributing to the pool. This normalisation does not estimate individual prevalence, distribution, or variance. No inferential statistical test was performed because there was only one pooled analytical sample per length group.

RESULTS AND DISCUSSION

Microscopic examination detected only fibre-like particles in both pooled digestive-tract samples. Table 1 presents the raw pooled counts and the corresponding descriptive normalised counts. Because each length group produced a single pooled observation, the results describe the analysed pools and do not represent individual-fish variation.

Table 1. Suspected fibre counts in pooled digestive-tract samples of manggaba'i fish from Lake Limboto

Fish length (cm)	Fish in pool (n)	Suspected fibres in pooled sample (particles)	Normalised count (particles per fish sampled)
10-12	10	2	0.2
12.5-14	10	3	0.3

The pooled sample from fish measuring 10-12 cm contained two suspected fibre particles; 2/10 yielded a normalised count of 0.2 particles per fish sampled. The pooled sample from fish measuring 12.5-14 cm contained three suspected fibre particles; 3/10 yielded 0.3 particles per fish sampled. No rounding beyond one decimal place was required.

The second pool contained one more suspected fibre than the first. This is a descriptive difference between two pooled samples, not evidence of a size-related trend. Pooling prevents determination of whether the particles were distributed across several fish or concentrated in one fish, and it eliminates the individual replication required to estimate variability or test an association with fish length.

The fibre morphology is broadly consistent with findings from freshwater and marine fish studies in which fibres were frequently dominant (Jaafar et al., 2021; Parvin et al., 2021; Senduk et al., 2021; Buwono et al., 2022; Frank et al., 2022; Seetapan & Prommi, 2023; Kittichai et al., 2023; Khan et al., 2024; Simbolon et al., 2025). Nevertheless, cross-study comparison must remain cautious because reported abundance is affected by fish ecology, organ analysed, particle-size threshold, digestion chemistry, filtration medium, contamination control, and polymer-identification method (Galafassi et al., 2021; Parker et al., 2021). The absence of proceduralblanks, documented airborne-contamination controls, microscopic scale

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measurements, and spectroscopic confirmation in the present study increases the risk of contamination or visual misclassification. Future studies should analyse each fish separately, record tissue mass and particle dimensions, document stations and fishing gear, employ field and laboratory blanks, and confirm polymer identity using FTIR or Raman spectroscopy.

CONCLUSION

Fibre-like particles suspected to be microplastics were detected in both pooled digestive-tract samples of manggaba'i fish (*Glossogobius giuris*) from Lake Limboto. The 10-12 cm pool contained two particles (0.2 particles per fish sampled after descriptive normalisation), and the 12.5-14 cm pool contained three particles (0.3 particles per fish sampled). These values are descriptive pooled-group estimates and cannot establish individual prevalence, variability, or a causal or statistical relationship between fish length and particle burden. Because polymer identity was not confirmed, the findings should be treated as preliminary.

REFERENCES

Aryani, D., Hasanah, A. N., Radityani, F. A., Faustine, D., Nuryadin, E., & Azkia, L. I. (2023). Karakteristik mikroplastik pada ikan layang (Decapterus russelli) dan ikan nila (Oreochromis niloticus) di Pasar Rau, Kota Serang. Habitus Aquatica, 4(1), 1–7. https://doi.org/10.29244/HAJ.4.1.1

Buwono, N. R., Risjani, Y., & Soegianto, A. (2022). Spatio-temporal patterns of occurrence of microplastics in the freshwater fish Gambusia affinis from the Brantas River, Indonesia. Environmental Pollution, 311, 119958. https://doi.org/10.1016/j.envpol.2022.119958

Fitriyah, A., Syafrudin, S., & Sudarno, S. (2022). Identifikasi karakteristik fisik mikroplastik di Sungai Kalimas, Surabaya, Jawa Timur. Jurnal Kesehatan Lingkungan Indonesia, 21(3), 350–357. https://doi.org/10.14710/jkli.21.3.350-357

Frank, Y., Vorobiev, D., Mandal, A., Lemeshko, Y., Rakhmatullina, S., & Darbha, G. K. (2023). Freshwater fish Siberian dace ingest microplastics in the remote Yenisei tributary. Toxics, 11(1), 38. https://doi.org/10.3390/toxics11010038

Galafassi, S., Campanale, C., Massarelli, C., Uricchio, V. F., & Volta, P. (2021). Do freshwater fish eat microplastics? A review with a focus on effects on fish health and predictive traits of MPs ingestion. Water, 13(16), 2214. https://doi.org/10.3390/w13162214

Jaafar, N., Azfaralariff, A., Musa, S. M., Mohamed, M., Yusoff, A. H., & Lazim, A. M. (2021). Occurrence, distribution and characteristics of microplastics in gastrointestinal tract and gills of commercial marine fish from Malaysia. Science of the Total Environment, 799, 149457. https://doi.org/10.1016/j.scitotenv.2021.149457

Khan, H. M. S., Hasan, J., Manik, M., Farukh, M. A., & Shahjahan, M. (2024). Pervasiveness of microplastics in the gastrointestinal tract of selected fish species from the Turag River alongside the capital city of Bangladesh. Emerging Contaminants, 10(3), 100309. https://doi.org/10.1016/j.emcon.2024.100309

Kittichai, C., Krittawit, S.-U., Intep, P., & Vittayapadung, S. (2023). First evidence of microplastics ingestion by freshwater fishes from Nong Luang Wetland, Chiang Rai, Thailand. Sains Malaysiana, 52(9), 2471–2483. https://doi.org/10.17576/jsm-2023-5209-01

Koniyo, Y., & Juliana. (2018). Aspek biologi dan ekologis ikan manggaba'i. Ideas Publishing.

e-ISSN: 2774-1966
Volume. 7. Nomor 2. Juli 2026
Halaman: 154 -159
DOI: https://doi.org/10.63976/kuantum.v7i2.1575

Laksono, O. B., Suprijanto, J., & Ridlo, A. (2021). Kandungan mikroplastik pada sedimen di Perairan Bandengan Kabupaten Kendal. Journal of Marine Research, 10(2), 158–164. https://doi.org/10.14710/jmr.v10i2.29032

Mardiansyah, M., Utomo, A., & Putri, L. (2022). Microplastics in grouper fish (Genera Epinephelus) gastrointestinal tract from Pramuka Island, Seribu Islands, Indonesia. Journal of Ecological Engineering, 23(3), 194–205. https://doi.org/10.12911/22998993/145466

Nurdhiana, I. (2021). Mikroplastik pada ikan mujair (Oreochromis mossambicus) di keramba ikan Kali Kanal Mangetan Kabupaten Sidoarjo. Environmental Pollution Journal, 1(3), 192–198. https://doi.org/10.58954/epj.v1i3.68

Okamoto, K., Nomura, M., Horie, Y., & Okamura, H. (2022). Color preferences and gastrointestinal-tract retention times of microplastics by freshwater and marine fishes. Environmental Pollution, 304, 119253. https://doi.org/10.1016/j.envpol.2022.119253

Parker, B., Andreou, D., Green, I. D., & Britton, J. R. (2021). Microplastics in freshwater fishes: Occurrence, impacts and future perspectives. Fish and Fisheries, 22(3), 467–488. https://doi.org/10.1111/faf.12528

Parvin, F., Jannat, S., & Tareq, S. M. (2021). Abundance, characteristics and variation of microplastics in different freshwater fish species from Bangladesh. Science of the Total Environment, 784, 147137. https://doi.org/10.1016/j.scitotenv.2021.147137

Sandra, S. W., & Radityaningrum, A. D. (2021). Kajian kelimpahan mikroplastik di biota perairan. Jurnal Ilmu Lingkungan, 19(3), 638–648. https://doi.org/10.14710/jil.19.3.638-648

Seetapan, K., & Prommi, T. O. (2023). Microplastics in commercial fish digestive tracts from freshwater habitats in Northern Thailand. Ecologica Montenegrina, 68, 48–65. https://doi.org/10.37828/em.2023.68.6

Senduk, J. L., Suprijanto, J., & Ridlo, A. (2021). Mikroplastik pada ikan kembung (Rastrelliger sp.) dan ikan selar (Selaroides leptolepis) di TPI Tambak Lorok Semarang dan TPI Tawang Rowosari Kendal. Buletin Oseanografi Marina, 10(3), 251–258. https://doi.org/10.14710/buloma.v10i3.37930

Simbolon, L. L., Sudibyo, M., & Hanim, N. (2025). The identification of microplastics in gills and digestive tract in tilapia fish (Oreochromis mossambicus) in Lake Toba. BIOLINK (Jurnal Biologi Lingkungan Industri Kesehatan), 11(2), 301–308. https://doi.org/10.31289/biolink.v11i2.13963

Uurasjärvi, E., Sainio, E., Setälä, O., Lehtiniemi, M., & Koistinen, A. (2021). Validation of an imaging FTIR spectroscopic method for analysing microplastic ingestion by Finnish lake fish. Environmental Pollution, 288, 117780. https://doi.org/10.1016/j.envpol.2021.117780

Yang, J., Monnot, M., Sun, Y., Asia, L., Wong-Wah-Chung, P., Doumenq, P., & Moulin, P. (2023). Microplastics in different water samples: Methodology approach for characterization using micro-FTIR spectroscopy. Water Research, 232, 119711. https://doi.org/10.1016/j.watres.2023.119711