Journal of Marine Sciences & Environmental Technologies (JMSET)

مجلة علوم البحار والتقنيات البيئية (JMSET)

https://journals.asmarya.edu.ly/jmset/index.php
Volume (12), Issue (1), January-June (2026)

(p) ISSN: 2413-5267 (e) ISSN: 2706-9966
المجلد (12)، العدد (1)، يناير-يونيو (2026)

Research Article

Marine Environmental Science

A Preliminary Study of Microplastics Ingestion by Some Fish Species Collected from the Coast of Benghazi, Libya, Southern Mediterranean

Mona M. Said, Laila A. Ibrahim*, and Marwa M. Elamami

Department of Zoology, Faculty of Science, University of Benghazi, Benghazi, Libya.

Article Info

Received: 24 July 2025
Revised: 15 September 2025
Accepted: 02 January 2026
Online: 31 March 2026

Keywords: Benghazi coast, Microplastic, Contamination, Microplastics ingestion, Gastrointestinal tract, Libyan marine fish.

Abstract

Microplastic pollution is widespread across the globe. Their concentrations have increased, and these substances have accumulated in aquatic environments for years, inducing numerous physiological abnormalities in living organisms, including fish. The present study examined microplastics in the guts of two fish species (*Serranus scriba* and *Lithognathus mormyrus*) along the coast of Benghazi (southern Mediterranean), Libya. It was observed that both fish species (n=36) ingested 101 MPs in total. The highest contamination was found in *Serranus scriba* (3.94 MP/individual). A total of 1.90 MP/individual was registered for *Lithognathus mormyrus* specimens. Fibers were the most common microplastic type in *Serranus scriba* (37; 58%), while fragments were the most prevalent in *Lithognathus mormyrus* (11, 28%). This experimental study was the first to present data on various microplastic polymers in Libyan fishes.

دراسة أولية لابتلاع اللدائن الدقيقة (الميكروبلاستيك) بواسطة بعض أنواع الأسماك المُجمَّعة من ساحل بنغازي، ليبيا، جنوب البحر الأبيض المتوسط

منى م. سعيد، ليلى ع. إبراهيم* و مروة م. العمامي

قسم علم الحيوان، كلية العلوم، جامعة بنغازي، بنغازي، ليبيا.

معلومات المقالة

تاريخ الاستلام: 24 يوليو 2025.
تاريخ المراجعة: 15 سبتمبر 2025.
تاريخ القبول: 02 يناير 2026.
تاريخ النشر: 31 مارس 2026.

الكلمات المفتاحية: ساحل بنغازي، اللـــدائن الدقيقة (الميكروبلاستيك)، التلوث، ابتلاع اللدائن الدقيقة، الجهاز الهضمي، الأسماك البحرية الليبية.

الملخص

يُعد التلوث باللدائن الدقيقة -البلاستيك الدقيق- (Microplastics) ظاهرةً واسعة الانتشار على مستوى العالم، حيث شهدت تراكيزه تزايدًا مستمرًا مع تراكم هذه الجسيمات في البيئات المائية على مدى سنوات، مما أدى إلى حدوث العديد من الاضطرابات الفسيولوجية لدى الكائنات الحية، بما في ذلك الأسماك. هدفت الدراسة الحالية إلى فحص وجود البلاستيك الدقيق في أمعاء نوعين من الأسماك هما *Serranus scriba* و*Lithognathus mormyrus* على طول الساحل البحري لمدينة بنغازي (جنوب البحر الأبيض المتوسط)، ليبيا. وأظهرت النتائج أن كلا النوعين من الأسماك (عدد العينات = 36) قد ابتلع ما مجموعه 101 جسيمًا من البلاستيك الدقيق. وسُجل أعلى مستوى من التلوث في أسماك *Serranus scriba* بمتوسط 3.94 MP/individual (جسيم بلاستيكي دقيق لكل فرد)، في حين بلغ المتوسط 1.90 MP/individual في عينات *Lithognathus mormyrus*. وكانت الألياف البلاستيكية أكثر أنواع البلاستيك الدقيق شيوعًا في أسماك *Serranus scriba*، حيث بلغ عددها 37 جسيمًا (58%)، بينما كانت الشظايا البلاستيكية الأكثر انتشارًا في أسماك *Lithognathus mormyrus*، إذ سُجل 11 جسيمًا (28%). وتُعد هذه الدراسة التجريبية الأولى من نوعها التي تقدم بيانات حول الأنواع المختلفة من بوليمرات البلاستيك الدقيق الموجودة في الأسماك الليبية.

***Corresponding author Email:** lailaawadramadan@gmail.com
DOI: https://doi.org/10.59743/jmset.v12i2.186

1. Introduction

The influence of plastic on the marine ecosystem is much more pronounced (Zeng 2018; Wang *et al*., 2017). Worldwide plastic production will reach 400 million tons by 2022 (OECD, 2022; Jambeck *et al*., 2015). Each year, anywhere from 1.4% to 3.8 % of this production winds up in the ocean. Plastic objects and fragments have a wide range of negative consequences once they enter the environment. They can inflict injuries and fatalities on animals and cause habitat and ecosystem damage. Once microplastics are fragmented into smaller particles, they could directly or indirectly release some hazardous components that might contribute to contaminating food chains (Bergmann *et al*., 2015).

Microplastics (MPs) are found in a lot of human foods (Kim *et al*., 2018; Barboza *et al*., 2018). They are also consumed by many marine organisms, including vertebrates and invertebrates (Dehaut *et al*., 2016). Previous research has revealed significant records of microplastics in many fish species. As a result, humans globally are ingesting these particles by consuming fish and seafood (Zeng, 2018).

Over four billion people depend on fish and seafood for a major part of their animal protein intake (Wright & Kelly, 2017; Seltenrich, 2015). Plastic pollution in fish and seafood exposes billions to microplastic and nanoplastic particles.

Microplastic pollution is plastic debris that is less than 5 mm in size, which has been paid attention to in recent decades and is becoming an increasingly urgent concern (Arthur *et al*., 2010). Primary microplastics are microscopic particles found in products such as personal care items, cosmetics, clothing products, and pharmaceuticals. While, secondary microplastics are found by the breakdown of larger pieces of plastic debris (Akhbarizadeh, *et* al., 2018).

Ingested Microplastics can be excreted and accumulate in the digestive tract (Fossi *et al*., 2018). Additionally, trophic transfer of microplastics may be a significant way for these particles to reach humans by eating seafood (Nelms *et al*., 2018; De-La-Torre *et al*., 2019). The research on the ingestion of microplastics by marine fish in the Mediterranean Sea is limited, particularly in Libya. This study aimed to preliminarily investigate microplastic ingestion in two commercially important fish species from the coast of Benghazi, Libya (southern Mediterranean). The species used in this study are *Serranus scriba* and *Lithognathus mormyrus,* both of which are widely distributed and valued in commercial fisheries.

2. Materials and Methods

2.1. Fish Sampling

Two marine fish species were chosen for this study. On March 11, 2023, thirty-six specimens (16 of *Serranus scriba* and 20 of *Lithognathus mormyrus*) were collected from fresh landings at the fish market of Benghazi city. Specimens were transported on ice to the Department of Zoology, University of Benghazi, where they were stored at -10 °C for further processing. Plastic material was used. Glassware was also cleaned with distilled water and washed with ethanol before being used. To avoid any airborne microplastic pollution, the research steps were performed in an outflow cabinet. Beakers and other glass equipment were covered during the process. Blank samples were used without fish gut to ensure that no plastic contamination occurred during the study protocol.

2.2. Treatment and Digestion

Before dissection, each specimen was measured for total length (cm) and body weight (g). The fish's gut was then dissected, weighed, and transferred to a 200 mL glass beaker containing 10% H_2O_2. It was mixed for 15 minutes on a heating plate set to 60 °C.

2.3. Microplastics Identification

The samples were filtered by stainless steel sieves of size 150 µm and then transferred to Petri dishes. Using a stereomicroscope, the plastic particles were identified and classified according to size, shape, and color. Following the visual examination, the microplastics were counted and categorized into four groups: Fragments, Pellets, Fibers, and Films.

3. Results and Discussion

Thirty-six fish specimens were collected in Benghazi, Libya. Fish were identified as *Serranus scriba* (n=16) and *Lithognathus mormyrus* (n=20). The *Serranus scriba* specimens had a mean total length of 20.43 cm and body weight of 118.45 g. The *Lithognathus mormyrus* specimens had a mean length of 17.44 cm and body weight of 70.28 g (Table 1). Additionally, procedural blanks were analyzed and showed no microplastic contamination. Fish are inevitably exposed to microplastics (MPs) because they can confuse them with other food, leading to ingestion through the food chain, and can accidentally ingest them by taking in water (Roch *et al.*, 2020). Furthermore, the findings indicated that both species were contaminated with microplastics.

Both species are carnivores that primarily consume benthic mollusks, crustaceans, and fish, which may make them susceptible to consuming plastics through their natural prey. Among the fish studied, *Serranus scriba* had the highest level of contamination, with an average of 3.94 MP/individual. In contrast, specimens of *Lithognathus mormyrus* exhibited a low occurrence of microplastics, averaging only 1.90 MP/individual.

Table 1. Measurements of fish, their feeding habitats, and feeding strategies.

Fish species	*n*	Total length (cm) (mean± SD)	Body weight (g) (mean± SD)	Gut weight (g) (mean± SD)	Feeding habitat	Feeding strategy
S. scriba	16	20.43±12.30	118.45±83.10	5.11±0.90	Fish and Crustaceans	Carnivores
L. mormyrus	20	17.44±0.90	70.28±11.81	1.95±0.50	Worms, mollusks, small crustaceans	Carnivores

The results presented in Table (2) show that fibers were the most common kind of microplastic found in *Serranus scriba*, accounting for 37 instances (58% of the total). This was followed by fragments (14 instances, 22%), pellets and films (5 instances, 7.9%), and burnt microplastics (2 instances, 3.17%). In *Lithognathus mormyrus*, fragments were the most prevalent, with 11 instances (28%), followed by films (10 instances, 26.3%), pellets (9 instances, 23.6%), and fibers (8 instances, 21%).

In *Serranus scriba,* the recorded colors of microplastics (MPs) show that brown MPs were the most abundant, making up 20.6% of the total. This was followed by blue at 19%, white at 17.4%, and red at 14.2%, while pink and black comprised 4.7% (Figure 1). In

Lithognathus mormyrus, blue MPs were the most prevalent at 36.8%, followed by white at 26.3%, green at 13%, brown at 10.5%, red at 7.8%, and black at 5.2% (Figure 2). Additionally, various research studies found that microplastics on the water surface indicate that different colors were found (Turhan, 2021; Sayed *et al*., 2021).

Table 2. Data summary of microplastic characteristics collected from the gut of *Serranus scriba* and *Lithognathus mormyrus*

		Serranus scriba	***Lithognathus mormyrus***
Total number of MPs		63	38
Total number of MPs by type	Fragments	14 (22%)	11 (28%)
	Pellets	5 (7.9%)	9 (23.6%)
	Fibers	37 (58%)	8 (21%)
	Films	5 (7.9%)	10 (26.3%)
	Burnt MPs	2 (3.17%)	0
Total number of MPs by color	Green	12 (19%)	5 (13%)
	Pink	3 (4.7%)	0
	Blue	12 (19%)	14 (36.8%)
	White	11 (17.4%)	10 (26.3%)
	Black	3 (4.7%)	2 (5.2%)
	Red	9 (14.2%)	3 (7.8%)
	Brown	13 (20.6%)	4 (10.5%)
Total number of MPs by size	< 1mm	23 (36.5%)	12 (31.5%)
	1-3 mm	40 (63.5%)	26 (68.4%)

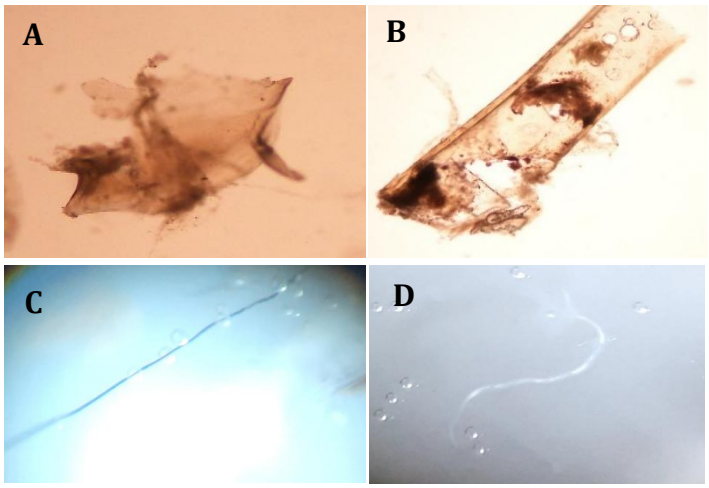

Figure 1. Examples of microplastics collected from the gut of *Serranus scriba*; **A & B)** Burnt microplastics, **C)** Black fiber, & **D)** White fiber

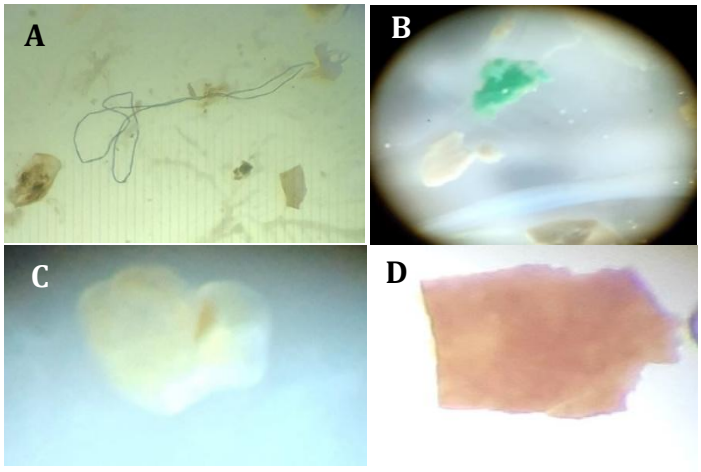

Figure 2. Examples of microplastics collected from the gut of *Lithognathus mormyrus;* **A)** Blue fiber, **B)** Fragment, **C)** Pellet, & **D)** Big fragment

Accidental ingestion of microplastics by marine fish can occur through several means: they may breathe in contaminated surface water or consume food have microplastics in it (Lim *et al*., 2021). Consequently, the variety of colors found in the fish's stomachs may reflect the predominant colors present in the seabed.

The results of this study on microplastics showed that *Serranus scriba* ingested 63.5% of MPs sized between 1-3 mm and 36.5% of MPs smaller than 1 mm. In comparison, 68.4% of the MPs ingested by *Lithognathus mormyrus*, while 31.5% were smaller than 1 mm (Figure 3). The prevalence of small microplastics may be attributed to their size being similar to natural food, which makes them easy to incorporate into their diet.

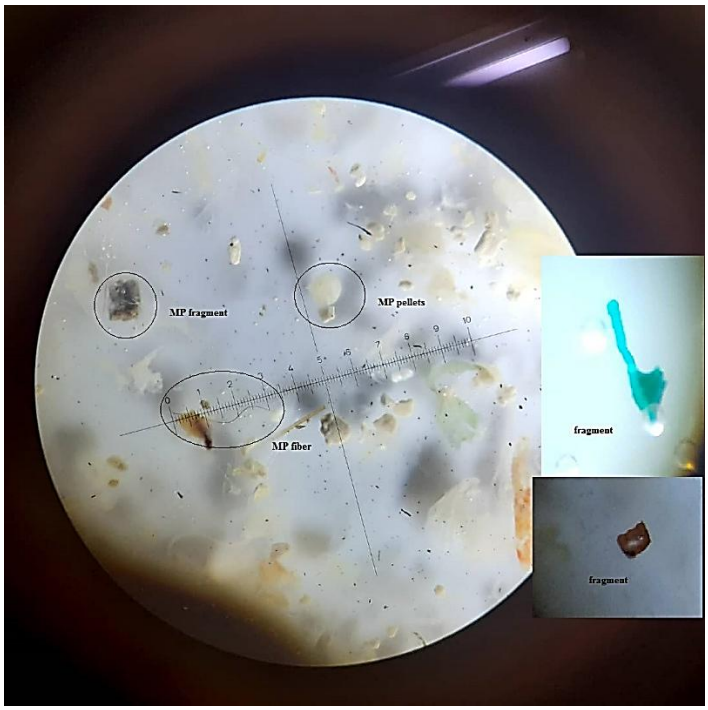

Figure 3. Mixed examples of microplastics collected from the gut of both species *Serranus scriba* and *Lithognathus mormyrus*

In Libya, plastic pollution is a significant concern that requires attention, but the actual extent of the problem remains alarming, as much of it goes unreported. The dumping of unsorted and untreated sewage into the sea exacerbates the degradation of marine habitats and contributes to the rising levels of pollution, particularly plastic pollution.

4. Conclusion

This preliminary study reports on microplastics in fish along the coast of Benghazi, Libya, in the southern Mediterranean. Microplastics were found in the gut of two commercially important fish species. The average amount of microplastics found was 3.94 MP/individual in *Serranus scriba* and 1.90 MP/individual in *Lithognathus mormyrus*. The most common shape of these microplastics was fiber, which may impact fishing activities. To understand microplastic contamination in the marine environment, especially in commercial species closely tied to human seafood consumption, monitoring programs should be established. These findings offer important insights into microplastic contamination in the benthic habitats of Benghazi and enhance the existing database on microplastic pollution in Libya and the Mediterranean Sea. This research can also assist local environmental restoration agencies and policymakers in promoting further research on microplastic pollution on

marine biodiversity. However, future studies should consider seasonal variation, more marine species, and larger sample sizes to better understand temporal trends in microplastic ingestion.

Acknowledgment

We would like to thank a fisherman for providing fish specimens. Special thanks to H. Elbaraasi for assisting with the research and reviewing the manuscript.

References

Akhbarizadeh, R., Moore, F., & Keshavarzi, B. (2018). Investigating a probable relationship between microplastics and potentially toxic elements in fish muscles from northeast of Persian Gulf. *Environmental Pollution*, *232*, 154-163. **DOI:** 10.1016/j.envpol.2017.09.028

Arthur, C., & Baker, J. (2012). Proceedings of the second research workshop on microplastic debris. *NOAA Technical Memorandum NOS-OR&R-39*. National Oceanic and Atmospheric Administration. https://repository.library.noaa.gov/view/noaa/73619

Barboza, L. G. A., Vethaak, A. D., Lavorante, B. R., Lundebye, A. K., & Guilhermino, L. (2018). Marine microplastic debris: An emerging issue for food security, food safety and human health. *Marine Pollution Bulletin*, *133*, 336-348. **DOI:** 10.1016/j.marpolbul.2018.05.047

Bergmann, M., Gutow, L., & Klages, M. (2015). *Marine anthropogenic litter*. Springer Nature. **DOI:** 10.1007/978-3-319-16510-3

Dehaut, A., Cassone, A.-L., Frère, L., Hermabessiere, L., Himber, C., Rinnert, E., ... & Paul-Pont, I. (2016). Microplastics in seafood: Benchmark protocol for their extraction and characterization. *Environmental Pollution*, *215*, 223-233. **DOI:** 10.1016/j.envpol.2016.05.018

De-La-Torre, G. E., & Laura, R. P. (2019). Composición, características físicas y generación per cápita de los residuos sólidos en la playa Las Sombrillas, Lima. *Manglar Revista de Investigación Científica*, *16*(1), 39-44. **DOI:** 10.17268/manglar.2019.006

Fossi, M. C., Pedà, C., Compa, M., Tsangaris, C., Alomar, C., Claro, F., ... & Baini, M. (2018). Bioindicators for monitoring marine litter ingestion and its impacts on Mediterranean biodiversity. *Environmental Pollution*, *237*, 1023-1040. **DOI:** 10.1016/j.envpol.2017.11.019

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., ... & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, *347*(6223), 768-771. **DOI:** 10.1126/science.1260352

Kim, J. S., Lee, H. J., Kim, S. K., & Kim, H. J. (2018). Global pattern of microplastics (MPs) in commercial food-grade salts: sea salt as an indicator of seawater MP pollution. *Environmental Science & Technology*, *52*(21), 12819-12828. **DOI:** 10.1021/acs.est.8b04180

Lim, X. (2021). Microplastics are everywhere—but are they harmful. *Nature*, *593*(7857), 22-25. **DOI:** 10.1038/d41586-021-01143-3

Nelms, S. E., Galloway, T. S., Godley, B. J., Jarvis, D. S., & Lindeque, P. K. (2018). Investigating microplastic trophic transfer in marine top predators. *Environmental Pollution*, *238*, 999-1007. **DOI:** 10.1016/j.envpol.2018.02.016

OECD (2020). *Global Plastics Outlook: Policy Scenarios to 2060*. Organisation for Economic Co-operation and Development. **DOI:** 10.1787/aa1edf33-en

Roch, S., Friedrich, C., & Brinker, A. (2020). Uptake routes of microplastics in fishes: practical and theoretical approaches to test existing theories. *Scientific Reports*, *10*(1), 3896. **DOI:** 10.1038/s41598-020-60630-1

Sayed, A. E. D. H., Hamed, M., Badrey, A. E., Ismail, R. F., Osman, Y. A., Osman, A. G., & Soliman, H. A. (2021). Microplastic distribution, abundance, and composition in the sediments, water, and fishes of the Red and Mediterranean seas, Egypt. *Marine Pollution Bulletin*, *173*, 112966. **DOI:** 10.1016/j.marpolbul.2021.112966

Seltenrich, N. (2015). New link in the food chain? Marine plastic pollution and seafood safety. Environmental health perspectives, 124(7), A123. **DOI:** 10.1289/ehp.123-A34

Turhan, D. Ö. (2021). Evaluation of microplastics in the surface water, sediment and fish of Sürgü Dam Reservoir (Malatya) in Turkey. *Turkish Journal of Fisheries and Aquatic Sciences*, *22*(SI), TRJFAS20157. **DOI:** 10.4194/TRJFAS20157

Wang, J., Peng, J., Tan, Z., Gao, Y., Zhan, Z., Chen, Q., & Cai, L. (2017). Microplastics in the surface sediments from the Beijiang River littoral zone: Composition, abundance, surface textures and interaction with heavy metals. *Chemosphere*, *171*, 248-258. **DOI:** 10.1016/j.chemosphere.2016.12.074

Wright, S. L., & Kelly, F. J. (2017). Plastic and human health: a micro issue?. *Environmental Science & Technology*, *51*(12), 6634-6647. **DOI:** 10.1021/acs.est.7b00423

Zeng, E. Y. (Ed.) (2018) *Microplastic Contamination in Aquatic Environments: An Emerging Matter of Environmental Urgency*. Elsevier. **DOI:** 10.1016/C2016-0-04784-8