



Abstract

Bioavailability and Ingestion of Microplastics by Fish Larvae in the Douro Estuary [†]

Sabrina M. Rodrigues ^{1,2,*}, Liliana Sousa ¹, Diogo Silva ^{1,2}, Jacinto Cunha ^{2,3}, Vânia Freitas ², C. Marisa R. Almeida ² and Sandra Ramos ²

¹ ICBAS—Institute of Biomedical Sciences Abel Salazar, Porto University, 4050-313 Porto, Portugal; liliana.a.o.moreira@gmail.com (L.S.); silva.diogom@gmail.com (D.S.)

² CIIMAR—Interdisciplinary Centre of Marine and Environmental Research, University of Porto, 4450-208 Matosinhos, Portugal; jfrcunha@gmail.com (J.C.); vpfreitas@ciimar.up.pt (V.F.); calmeida@ciimar.up.pt (C.M.R.A.); ssramos@ciimar.up.pt (S.R.)

³ CITAB—Centre for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal

* Correspondence: smagalhaes@ciimar.up.pt

[†] Presented at the IX Iberian Congress of Ichthyology, Porto, Portugal, 20–23 June 2022.

‡ Presenting author (Poster presentation).

Abstract: In their early life stages, fish are highly susceptible to a wide range of biological and anthropogenic factors (e.g., habitat degradation or pollution) that can influence their growth and survival. Due to their size, microplastics (plastic particles with less than 5 mm) pose an additional threat to fish larvae since their size range coincides with their prey size. The ingestion of microplastics by fish larvae can cause gut blockage and limit food intake, and ultimately affect their growth, reproduction, and survival. This study aimed to evaluate the bioavailability of microplastics and quantify microplastic ingestion by fish larvae in an urban estuary. To this end, seasonal samplings surveys were performed in 2017 along the Douro estuary (NW Portugal). Sub-surface planktonic trawls were conducted along the estuarine horizontal gradient to collect fish larvae and microplastics. Samples were sorted, and fish larvae were identified and kept for further quantification of microplastics ingested. Microplastic bioavailability was determined using a previously optimized protocol. A total of 573 fish larvae were collected, with an average density of 14.63 fish larvae 100 m⁻³ and mostly composed of few but highly abundant taxa, such as *Pomatoschistus* spp. and *Clupeidae* n.i. A total of 609 microplastics were found in water samples, with an average density of 15.52 microplastics 100 m⁻³—namely, fibers, particles, and films. In Summer, fish larvae presented the highest values of abundance, contrary to the other three seasons when microplastic density surpassed larval fish density. Preliminary tests were conducted to identify the best protocol for the digestion of fish larvae to quantify microplastic ingestion. Additionally, in accordance with those results, fish larvae are currently being digested using H₂O₂ for a period of 7 h at 65 °C, to evaluate microplastic ingestion by fish larvae and to compare these results with the microplastics collected in the water.

Keywords: plastic particles; ichthyoplankton; urban estuary; ingestion



Citation: Rodrigues, S.M.; Sousa, L.; Silva, D.; Cunha, J.; Freitas, V.; Almeida, C.M.R.; Ramos, S. Bioavailability and Ingestion of Microplastics by Fish Larvae in the Douro Estuary. *Biol. Life Sci. Forum* **2022**, *13*, 54. <https://doi.org/10.3390/blsf2022013054>

Academic Editor: Alberto Teodorico Correia

Published: 7 June 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Funding: This research was partially funded by Ocean3R (NORTE-01-0145-FEDER-000064) and ATLANTIDA (NORTE-01-0145-FEDER-000040) projects, supported by the Norte Portugal Regional Operational Programme (NORTE 2020) under the PORTUGAL 2020 Partnership Agreement and through the European Regional Development Fund (ERDF). Additionally, FCT is awarded by the Strategic Funding UIDB/04423/2020 and UIDP/04423/2020 through national funds provided by FCT and ERDF, and a PhD fellowship to S.M.R. (SFRH/BD/145736/2019), D.S. (2020.06088.BD) and J.C. (PD/BD/150359/2019) and a research contract to SRamos (DL57/2016/CP1344/CT0020).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.