

MICROPLASTICS IN BIVALVE MOLLUSCS: LITERATURE REVISION TO SUPPORT THE EXPOSURE ASSESSMENT

Alice Giusti¹, Francesca Susini², Marco Diano¹, Enrica Ricci², Lisa Guardone¹, Andrea Armani¹

1. FishLab, Department of Veterinary Sciences, University of Pisa, Italy

2. Experimental Zooprophyllactic Institute of Lazio and Tuscany, Pisa, Italy

INTRODUCTION

Microplastics (MPs) presence in the marine environment is one of the most concerning contemporary pollution problems. MP are defined as heterogeneous mixture of differently shaped materials in the range of 0.1–5,000 µm. They are worldwide distributed as result of the fragmentation of larger plastic debris or may be introduced into the water already as micro-sized. Because of their small size and widespread occurrence, MPs are now available also to marine species throughout the food web. **Bivalve molluscs (BM), which are filter-feeding organisms, are particularly subjected to the phenomenon of MPs accumulation and, in addition, they are usually consumed as whole.** Even though the risk of MPs ingestion via BM consumption, such as mussels, was proved to be minimal respect to other exposure via, a correct human exposure assessment cannot disregard a detailed collection of data analysing MP level in BM categories of commercial interest. In general, data gaps in microplastic research lead to an insufficient information to assess the true amount of MPs to which humans may be exposed to via food. In a context when mass-media often cause excessive alarm by leveraging on the current high citizens sensibility towards environment and health issues, a scientifically validated consumers information is needed to reduce the potential damage against the seafood sector. In fact, awareness about MPs in BM could lead consumers to reduce their consumption. **In this work, outcomes from a preliminary analysis of data obtained by a systematic reviewing the scientific literature dealing with the occurrence of MPs in BM, are presented (^)**

METHODOLOGY

To collect data on MPs in BM categories of major commercial appeal, a **systematic literature review** was conducted. Search terms were employed to explore published literature in the bibliographic databases Web of Science, Scopus and PubMed. The following search string was used to maximize the return of relevant literature sources: **Microplastic* AND (bivalve* OR mussel* OR clam* OR oyster* OR scallop*)**. The following information was established as inclusion criteria for retaining the study in the analysis: **1) bivalve type** (species, genus or family) **2) geographical area of the investigation;** **3) MP quantification** (reported as number of MP/specimen or number of MP/weight). The year of publication and the subject area of the journals in which the selected papers were published were even considered and discussed. When available, also information on the microplastics characterization (size, colour, type, material) and analytical procedures used for MP detection were considered. The data were organized in an excel sheet for further analysis.

RESULTS(^)

A total of **87 scientific papers (SPs)** were included. The most part of them (79.5%) were published in the three-year period of 2018-2020 (Fig.1). The papers were published in 30 different scientific journals, most of which (70%) specifically referred to the environmental sciences research area and only a minority were published on journals focusing on food science. Overall, data on MPs were found for 67 species, 5 genera and 1 family; In details, 42 clams (36 species, 5 genera and 1 family), 16 mussels (15 species and 1 genus), 13 oysters and 5 scallops were investigated. Overall, **mussels were the most analysed category (68 SPs)** with *Mytilus* spp. as the most targeted genus. Among the other categories, the clam *Ruditapes philippinarum* and the oyster *Crassostrea gigas* were the most frequently analysed. **FAO fishing area 61 and 27 were the most investigated geographical areas.** Sampling conducted in Asia were the most representative in term of species variability. Data on the MPs quantification were given as a mean value, a range or both and reported as number of MPs/gram and/or number of MPs/individual. In most cases, the MPs size was less than 5 mm. Blue, red and black fibres or fragments composed by polyethylene, polypropylene, polyvinylchloride and polyamide were the most representative MP type. **The analytical procedures applied to detect MPs, although all sharing similar basic steps, vary greatly.**

DISCUSSION

The MPs occurrence in the ecosystem has attracted great interest within scientific community in the last years. The abovementioned trend was confirmed by the increase of scientific production observed in the last three-year period. However, **literature especially addressed to the food inspection field is scarce.** Moreover, although MPs were also investigated in the most commercially relevant BM species, other studies covering all commercial species are needed, especially considering the high species variability that can be found in the context of the global market. **A scarcity of data was observed for depurated and cooked MB.** In addition, **a standardization of the MPs quantification both as analytical procedures and unit of measure used for reporting data is required,** as already mentioned in a recent EFSA scientific opinion on this topic. Overall, the abovementioned gaps limit the exposure assessment that, as part of the risk analysis, is stated as cornerstone of the EU legislation. This study, by highlighting the main issues related to the MPs investigation in BM, may represent a valid starting point for the scientific community for improving the research in this field.

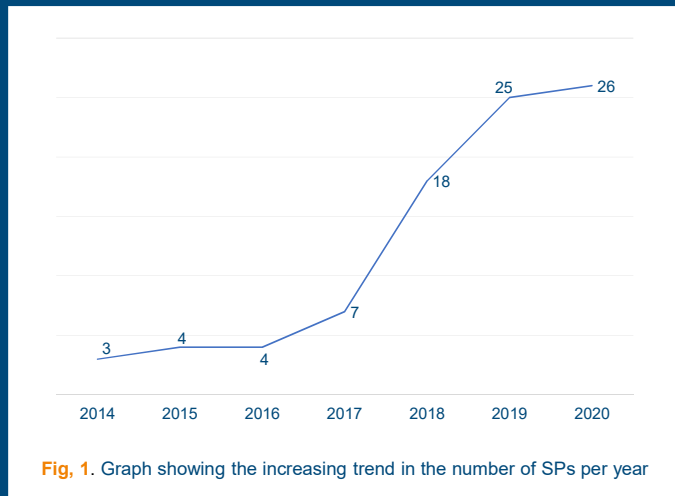


Fig. 1. Graph showing the increasing trend in the number of SPs per year

(^) The full study entitled: **“Occurrence of microplastics in bivalves: can a systematic literature review support risk assessment?”** in which human exposure was also analyzed, is currently under revision for possible publication in the *Journal Comprehensive Reviews in Food Science and Food Safety*.

REFERENCES

- Catarino, A. I., Macchia, V., Sanderson, W. G., Thompson, R. C., & Henry, T. B. (2018). Low levels of microplastics (MP) in wild mussels indicate that MP ingestion by humans is minimal compared to exposure via household fibres fallout during a meal. *Environmental Pollution*, 237, 675-684.
- Hoogenboom, L. A. P. (2016). Statement: Presence of microplastics and nanoplastics in food, with particular focus on seafood. *EFSA Journal*, 14(6), e04501.
- Smith, M., Love, D. C., Rochman, C. M., & Neff, R. A. (2018). Microplastics in seafood and the implications for human health. *Current environmental health reports*, 5(3), 375-386.
- Zhang, F., Man, Y. B., Mo, W. Y., Man, K. Y., & Wong, M. H. (2019). Direct and indirect effects of microplastics on bivalves, with a focus on edible species: A mini-review. *Critical Reviews in Environmental Science and Technology*, 1-35.