ZooNotes 191: 1-4 (2022)
www.zoonotes.bio.uni-plovdiv.bg
ISSN 1313-9916

Ingestion of plastics in the European bass (*Dicentrarchus labrax* Linnaeus, 1758): first known observation in the city of Plovdiv, Bulgaria

VESELA YANCHEVA*, STELA STOYANOVA, BORISLAVA TODOROVA, ELENKA GEORGIEVA, ILIANA VELCHEVA

*Plovdiv University, Faculty of Biology, 4000 Plovdiv, Bulgaria, *veselayancheva@yahoo.com*

Abstract. In this article we report the first registered case of plastic products in fish purchased from a local fish market in the city of Plovdiv, Bulgaria.

Key-words: Sea bass, fish, plastic pollution.

Introduction

The European bass (*Dicentrarchus labrax* Linnaeus, 1758) is well known throughout much of the Mediterranean and coastal Europe, and has also long been valued as a food fish in France, Italy and Spain. In Bulgaria most of this economically important fish species is imported from Greece as a neighboring county where it is reared extensively in aquaculture. Furthermore, it can come from Turkey, Spain and Portugal as they are one of main growers of this fish species in Europe. Sea bass is, on average, the second most expensive North-East Atlantic commercial catch, fished by fleets also from the United Kingdom, the Netherlands and Belgium. In addition, in Bulgaria it is most commonly found in the supermarkets ready to cook as fish fillets, but it also can be purchased whole from small neighborhood markets where its origin is in most cases from the wild, but not aquaculture.

There is an increasing trend in the production and usage of plastics worldwide (Plastics Europe, 2015). However, the wide use of plastics, in a variety of applications, increases their release into the marine environment, and it is estimated that 4.6 to 12.7 million tons are introduced annually in the ocean (Jambeck *et al.*, 2015). Moreover, according to Eriksen *et al.* (2014) it is estimated that around 5.25 trillion plastic particles weighing about 270.000 tons are floating on the ocean's surface. Plastics' chemical stability, persistence and bioaccumulation causes many serious environmental issues as plastics are very resistant to decomposition. Therefore, large plastic rubbish pieces will breakdown to meso-plastics (5-40 mm), micro-plastics (1-5000 μm) (MPs), and nano-plastics (NPs) (1-100 nm) as explained by Gonçalves & Bebianno (2021).

Plastic ingestion has already been documented in the low trophic fauna of the marine environment. In the case of vertebrates, the digestive tracts of fish species have been investigated at different points of the European coastline, e.g. in the North and Baltic Seas (Rummel et al., 2016), at the Portuguese coast (Neves *et al.*, 2015), the Adriatic Sea (Avio *et al.*, 2015), the Black Sea and the Danube (Lechner *et al.*, 2014). Hence, according to Avio *et al.* (2015) the multiple risks that plastics pose to marine life prompted their inclusion in some international legislation and marine protection projects, like the European Marine Strategy Framework Directive (MSFD) and the Marine Debris Program of the US National Oceanographic and Atmospheric Administration (NOAA).

In Bulgaria as an agrarian country, in terms of ecological toxicology, priority substances of research are mainly organic chemicals, such as pesticides, but also PAHs,

Received: 23.09.2021, Accepted: 01.01.2022, Published: 6.01.2022
Университетско издателство "Паисий Хилендарски"
Plovdiv University Press "Paisii Hilendarski"

PBDEs, and heavy metals because of the significant metallurgical processes that used to take place in the country. Much less is known about the current situation of contamination of fresh and seawater with plastics and its effects on different biomarkers in fish.

Material and Methods

European seabass was purchased from a local fish shop in the city of Plovdiv, Bulgaria (Smirnenski District) on the 17th of September 2021. The fish was whole and it hasn't been filleted in advance. Its size was 501 grams (total weight) and 30.5 cm (total length), respectively.

Results

After the abdomen was cut open in order to remove the internal organs and clean the fish prior to cooking, we found out that the gut was full of different plastic materials, such as fish nets, fishing ropes, polyethylene, etc. (Fig. 1).

Fig. 1. Different plastic products found in the gut of European bass, purchased from the city of Plovdiv (photograph: Velichka Pachedzhieva).

Discussion

The production and use of plastics expanded since 1940s, due to its low cost, versatility, wide durability, and mechanical resistance that facilitate its application in many activities of modern human life, and it is estimated that 360 million tons of plastics produced in 2018 will reach around 1800 million tons in 2050 (Plastics Europe, 2018). According to the European Commission (2018) assessment of plastic pollution in the ocean emerged in the beginning of the 70's, a few years after it was detected.

Once in the ocean, due to several environmental factors, such as physical abrasion, exposure to UV radiation (photo-degradation) and hydrodynamics plastics break down into smaller particles, of less than 5 mm in size, known as micro-plastics (MPs), which pose a serious threat to the marine environment (Vital *et al.*, 2021). Herein, MPs are bio-available and end up ingested by marine organisms, such as bivalves, crustaceans and fish either of being confused as food or simply by ingestion of water contaminated with MPs (Barboza *et al.*, 2020).

As summarized by Vital *et al.* (2021) MPs were detected in various bivalves, such as mussels (*Mytilus* spp.) and oysters (*Crassostrea virginica* and *Ostrea edulis*) and even sea salt as used for human consumption, but also in commercial fish species, such as common

mackerel (*Trachurus trachurus*), Atlantic hake (*Merluccius merluccius*), striped red mullets (*Mulus surmuletus*) and seabass (*Dicentrarchus labrax*).

Islam *et al.* (2021) explain that MPs due to their large surface area in relation to their volume, can adsorb and concentrate various pollutants present in the marine environment including metals, persistent organic pollutants (POPs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), dichlorodiphenyltrichloroethanes (DDTs) (and perfluorooctanesulfonic acid (PFOs) which are known to have endocrine, mutagenic, and carcinogenic effects. Last but not least, as Vital *et al.* (2021) generalize it is estimated that in European countries the possible transfer of MPs to humans will be around 11.000 MPs per year, with seafood representing a possible intake of 0.5 g of MPs per week.

From our perspective this first observation of plastic products in fish in the city of Plovdiv is very disturbing. We consider that if the fish can swallow large pieces of plastic, then it will certainly be exposed to the action of MPs in its natural environment, which enter the body directly via blood flow through the gills or by swallowing them with food. Therefore, we strongly suggest that further research is carried on this topic to answer the following questions which require prompt answers - are there more fish with plastics in the gut on the market in the city of Plovdiv; which species are these and where they come from; can the plastics be chemically analyzed in order to learn more what the possible hazard for the fish health could be; and lastly to also assess the human health risks.

Acknowledgements. The authors send many thanks to the team of prof. Maria João Bebianno from the Centre for Marine and Environmental Research – CIMA University of Algarve, Faro, Portugal for teaching us (micro) plastics.

References

Barboza, L.G.A., Lopes, C., Oliveira, P., Bessa, F., Otero, V., & Henriques, B., et al. (2020) Microplastics in wild fish from north East Atlantic Ocean and its potential for causing neurotoxic effects, lipid oxidative damage, and human health risks associated with ingestion exposure. *Science of the Total Environment*, 717: 134625.

Vital, S.A, Cardoso, C., Avio, C., Pittura, L., Regoli, F. & Bebianno, M.J. (2021) Do microplastic contaminated seafood consumption pose a potential risk to human health? *Marine Pollution Bulletin*, 171: 112769.

Eriksen, M., Laurent, C.M.L., Henry, S.C., Thiel, M., Moore, C.J., Borerro, J.C., Galgani, F., Ryan, P.G. & Reisser, J. (2014) Plastic pollution in the world's oceans: more than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. *PLoS ONE*, 9 (12): 111913.

European Commission (2018) Marine litter - GES – Environment. Available at: https://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm. (Accessed on 3 January 2022).

Islam, N., Garcia da Fonseca, T., Vilke, J., Gonçalves, J.M., Pedro, P., Keiter, S., Cunha, S. C., Fernandes, J.O. & Bebianno, M.J. (2021) Perfluorooctane sulfonic acid (PFOS) adsorbed to polyethylene microplastics: accumulation and ecotoxicological effects in the clam *Scrobicularia plana*. *Marine Environmental Research*, 164: 105249.

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

Gonçalves, J.M & Bebianno, M.J. (2021) Nanoplastics impact on marine biota: A review. *Environmental Pollution*, 27: 116426.

Lechner, A., Keckeis, H., Lumesberger-Loisl, F., Zens, B., Krusch, R., Tritthart, M., Glas, M. & Schludermann, E. (2014) The Danube so colourful: a potpourri of plastic litter

outnumbers fish larvae in Europe's second largest river. *Environmental Pollution*, 188: 177-181.

Avio, C.G., Gorbi, S. & Regoli, F. (2015) Experimental development of a new protocol for extraction and characterization of microplastics in fish tissues: First observations in commercial species from Adriatic Sea. *Marine Environmental Research*, 111: 18-26.

Neves, D., Sobral, P., Ferreira, J.L. & Pereira, T. (2015) Ingestion of microplastics by commercial fish off the Portuguese coast. *Marine Pollution Bulletin*, 101 (1): 119-126.

Plastics Europe (2018) Plastics – the facts 2018: an analysis of European plastics production, demand and waste data. Available at: https://plasticseurope.org/wp-content/uploads/2021/10/2018-Plastics-the-facts.pdf. (Accessed on 3 January 2022).

Plastics Europe (2015) Plastics – the facts 2015: an analysis of European latest plastics production, demand and waste data. Available at: https://plasticseurope.org/wp-content/uploads/2021/10/2015-Plastics-the-facts.pdf. (Accessed on 3 January 2022).

Rummel, C.D., Löder, M.G.J., Fricke, N.F., Lang, T., Griebeler, E.-M., Janke, M. & Gerdts, G. (2016) Plastic ingestion by pelagic and demersal fish from the North Sea and Baltic Sea. *Marine Pollution Bulletin*, 102 (1): 134-141.