European sea bass absorb virtually no microplastic in their muscle tissue

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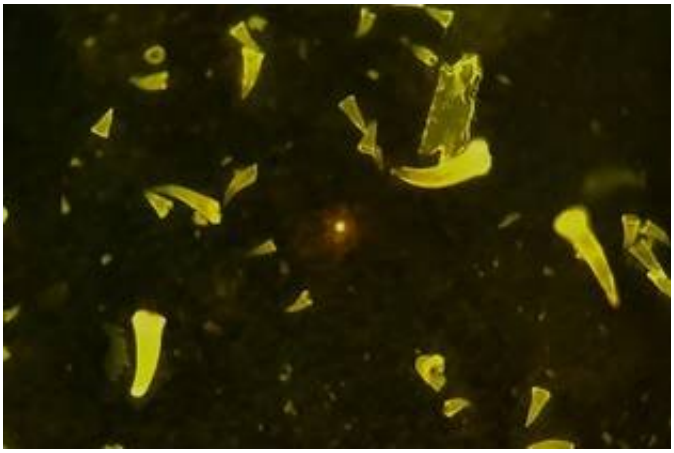

Round fluorescent microplastic under a manual fluorescent microscope. Credit: Alfred-Wegener-Institut, Sinem Zeytin.

In a new laboratory study, experts from the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) investigated how many microplastic particles would be absorbed in the muscle tissue of young European sea bass after being given feed with extremely high microplastic particle content for a period of four months. At least with regard to this particular food fish, their findings are good news: only an extremely small percentage of the plastic particles ingested found their way into the fish filets; the majority were excreted. The experts take this finding as a first indication that fish filets can still be safe for human consumption, even if the fish eaten are subjected to extreme

microplastic pollution. Their study has now been published in the July issue of the journal *Marine Pollution Bulletin.*

By now, fish are subjected to microplastic particles in all of their habitats—in rivers, lakes and seas, as well as aquaculture. Further, it has been confirmed that the animals ingest these tiny particles together with their food. In a new study conducted at the Centre for Aquaculture Research, part of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven, scientists have for the first time investigated how many of the ingested particles make their way from the sea bass' digestive tract to the bloodstream, and subsequently to the muscle tissue. "This question is relevant for us human beings, especially because, as a rule, we don't eat the whole fish, including its innards, but only the filets," explains Dr. Sinem Zeytin, an AWI biologist and first author of the study.

For the laboratory experiment, adolescent European sea bass (Dicentrarchus labrax) were fed pellets consisting of fish meal, wheat bran, vitamins and fish oil, which the scientists had laced with a powder of yellow-orange fluorescing microplastic particles, for 16 weeks. The particles had a diameter of one to five micrometers (thousandths of a millimeter), so as to be representative of the smallest size category for microplastic. In the course of the experiment, every sea bass ingested roughly 163 million of these microscopically small plastic particles. Once the experiment was over, the experts fileted the fish to measure the particle content, while also gathering samples from their blood, gills, intestinal tract and internal organs like the liver for subsequent analysis. They heated part of the filets in caustic potash, which completely dissolved the muscle tissue. The resultant fluid was then pressed through a filter that captured all of the plastic. They counted the number of particles present using a fluorescence microscope—first manually, and then using an automated technique.

One to two microplastic particles per five grams of fish filet

The results came as a pleasant surprise to the researchers. "Even though we subjected the sea bass to extremely high microplastic pollution in comparison to their natural setting, in the end there were only 1 or 2 particles in every five grams of their filets," Sinem Zeytin reports. "This, along with the fact that the fish grew very well and were in perfect health, tells us that the fish can apparently isolate and excrete these particles before they have a chance to penetrate their tissues. For everyone who enjoys eating sea bass, that's very good news," adds Dr. Matthew Slater, Head of the Aquaculture Research Group at the AWI.

As Slater explains, due to the nature of the study, it's also possible that those microplastic particles detected weren't actually in the muscle cells, but instead in the tiny amounts of residual blood in the filets. "In fact, during our study we found virtually no indications that the particles pass from the blood into the muscle cells," the AWI expert explains. That being said, initial analyses of other tissues confirmed that the particles do pass from the digestive tract to the bloodstream.

But how do the microplastic particles get from the digestive tract to the bloodstream? According to Sinem Zeytin, "So far, we have identified two ways: either the microscopically small plastic fragments manage to squeeze between two cells in the intestinal wall, or special transporter cells actively separate the particles from the remainder of the feed and pass them on, just like they do with minerals and nutrients."

Which of these two processes is predominant, whether there are other processes, and just how particle transport works in each one are questions the experts will seek to answer in future experiments.

More information: Sinem Zeytin et al, Quantifying microplastic translocation from feed to the fillet in European sea bass Dicentrarchus labrax, *Marine Pollution Bulletin* (2020). DOI: 10.1016/j.marpolbul.2020.111210

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