FACT ! SHEET

ZMT LEIBNIZ CENTRE for Tropical Marine Research

MICROPLASTIC:

Ingestion by juvenile fish

Already in the 1970s, fish have been observed to take up microplastic particles and fibres. Since then, the number of studies on plastic uptake by fish has steadily increased, but juveniles of commercially important fish species have been rarely covered. However, these early life stages can be considered the most crucial in a fish's life and their wellbeing is of interest for ecology, fisheries and aquacultures worldwide.
Could microplastic ingestion affect their growth and survival?

FACTS

The white seabream, *Diplodus sargus*

D. sargus is an edible, **commercially important** fish species distributed widely in the Atlantic and Mediterranean. Known to be an opportunistic omnivore, the white seabream feeds on a variety of organisms. Its juveniles use near-shore habitats as **nursery grounds** where they show a high site fidelity for seagrass meadows.

Why is the white seabream of particular interest?

Omnivorous fish seem to be at higher risk to ingest microplastic particles. Their **usage of various food sources** is usually an advantage – to avoid competition – but could result in a contradictory situation with regards to microplastic uptake. Moreover, juvenile seabream live close to the **shore**, often a **hotspot of plastic pollution**.

Microplastic

- Microplastics are particles or fragments < 5 mm in size
- Sources: fishing gear, packaging, tires, clothing, cosmetics, etc.

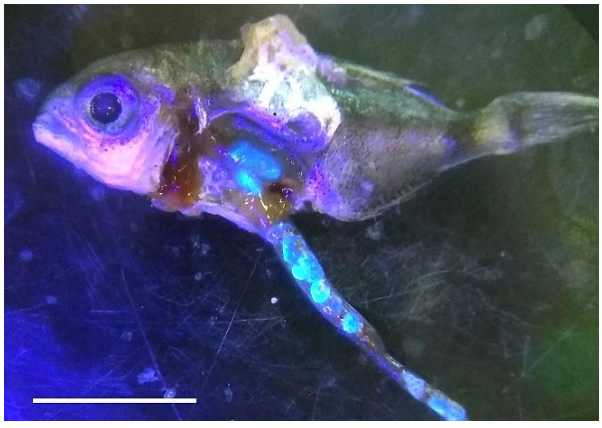
Microplastic feeding experiment

Juvenile seabream were exposed for 3.5 weeks to either pristine or weathered polystyrene particles along with natural food items (*Artemia* sp. nauplii). Microplastic densities were close to the conditions found in the natural habitat of the fish. The blue, fluorescent plastic fragments were 0.5 – 1 mm in size, small enough to be ingestible and approximately the same size as the *Artemia*.

To assess juvenile growth and condition, white seabream, were measured and weighed before and after dissection.

In the feeding experiment, only ca. 13% of the juvenile seabream ingested microplastic (1 – 78 particles per individual). The fish were observed spitting out the plastics, a behaviour which suggests the fish's ability to discriminate plastic from natural prey. Growth, condition and survival of the fish were not adversely impacted by low plastic ingestion.

Interestingly, the fish ingested more pristine plastics than weathered ones, the latter being hypothesized to emit forage-inducing odours. To complement the laboratory findings, a field study with juvenile white seabream in a vital nearshore nursery ground was conducted.



Juvenile D. sargus upon dissection. UV-Light was used to enhance the visibility of the fluorescent plastic particles.

Carolin Müller is a marine biologist and member of the ZMT work group *Fisheries Biology*. While studying at the Portuguese coast during her master, she developed an interest for anthropogenic pressures (such as plastic pollution) on coastal ecosystems and their fish fauna. She published a paper on microplastic uptake by juvenile seabream, *D. sargus,* and is currently working towards her PhD.

References

Müller, C. et al. (2020). DOI: 10.1016/j.marpolbul.2020.111162

Müller, C. (2021). DOI: 10.3389/fmars.2021.672768

Photos

Carolin Müller

»The smaller the particle, the bigger the problem?«

What did we find out?

- **Low ingestion** rates of **plastic particles** both in the laboratory and in the field
- Plastic **fibres** may be taken up unintentionally along with natural prey
- Plastic ingestion **does not necessarily impair** growth and condition of **juvenile fish**
- Inter-individual, species- and life stage-specific **prey preferences** determine extent of plastic uptake

What does that mean?

- Juvenile seabream are opportunistic feeders and ingest a wide range of prey items, yet they show selective feeding behaviour
- Microplastic uptake may vary between individuals, life stages, species and geographic regions
- In the context of climate change, interlinked environmental conditions (e.g., high temperatures, low oxygen concentrations) could impact feeding behaviour and thus microplastic uptake
- Certain feeding modes may be more vulnerable to microplastic pollution than others

Conclusion and Outlook

We need more in-depth studies of individual fish species and life stages, as it is difficult to deduce microplastic feeding behaviour and its impacts on juveniles of species A by looking at adults of species B.

Take-home messages

→ **Juvenile white seabream ingest microplastics, but there are strong inter-individual differences**

→ **Juvenile fish could be more resilient to plastic pollution than we think**

→ **The impact of microplastic pollution on fish is challenging to determine and may be characterised by the interaction of several anthropogenic pressures**

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