Growing up in a plastic ocean

The impact of microplastic uptake in juvenile seabream

Carolin Müller [a*)], Karim Erzini [b)], Werner Ekau [a)]

a) Centre for Tropical Marine Research (ZMT), Fahrenheitstr. 6, 28359 Bremen, Germany
b) Centro de Ciências do Mar (CCMAR), Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal

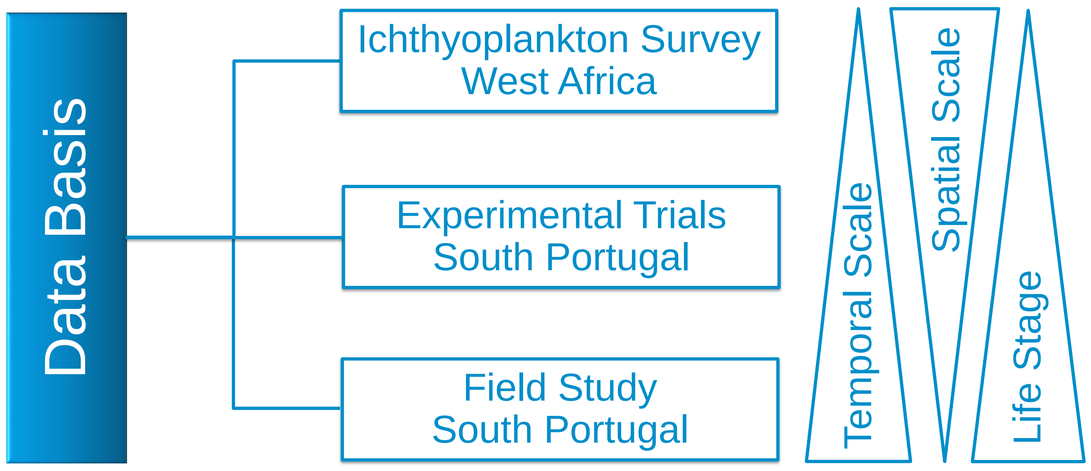
Introduction

Coastal ecosystems offer a wide range of goods and services, amongst them the provision of essential nursery grounds for many commercially important fish species. Due to the exponential application of plastic within the last decades, these vital habitats are facing increasing levels of riverine input of synthetic particles and fibres which pose a risk to a variety of marine biota [1].

As thorough assessments of microplastic (MP) uptake in early life stages of fish are lacking, the main objective of this study is to investigate the spatial and temporal variability of development and growth of larval and juvenile stages of members of the family Sparidae in relation to habitat quality parameters and MP pollution in East Atlantic coastal ecosystems.

Materials & Methods

The data basis of this study is a combination of empirical assessments and experimental approaches:



Preliminary Results

Ichthyoplankton survey

The interim results of the visual examination reveal the following distribution of MP fibres and fragments along the West African coast:

Horizontal distribution (fig. 1)

- Highest amount of MP in neritic zone
- Sharp decline in abundance at continental slope
- MP less prevalent yet constantly present in oceanic region

Vertical distribution (not shown here)

- High abundance of MP in the upper 70 m depth
- Homogeneous distribution to 200 m depth
- Fibres and fragments at greater depths frequently bound in organic aggregates (fig. 2 a + b)

Experimental trials

The first set-up (fig. 3) tested the uptake of pristine and biofilm-coated polystyrene particles by juvenile *Diplodus sargus* (Linnaeus, 1758). Preliminary findings indicate that juvenile seabream are able to discriminate between natural prey items and synthetic particles. Stomach content analyses along with RNA:DNA ratio evaluation will yield further insights into potential differences in growth and condition between treatments.

Field Study South Portugal

The first fieldwork campaign in the Ria Formosa lagoon in spring 2018 shows that early life stages of seabream are highly abundant over seagrass meadows and that several cohorts occur in the same habitat. MP distribution seems to follow a gradient from the interior to the exterior part of the lagoon.

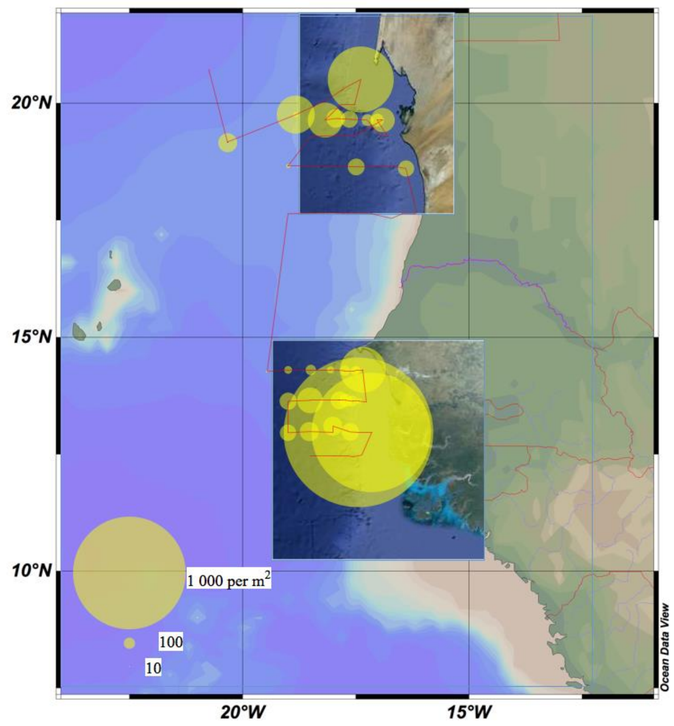


Fig. 1. Horizontal distribution of plastic fibres off the West African coast.

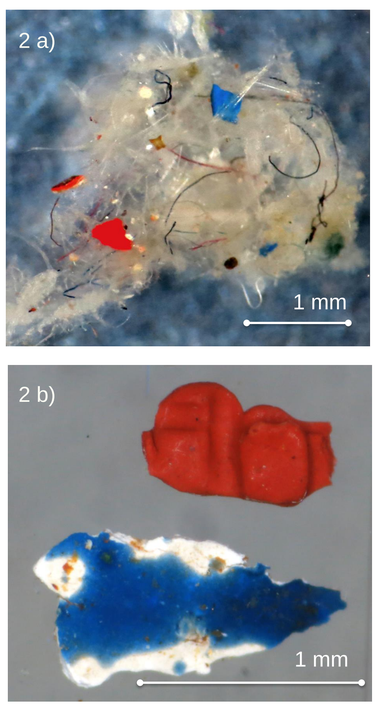


Fig. 2 a + b. Fibres and fragments found in West African coastal waters.

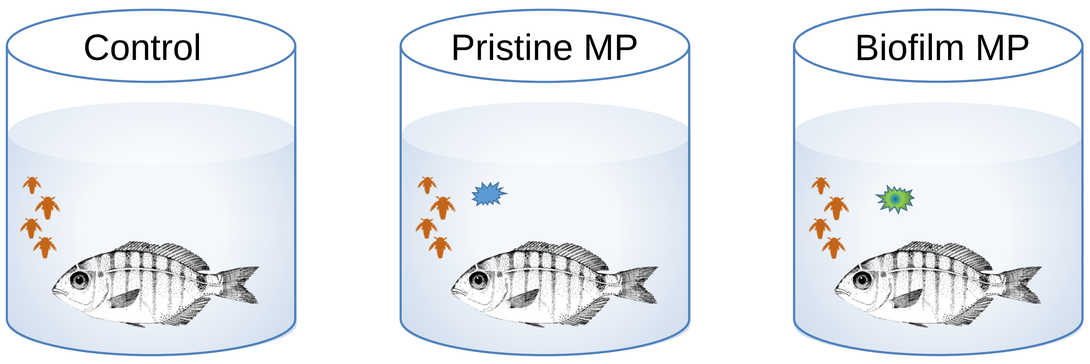


Fig. 3. Overview of the experimental design of the feeding trials with juvenile *Diplodus sargus* [fig. after 2]. All treatments are tested by three replicate tanks, each holding fifty juveniles.
Live prey: cultured *Artemia salina* + natural *Artemia franciscana*
Pristine MP particles Biofilm-coated MP particles (size range 0.5 – 1 mm)

Outlook

As MP has been found to impact adult fish condition, consequences for growth and survival are expected to be also attested for early life stages of fish, on the basis of the empirical data collection in combination with the laboratory experiments.

The M129 data collection is the first one to allow for a thorough horizontal and vertical assessment of fish abundance and MP distribution in West African waters.

The visual examination of MP will be complemented by mass spectrometric methods.

The field study in the Ria Formosa lagoon along with the feeding trials enable monitoring of juvenile growth and survival over a broader temporal scale and assessment of recruitment success under varying environmental conditions and increasing MP pollution.

Literature

[1] Lusher, A. (2015). Microplastics in the Marine Environment: Distribution, Interactions and Effects. In: Bergmann, M., Gutow, L., Klages, M. (eds.) Marine Anthropogenic Litter. Springer International Publishing.
[2] Arias García, A. M. & Drake Moyano, P. (1990). Estados juveniles de la ictiofauna en los caños de las salinas de la bahía de Cádiz. Cádiz: Instituto de Ciencias Marinas de Andalucía.

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