FACT ! SHEET

ZMT LEIBNIZ CENTRE for Tropical Marine Research

MICROPLASTIC:
Impacts on Corals

Plastic pollution has rapidly increased over the past few decades, becoming a large risk for marine organismal health. Smaller plastic particles, so called microplastics, are reportedly consumed by tropical reef-building corals with serious health consequences. Globally, reef building corals are threatened by heat waves with insufficient time for recovery. Are microplastics yet another serious threat to coral health and persistence in future reefs?

FACTS

Why are corals important?

Corals precipitate hard skeletons that form barriers along tropical coasts and around islands offering **shoreline protection** by dissipating wave energy and minimizing coastal erosion. Corals also provide habitats for as fishes and invertebrates, while **improving water quality** through feeding. Importantly, coral reefs are integral to the **fishing and tourism** industries.

Signs of stress?

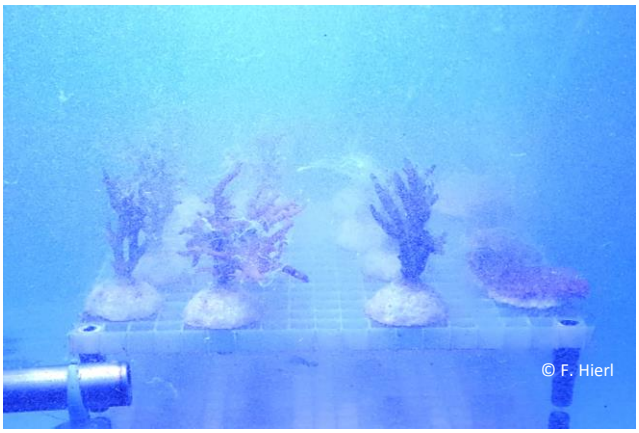
When exposed to environmental stressors, corals can react to them with **heightened mucus production or polyp retraction**. In severe cases, corals dissassociate from their microsymbionts. Those reactions can **deplete the corals energy levels** and can therefore have an impact on feeding behaviour or the overall resilience to disease of the organism.

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

What are possible reactions to microplastic contact?

Previous studies around the world have documented negative health effects like **tissue necrosis, heightend disease likelihood** and **bleaching** have been observed in previous experiments. **Ingestion** of microplastic took place in many studies, as well as **egestion**. As a sign of stress, corals tend to produce **more mucus** or **retract their polyps.**

Corals in experimental tank (control group without microplastic)



Corals exposed to high densities of microplastic

Coral morphology – their growth pattern and structure – may affect responses to microplastic exposure. All of these physiological responses – ingestion, egestion or mucus production – require energetic costs. In two separate studies, researchers documented the corals reaction to varying degrees of microplastic exposure:

Experiment 1:

Are corals able to reject microplastic at the same rate as natural sediment?
(with realistic microplastic concentrations)

- Dr. Sonia Bejarano

Experiment 2:

Will corals incorporate microplastic into their calcareous skeleton?
(with heightened microplastic concentrations)

- Florian Hierl

Both these projects provide insights into the impact of microplastic on calcification, which is the basis for skeleton growth and sedimentation potential.

Microplastic exposure experiments

Two studies were conducted at ZMT to understand microplastic exposure effects on coral physiology. **Experiment 1** exposed branching corals (*P. damicornis, S. pistillata*) to **realistic concentrations** of microplastic particles (*Dr. S. Bejarano*). **Experiment 2** exposed branching (*S. hystrix, P. damicornis, A. valida*) and plating (*M. capricornis*) corals to **very high densities** of microplastic particles (*F. Hierl*). While **branching corals** develop multiple tree-like branches in different directions, **plating corals** are mostly flat and wide in appearance, providing a larger surface for microplastic contact.

In his study, Florian Hierl documents, that corals did incorporate microplastic particles into their skeleton. Also, one of the coral species (*S. hystrix*) showed heightened mucus production during the start of the experiment, indicating a possible stress reaction.

Dr. Sonia Bejarano observed significantly more polyp retractions (also indicating physiological stress) during single pulse microplastic depositions. Contamination of calcareous reef sediments with microplastics did not retard corals' sediment clearing rates.

When she exposed corals to micro-zooplankton mixed with microplastic, polyps fed preferentially on zooplankton. Also, feeding on microplastic still occurred, but significantly decreased when no zooplankton was present. However, with most microplastics being rapidly egested, they may cause no serious long-term interference to natural coral feeding function.

Florian Hierl is a geoscientist, currently part of the work group *Geoecology and Carbonate Sedimentology*. He started working with plastic as part of his doctoral studies, to investigate the impact of microplastic pollution on sedimentation and biomineralization processes.

Dr. Sonia Bejarano is a coral reef ecologist and the work group leader of *Reef Systems*. Her work on plastics extends her understanding the functional morphology of organisms.

References

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»Today, there are at least two big issues in nature: Climate change and pollution.« - Florian Hierl

What did we learn?

- Corals **react differently** to varying amounts of microplastic, but many show **visible signs of stress,** even under realistic concentrations
- Corals **incorporate microplastic** into their skeleton
- Microplastics seem to be **treated similar to sediments**, as long as natural sediment is present
  - → Corals **reject it easily**
  - → Corals do not actively avoid microplastic contact
- Corals in severely polluted areas might be more likely to be impacted by microplastic

»Is microplastic more important than other pollutants?«
- Dr. Sonia Bejarano

Take-home messages

→ **Many studies describe a negative response (ingestion, tissue necrosis, disease, bleaching, stress, etc.) to microplastic contact**

→ **Two recent ZMT projects document, that the corals wellbeing was not severely affected by microplastic contact, but two species showed signs of stress**

→ **The impact of microplastic exposure differs between species and microplastic concentrations**

→ **The role of microplastic pollution – especially compared to other environmental stressors – remains unclear and needs more investigation**

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