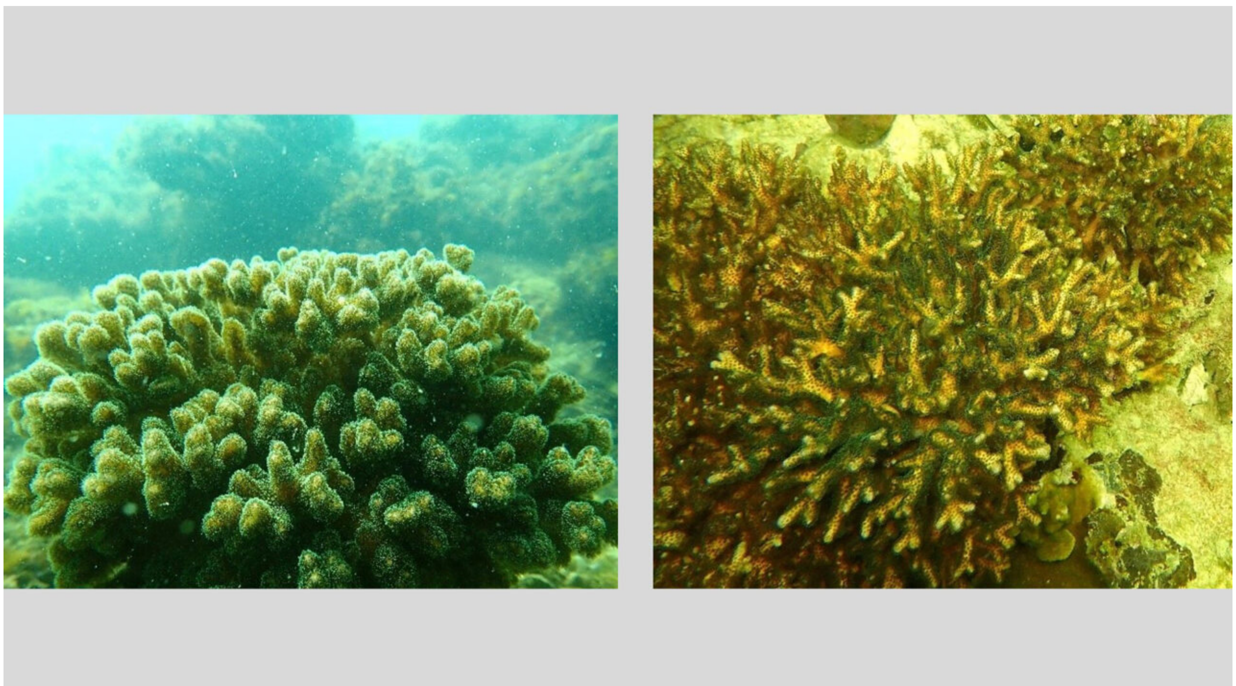
Uncovering microplastic dynamics and patterns in coastal habitats

September 9 2024



Pocillopora acuta compact (left) and open (right) morphologies. Credit: Janine Ledet and Rachel Mark

Microplastics have raised concerns among scientists and the public in recent years due to their widespread presence and associated health risks. They have been found in every corner of the planet, from mountain peaks to the deep sea, and in the diets of many organisms, including humans.

A significant portion of microplastic pollution originates from land-based sources, such as mismanagement of waste and shedding of microfibers from textile and domestic industries. These tiny particles travel through multiple pathways and eventually enter the ocean, posing risks to marine organisms and habitats.

Singapore is home to several coastal habitats, such as coral reefs and seagrass beds. Many scientists suggest that these habitats act as microplastic traps because corals and seagrasses reduce water flow, encouraging the deposition of microplastics from the water column into the habitats and limiting the resuspension of already deposited particles.

Additionally, coral reefs and seagrass beds, being transitional environments between land and the sea, intercept the transport of microplastics from land to the ocean.

A team of marine ecologists, led by Associate Professor Peter Todd from the Department of Biological Sciences at NUS Faculty of Science, is contributing to our understanding of the fate and distribution of microplastics in local seagrass beds and coral reefs through three scientific journal publications released in 2024.

Seagrass as microplastic traps: Height matters

In a study published in *Marine Environmental Research* in May 2024, the team examined the distribution of microplastics across areas with varying levels of vegetation within seagrass beds at Chek Jawa and Changi Beach.

Upon studying the sediment samples, the team found that the seagrass beds in Singapore do not trap more microplastics compared to adjacent non-vegetated beds, regardless of vegetation density. These findings challenged previous assumptions about the role of seagrass in trapping microplastics.

The researchers proposed that vegetation height could be a crucial factor. Seagrass species in Singapore, such as Halophila ovalis, Halophila spinulosa, Halodule uninervis and Cymodocea rotundata, form a short canopy height ranging from 2 cm to 15 cm.

In contrast, seagrass species found in other regions, such as Enhalus acoroides and Zostera marina, can grow up to 150 cm. Height is of significance because taller vegetation not only reduces water flow and wave height, but also provides a greater surface area for biofilms to grow. These biofilms form sticky surfaces that microplastics can adhere to.

The NUS researchers then concluded that the presence of seagrass beds does not necessarily imply greater abundance of microplastics in the environment, as other factors such as vegetation height should also be taken into consideration.

Microplastic trapping by corals: The role of colony shape, structure and surface texture

In another study published in *Science of the Total Environment* in April 2024, the NUS team investigated the trapping of microplastics by a local branching coral species, Pocillopora acuta.

Previous research suggested that structural complexity and surface roughness of benthic-forming organisms play a role in trapping microplastics. Corals are one of the most structurally complex marine organisms. They exist in many morphologies ranging from branching to dome-shaped forms.

Within the species, the branching coral Pocillopora acuta can vary in the thickness of their branches and the proximity between the branches, forming compact and open branching morphologies.

While it is known that corals trap more microplastics than other benthic-forming species such as seagrass and algae, there is limited information on the role of coral morphology and surface roughness (conferred by the micro-skeletal structures and polyp actions) in trapping microplastics.

To fill this knowledge gap, the team conducted experiments in a saltwater flume at the Marine and Freshwater Facility at NUS. They discovered that while corals with compact morphologies trap more microplastics, there was no difference in microplastic trapping across varying levels of surface roughness.

In recent years, there has been an observed shift in the morphology of branching corals towards more compact arrangements due to their resilience against climate-change effects such as rising sea temperatures and an increased frequency of tropical cyclones. However, these corals, as well as coral reefs with a higher composition of such coral morphology, are also at a higher risk of microplastic pollution because they trap more plastics.

As part of their research, Assoc Prof Todd and his team compiled an inventory of existing and self-designed plastic-less equipment to assist in collecting samples for environmental microplastic monitoring, as they are mindful that using plastic equipment could potentially introduce contaminants through abrasion.

Their findings were published in *Frontiers in Marine Science* in February 2024. Using their plastic-less equipment, the team sampled coral reef beds and associated organisms in Singapore to understand microplastic distribution in coral reef environments and food webs.

Todd said, "It is predicted that the level of microplastic pollution will increase in the coming years. Understanding the current fate and distribution of microplastics will not only provide insight into the habitats at greater risk of pollution in the future, but also feed into analyses of the impact of this pernicious pollutant."

More information: Janine Ledet et al, Trapping of microplastics and other anthropogenic particles in seagrass beds: Ubiquity across a vertical and horizontal sampling gradient, *Marine Environmental Research* (2024). DOI: 10.1016/j.marenvres.2024.106487

Li Peng Yen et al, The effect of coral colony morphology, coral surface condition, particle size, and seeding point on the trapping and deposition of microplastics, *Science of The Total Environment* (2024). DOI: 10.1016/j.scitotenv.2024.171077

Peter A. Todd et al, Plastic-less equipment for sampling marine microplastics, *Frontiers in Marine Science* (2024). DOI: 10.3389/fmars.2024.1345591

Provided by National University of Singapore

Citation: Uncovering microplastic dynamics and patterns in coastal habitats (2024, September 9) retrieved 9 September 2024 from https://phys.org/news/2024-09-uncovering-microplastic-dynamics-patterns-coastal.html