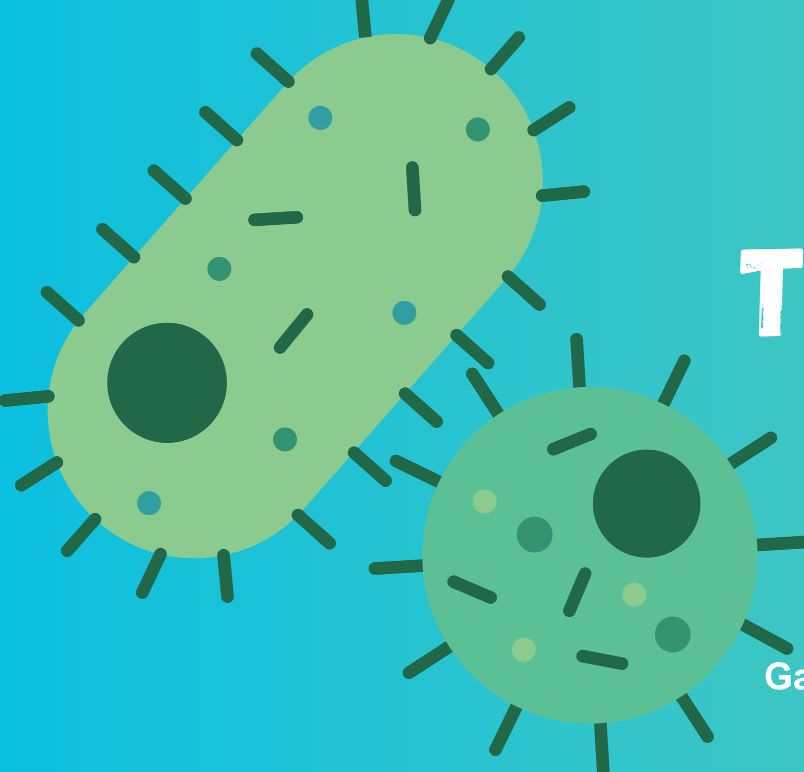

THE UNSEEN WORLD: PLASTIC'S BACTERIAL COLONIZERS

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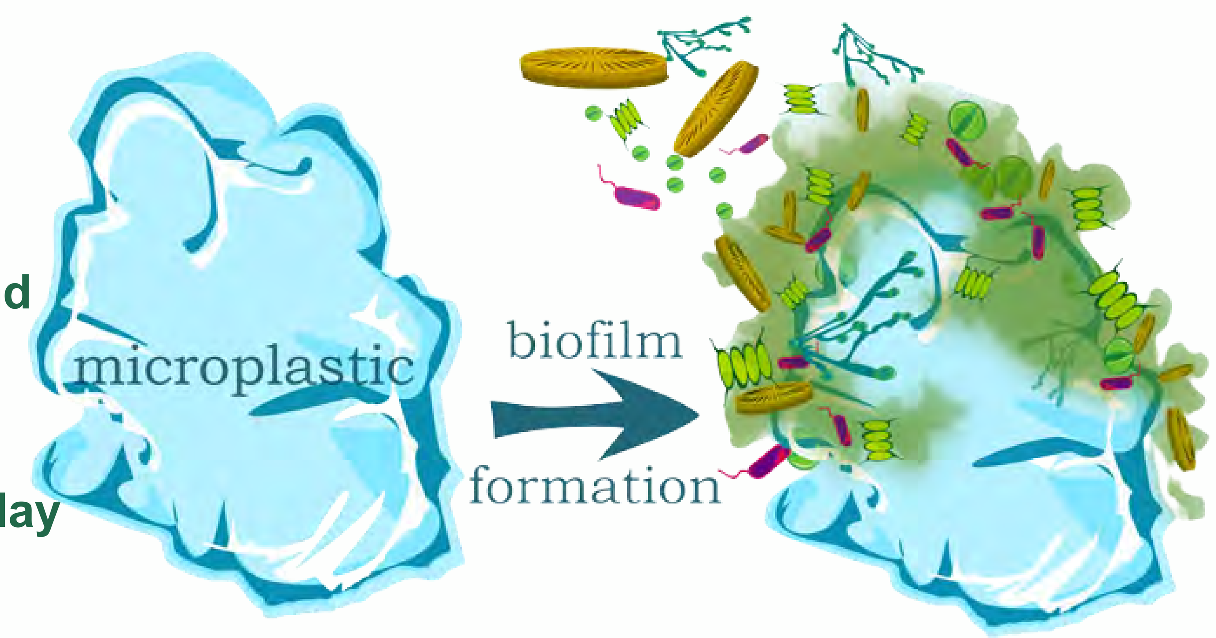
Introduction

Microplastics are of great environmental concern, due to their potential toxicity for aquatic environments. Recent studies have revealed evidence of microorganisms thriving on microplastics and thus, prefer to attach themselves to the plastic polluters, known as the "plastisphere". This has resulted in an increasing curiosity about the role bacteria and other microorganisms play in the degradation of plastic pollution found in marine environments. Biofilms on microplastics can create complex interactions and ecological implications, as they can facilitate the transfer of microplastics up the food chain and introduce contaminants into marine and terrestrial ecosystems. Furthermore, biofilms on plastic pollutant surfaces play a key role in the degradation process in marine environments [2,5] Biofilms are a structured system which facilitates metabolic interactions between cells.



Biofilm attachement on plastic

A study forming part of the MAPLE project at NTNU, Trondheim, Norway, explored the colonization rate of biofilm successions on plastic debris in marine ecosystems in Trondheimfjords.

Figure 1. Virgin HDPE (white) and colonized (brown) HDPE plates.

The experiment investigated the colonisation rate dynamics on high density polyethylene (HDPE) plates at varying timescales (Figure 1).

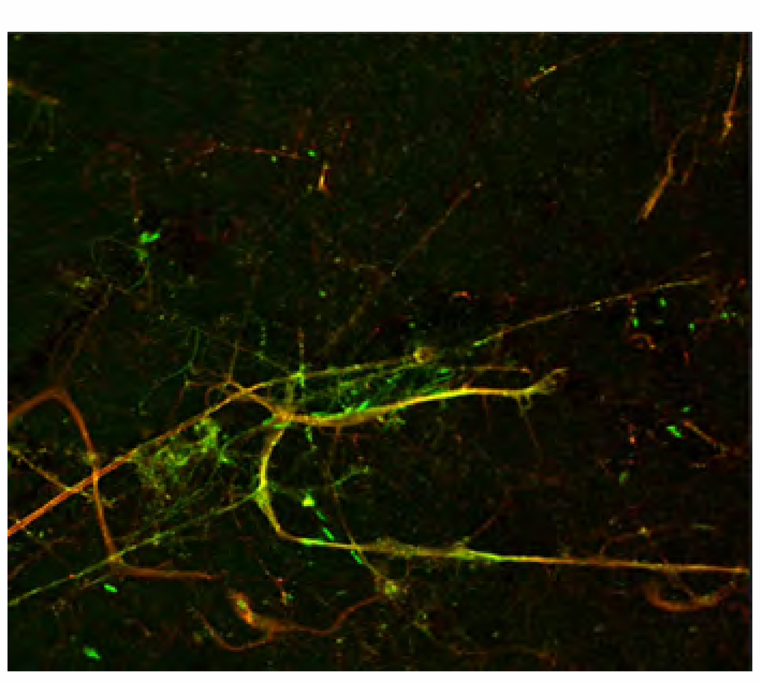


Figure 2: **Confocal laser scanning microscopy** (CLSM) using a BacLight Biofilm viability kit (Invitrogen) for bacterial cells.

Represents filaments, which correspond to the dye. Green dyes correspond to viable microbial colonies (alive), and red dyes correspond to nonviable microbial colonies (dead) on the surface of the plastic.

Polyethylene bottle found at Froya, Sor-Trondelag during a clean-up. Biofilm formation is present both internally and externally on the bottle. Thereby posing a health risk as these plastic bottles acts as a survival mechanism for disease causing bacteria in the environment.

Figure 3. Biofilmformation on PE bottle.

Microbial diversity on plastics

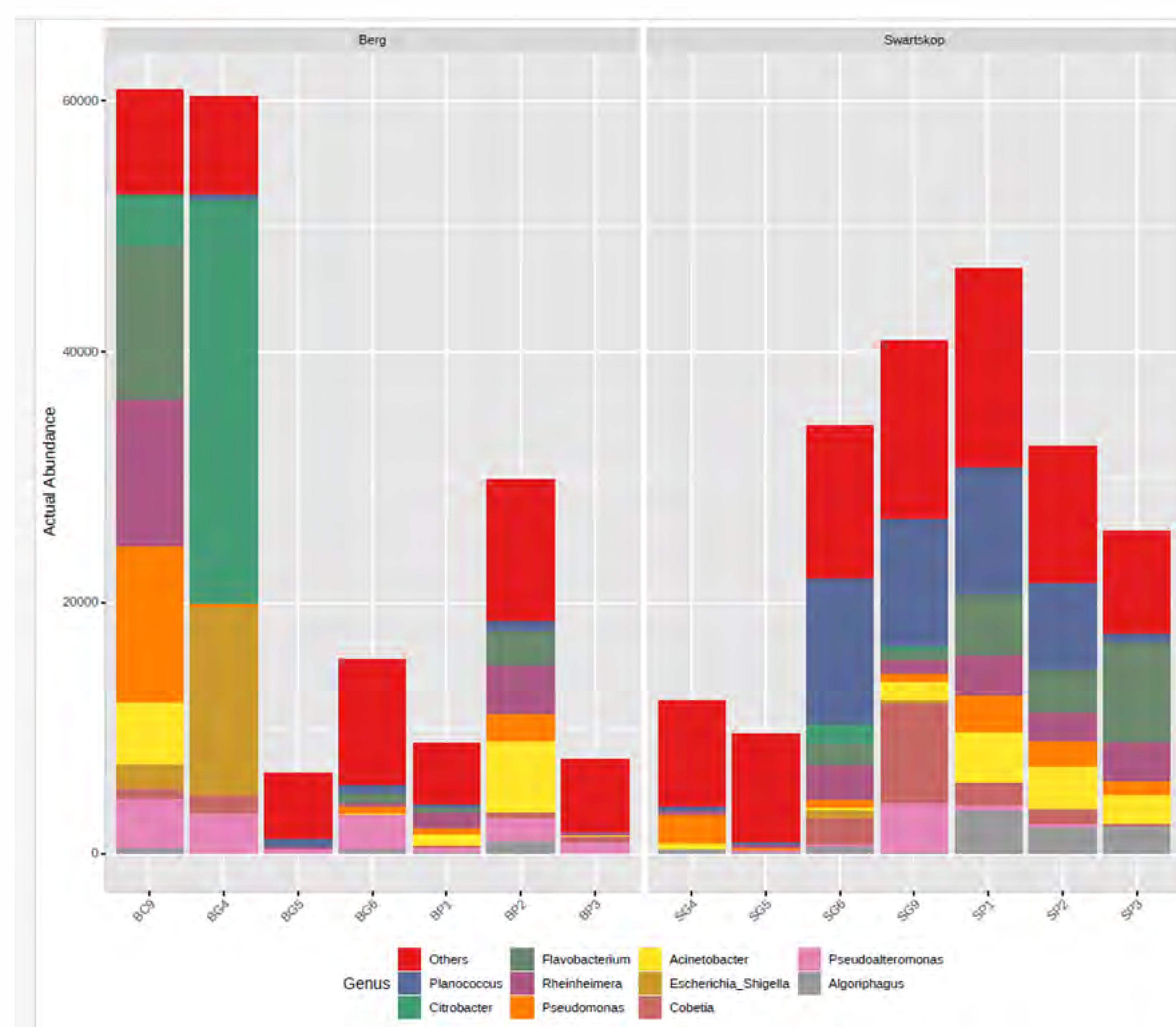


Figure 4 Stacked bar plot showing the relative abundance of the microbial community on plastics from the Swartkop and Berg Estuary.

- Research on biofilm colonizing microplastics is still underway on the African continent, with knowledge gaps still prevalent in South African estuarine systems.
- This research showcases the microbial communities on plastics from two estuaries in South Africa, namely: Swartkops Estuary (Indian Ocean and high pollution) and Berg Estuary (Atlantic and low pollution). Litter along the banks of the estuaries were collected for the experiment.
- These included 3 glass bottles, 3 tin cans and 3 cigarette wrappers.
- Evaluation of microbial communities showed *Planococcus*,*Citrobacter*, *Flavobacterium*, *Rheinheimera*, *Pseudomonas*, *Acinetobacter*, *Escherichia_Shigella*, *Cobetia*, *Pseudoalteromonas* and *Algoriphagus* to be the top 10 most dominant genus.

New developments

- Bacteria responsible for bacterial plastic-mediated degradation includes *Bacillus*, *Rhodococcus*, *Enterobacter asburiae* and *Bacillus gottheilii.*
- An important finding has found that using a variety of microorganisms to form a stable microbial community aids in eliminating the effects of toxic metabolites toward MP-degrading bacteria.
- Conditions need optimization to shorten the degradation process and increase the rate of bacterial plastic-mediated degradation of MPs. This aspect is highly complex, and the current understanding of the effects requires further research.

Acknowledgements

We acknowledge, Prof Murat V. Ardelan (NTNU) for assistance in the project conceptualization. We thank Luanne Thomas (UWC), Logan Londt (UWC), and Kabelo Staenger (NWU) for their assistance with sample collection and project design in the biofilm study. We thank Gabrielle Haeberli, for her contribution towards the biofilm visualization study. We would like to thank SST and NTNU for giving us this opportunity.