Investigating the Plastisphere: Understanding opportunities and threats of bacteria on plastics in South African estuaries

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1

Introduction

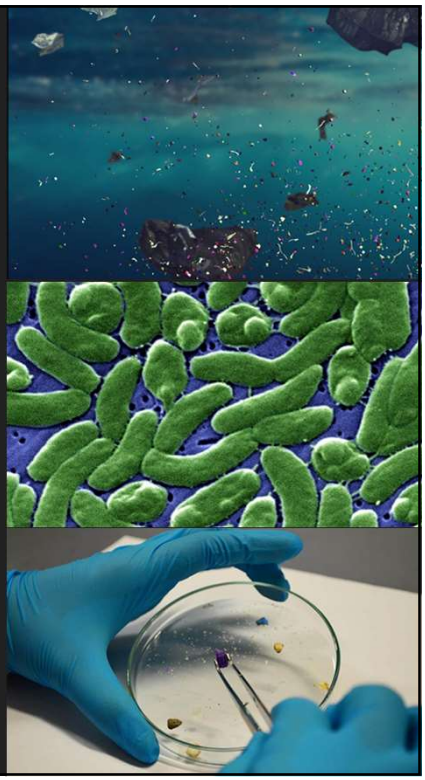
- Plastics found in all ecosystems
- Unique plastics characteristics
- Detrimental effects on marine life
- Macroplastics become microplastics

2

Introduction

- Microorganisms thrive on plastic debris

  = Plastisphere
- Plastic debris as a vector for pathogens
- Estuaries are a pollution sink



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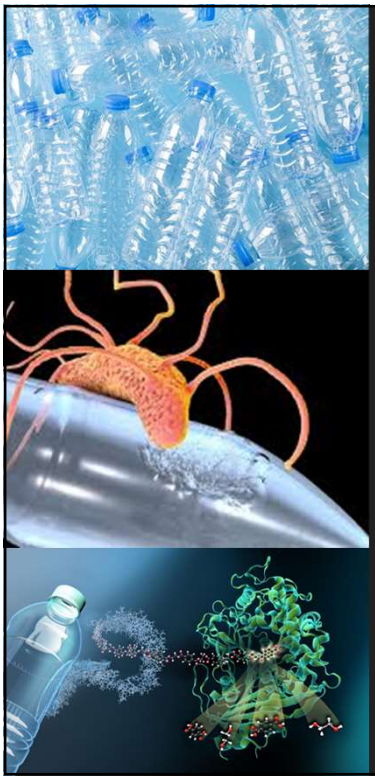
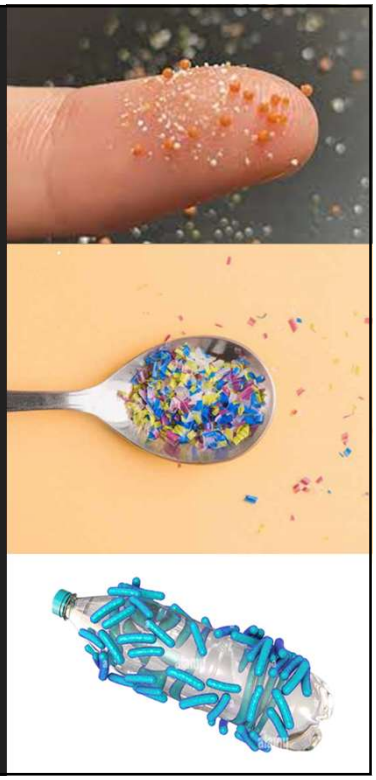


Introduction

- Macroplastics can be removed but microplastics

  cannot be
- Biofilm formation forms a key role in degradation
- Lack of research in South Africa



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Research Aim

This study aimed to determine the potential threats and opportunities of microbial communities on plastic debris across two biogeographical regions in South Africa. In Addition to determining the potential impacts of physico-chemical parameters and climatic conditions on bacteria colonization.

5

Study Sites

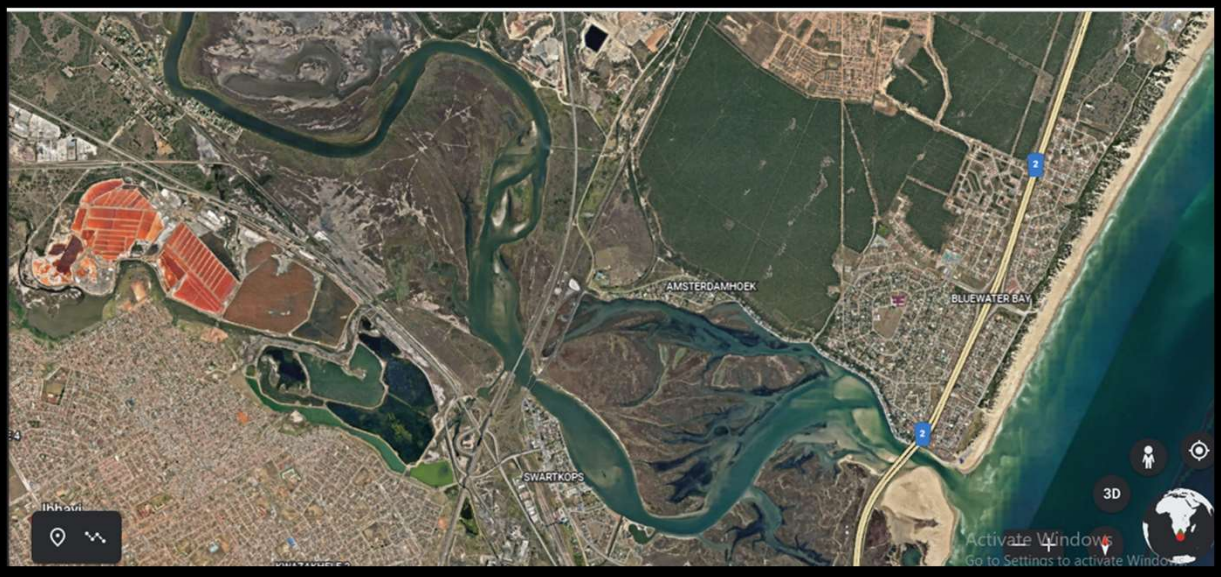


Figure 1: Swartkops Estuary

6

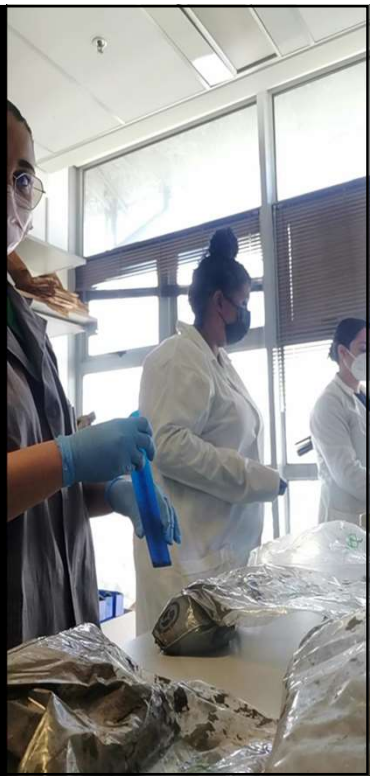
Study Sites

Figure 2: Berg river estuary

7

ORIGINAL METHODOLOGY

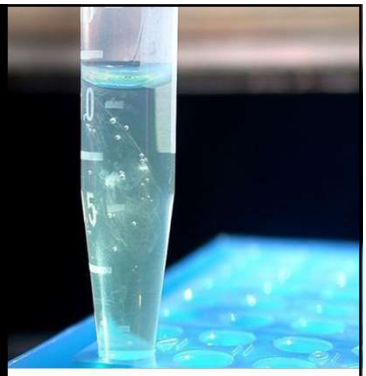
- Triplicate Substrates
- Water and Sediment
- PhYs/Chem in-situ



8

ACTUAL METHODOLOGY

- Triplicate Litter collection
- Water and Sediment
- Phosphate, Om and OC
- DNA extraction
- sequencing
- literature review



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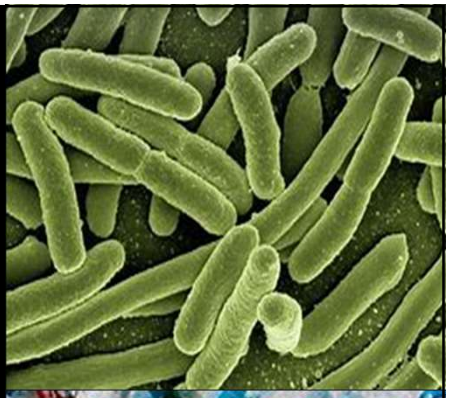
Results and discussion

- Data in SA is scarce
- Expected varying microbial communities
- Differences were related to climate conditions
- Physicochemical parameters have an effect on bacterial distribution



10

Results and discussion

Table 1: Physicochemical parameters taken for both the Berg and Swartkops Estuary.

Parameter	Swartkops Estuary	Berg Estuary
Salinity (ppt)	37 ± 2.16	35 ± 0.52
Phosphate (mg/L)	1 ± 0.77	1 ± 1.08
Sediment Moisture Content (%)	22 ± 7.50	24 ± 1.49
Sediment Organic Matter (%)	3 ± 1.06	3 ± 1.91
Particle size (%)	75 ± 15.96 *(sand)* 19 ± 2.12 *(silt)* 6 ± 4.91 *(clay)*	26 ± 28.67 *(sand)* 0.5 ± 0.27 *(silt)* 13 ± 6.01 *(clay)*

11

Results and discussion

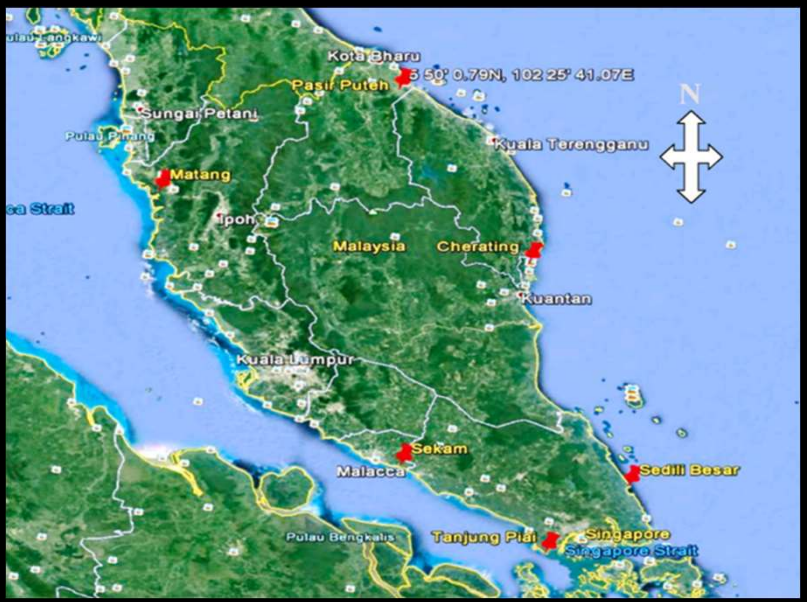


Figure 3: A geographical map showing the sampling sites used in Malaysian studies (marked red) and locations (Auta et al., 2022)

12

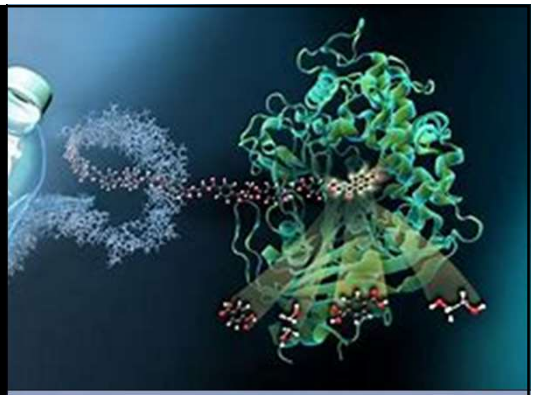
Table 2: Literature review of bacterial colonization on plastic debris across different states in Malaysia.

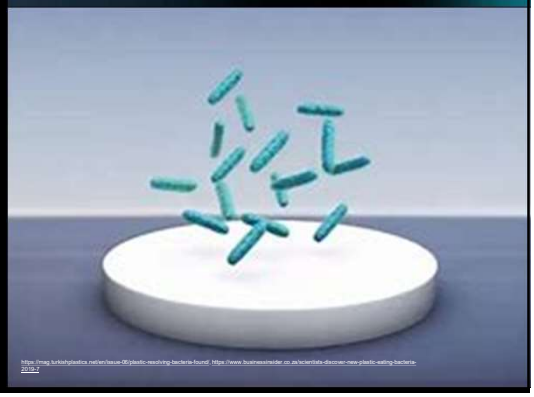
Country	State	Source	Bacteria	MP type	Degradation	Reference
Malaysia	Perak, Pahang, Johor, Malacca, Kelantan	Mangrove sediment	*Bacillus cereus*, *Sporosarcina globispora*	Polypropylene (PP)	Present Present	Helen et al., 2017
Malaysia	Perak, Pahang, Johor, Malacca, Kelantan	Mangrove sediment	*Bacillus cereus*, *Bacillus cibi*, *Acinetobacter Schindleri*, *Bacillus gottheilii*, *Bacillus pseudomycoides*, *Bacillus stratosphericus*, *Bacillus aquimaris*, *Stenotrophomonas maltophilia*	Polypropylene (PP) Polyethylene terephthalate (PET) Polystyrene (PS)	Present – – Present – – – –	Auta et al., 2017
Malaysia	Perak, Pahang	Mangrove sediment	Bacillus sp. strain 27, Rhodococcus sp. strain 36	Polypropylene (PP)	Present Present	Auta et al., 2018
Malaysia	Perak, Pahang	Mangrove sediment	*Bacillus* cereus, *Alcaligenes faecalis*, *Bacillus*sonorensis, *Staphylococcus epidermidis*, *Bacillus*vietnamensis, Rhodococcus ruber, *Bacillus*flexus, *Sporosarcina* globispora, *Bacillus*gottheilii	Polyethylene terephthalate (PET) Polystyrene (PS)	Present – Present (PS ONLY) Present Present – Present Present Present	Auta et al., 2022

13

Conclusion

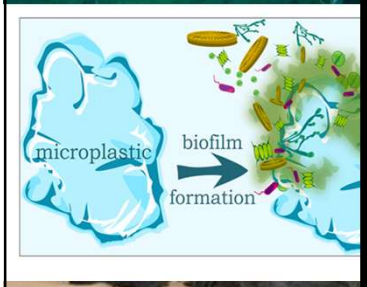
- Limited land space for plastic disposal
- Biodegradation is an ecofriendly approach
- Microbes could provide solution for plastic remediation





https://mag.turkishplastics.net/en/issue-08/plastic-resolving-bacteria-found/ https://www.businessinsider.co.za/scientists-discover-new-plastic-eating-bacteria-2016-2

14

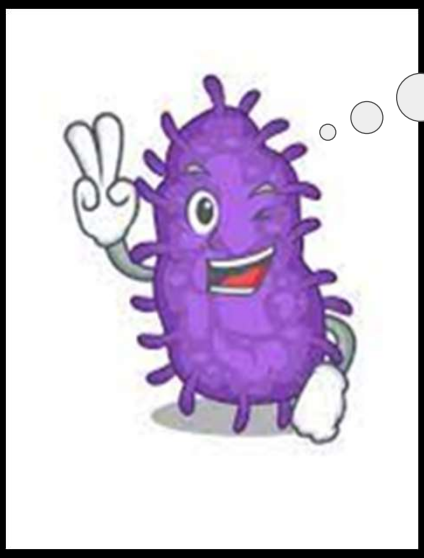


Limitations and improvements of study

- Time constraints
- The vegetation of the systems was most likely not conducive to retaining the litter
- Equipment and software limitations
- Longer study period
- Multiple systems
- Perhaps seasonal replications

15

Thank you for listening



16