Microplastics in Mauritius Waters

18th October 2021

Avin Ramanjooloo

Scientific contributions: Yashvin Neehaul, Anishta Audit-Manna, Namrata Reetoo, Reeya Oogarah, Prerna Roy Preeti Oogarah, Dr. Danishta Dumur-Neelayya, Sarvanen Curpen, Dr. Manvendra Singh

OVERVIEW OF PRESENTATION

- **Background (Plastic pollution and Microplastic)**
- **Research by MOI on Microplastic**
- **Way forward**

PLASTIC POLLUTION: A GLOBAL PROBLEM

- Ocean Plastic pollution is the most severe environmental problem
- ~ 12.7 million tonnes of plastic are in our oceans
- Prediction of there being more plastic than fish by 2050
- Serious problem directly effecting our eco-system and its health
- 5% of plastics are recycled effectively, while 40% end up in landfill and a third in fragile ecosystems such as the world's oceans

Material:	Degradation rate:
Plastic beverage holder	400 years
Plastic bag	Up to 1000 years
Plastic bottle	100-1000 years
Synthetic fabric	500 years
Foam cup	50 years
Fishing line	600 years
Polystyrene case	100 – 1000 years

MICROPLASTIC

- Plastics in the marine enviromment undergo fragmentation to form micro/nanoparticles.
- Two types: primary (enter the marine environment in their “micro” size) and secondary (breakdown of larger plastic)
- Microplastics can accumulate harmful pollutants from the surroundings thereby acting as transport vectors
- Can leach out chemicals (additives)
- 54.5% of microplastics floating in the ocean are polyethylene,
- 16.5% are polypropylene, and the rest includes polyvinyl chloride, polystyrene, polyester, and polyamides.

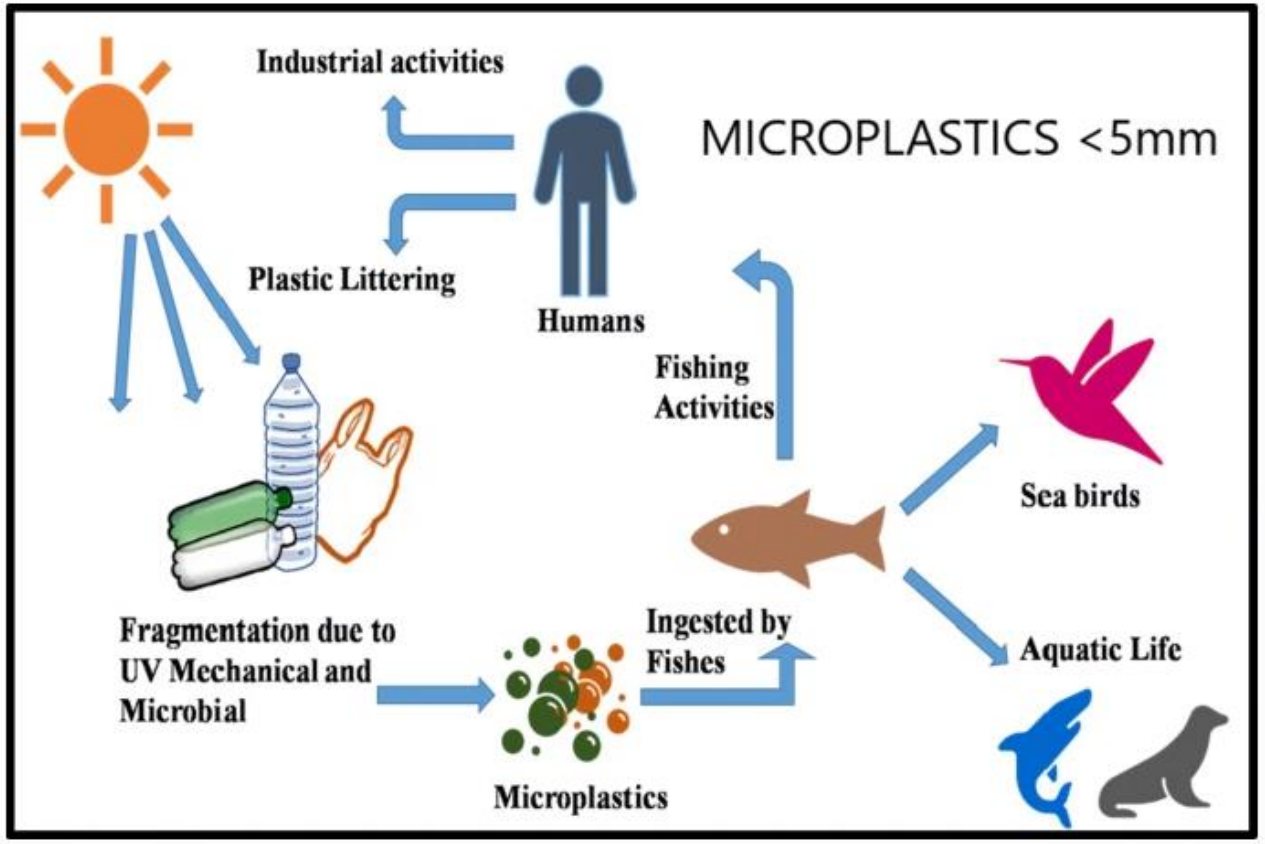
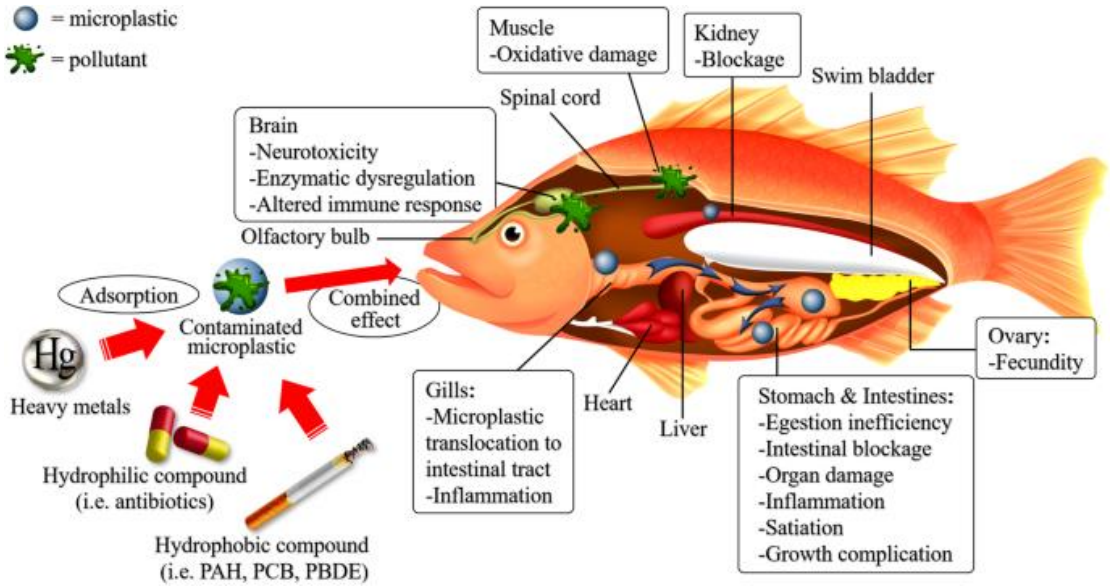
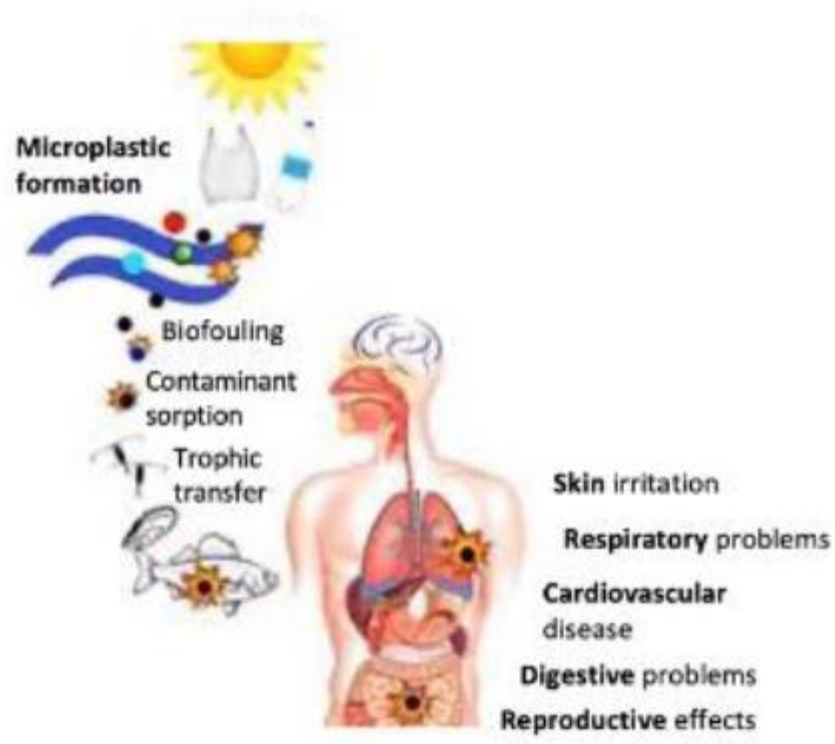


Fig 2: Effect of microplastic in water and aquatic system (Issac *et al 2021*)

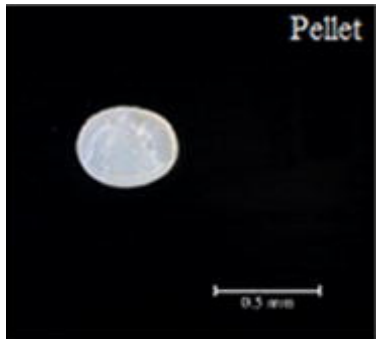
EFFECTS OF MICROPLASTICS ON HUMAN



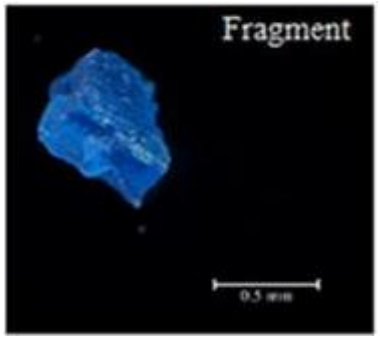


CATEGORISATION OF MICROPLASTICS

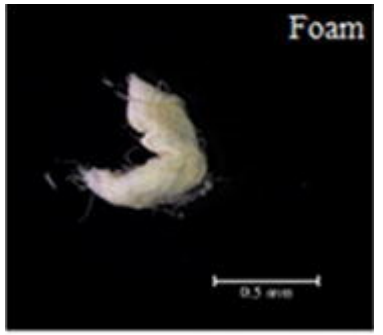
- Plastic
  - Solid
    - Smooth
    - Irregular
  - Flexible
    - Round
    - Thin & Large
    - Long



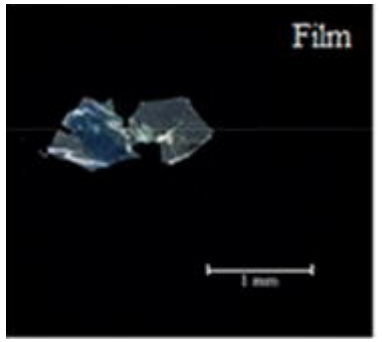
Sources
Cosmetic, toothpaste



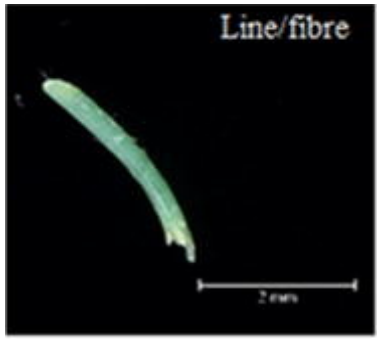
Sources
Polyethylene terephthalate (PET), High-densitypolyethylene (HDPE), Low density polyethylene (LDPE),Polyvinyl chloride (PVC), Polypropylene, Polystyrene



Sources
Polystyrene, Polyethylene



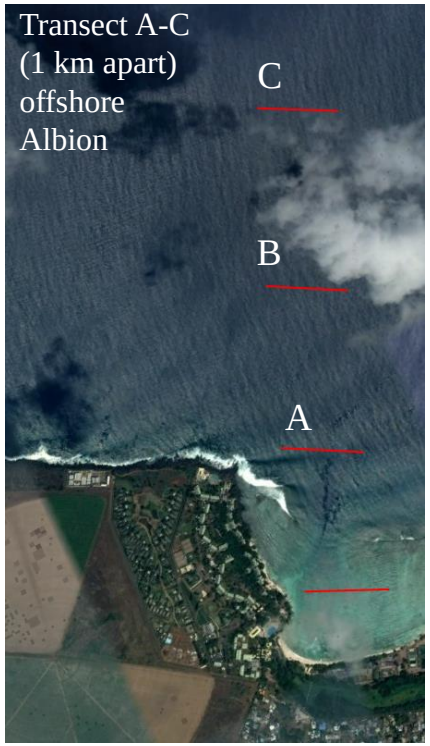
Sources
High-density HDPE, Low density LDPE



Sources
Nylon rope, clothing, diapers,
cigarette butts

RESEARCH BY MOI

- Project: Experimental approach in evaluating the distribution and the characterization of microplastics in Mauritius waters (2017-2019)
- This investigation directly addresses the Sustainable Development Goal 14 of the UN, *Target 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution* with the critical *indicator 14.1.1: Index of coastal eutrophication and floating plastic debris density*
- Development of sampling methodology (At Albion): *A plankton net (mesh size 20 µm) is towed along a defined transects to collect surface plastic samples*



ANALYTICAL PROCEDURES

Collected water samples

Digestion

Mixture heated

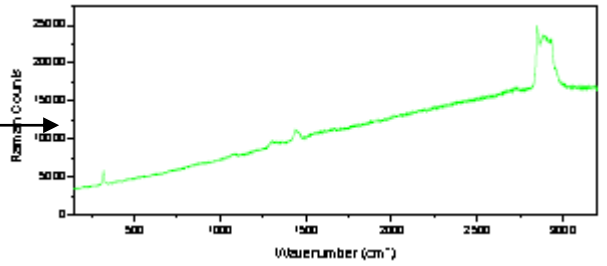
Removal of microplastic by density separation

The supernatant is filtered onto a gridded membrane (0.2 µm pore size).

Gridded membrane allows to count number of particles

Observed by optical microscope

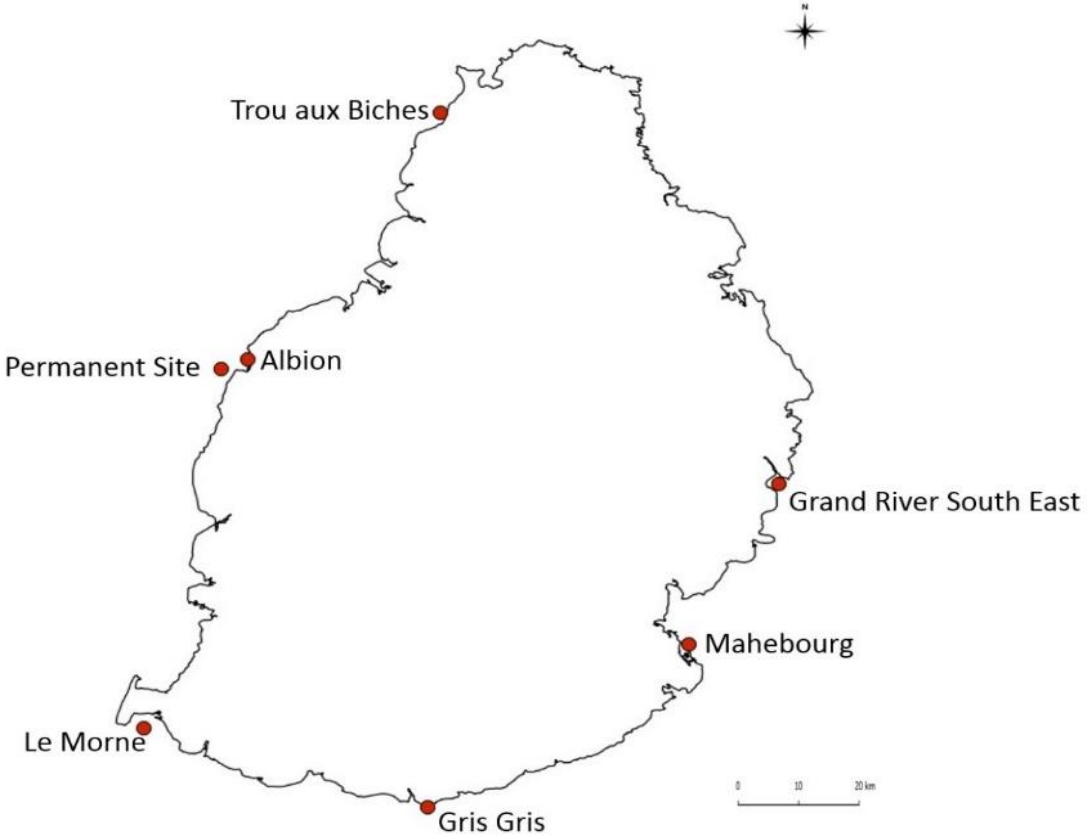
Characterisation of particles by Raman spectroscopy (Strasbourg University)

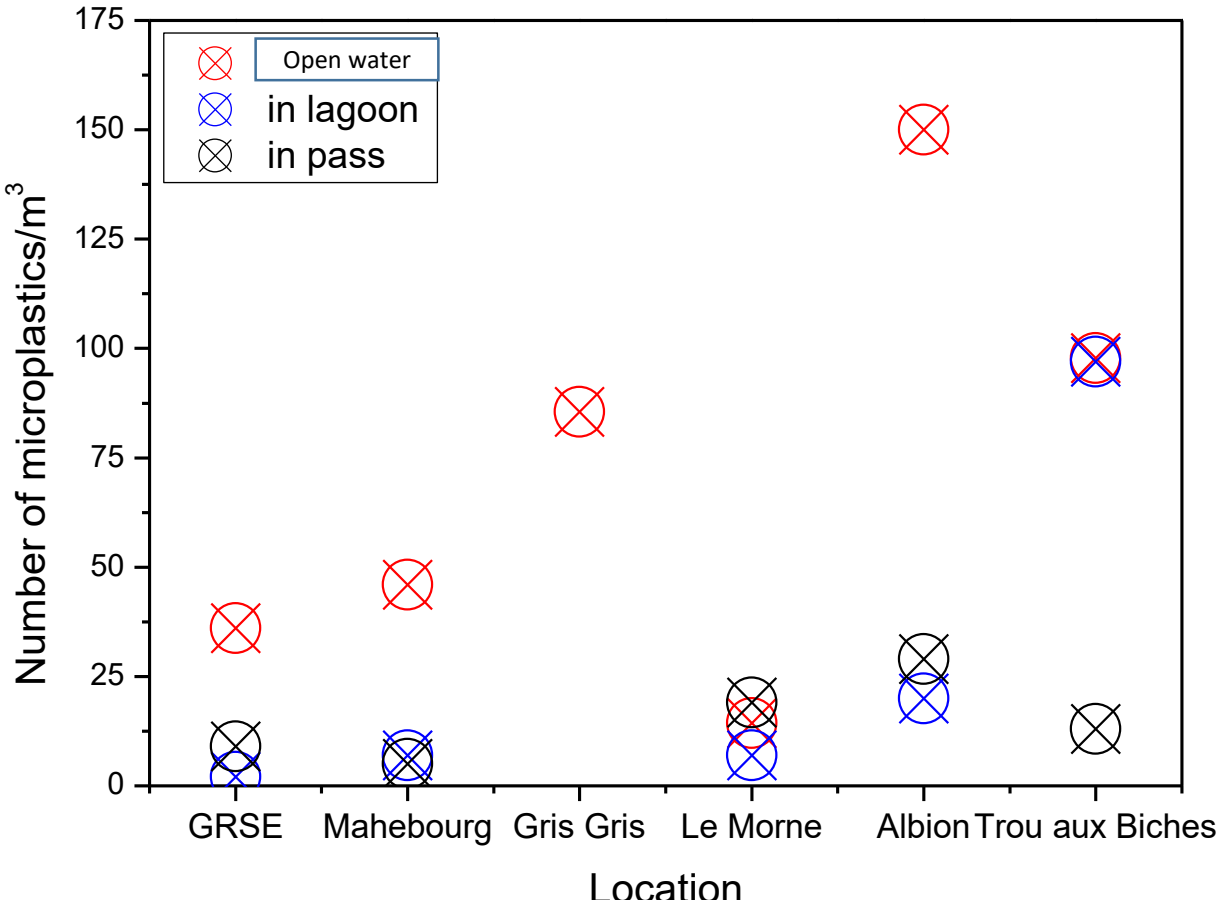


Polyethylene

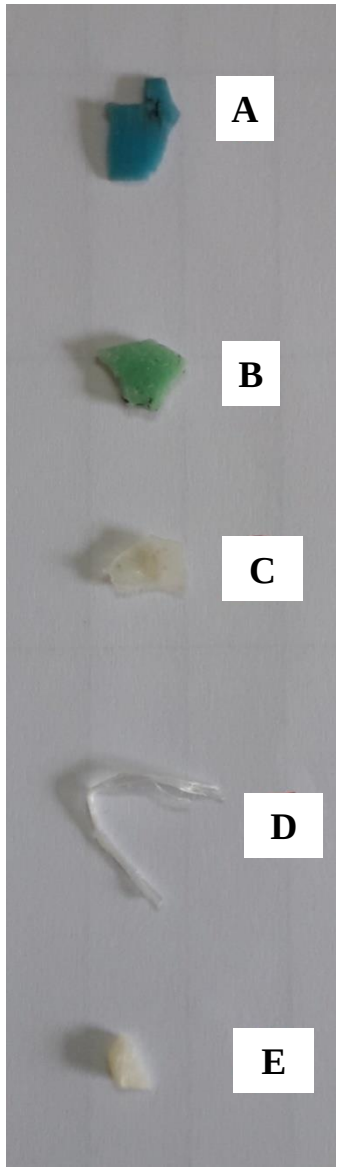
DISTRIBUTION OF MICROPLASTIC

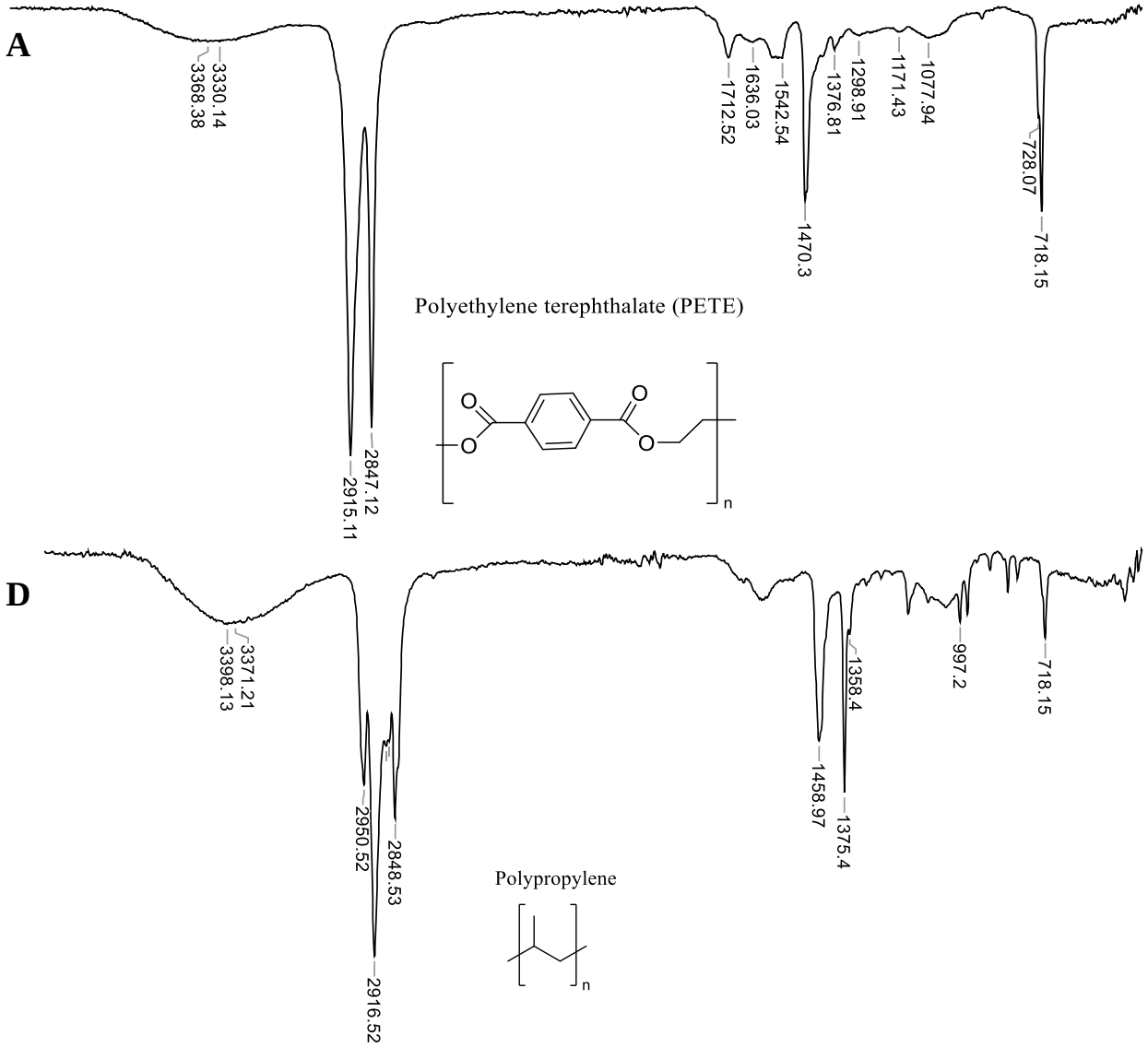
- Sites for microplastic distribution: Albion, Mahebourg, Grand River South East (GRSE), Gris Gris, Le Morne and Trou aux Biches.
- Surface water samples were collected along transects with variable lengths in the range 150 and 250 m.
- Between each sampling stations, there was an average of 1 km





EXAMPLES OF PLASTICS MARINE DEBRIS COLLECTED FROM MAURITIUS WATERS





WAY FORWARD

Project: Management instruments to limit the impact of plastic pollution on marine life

Received funds from NECCF Rs 8 M (2021-2024)

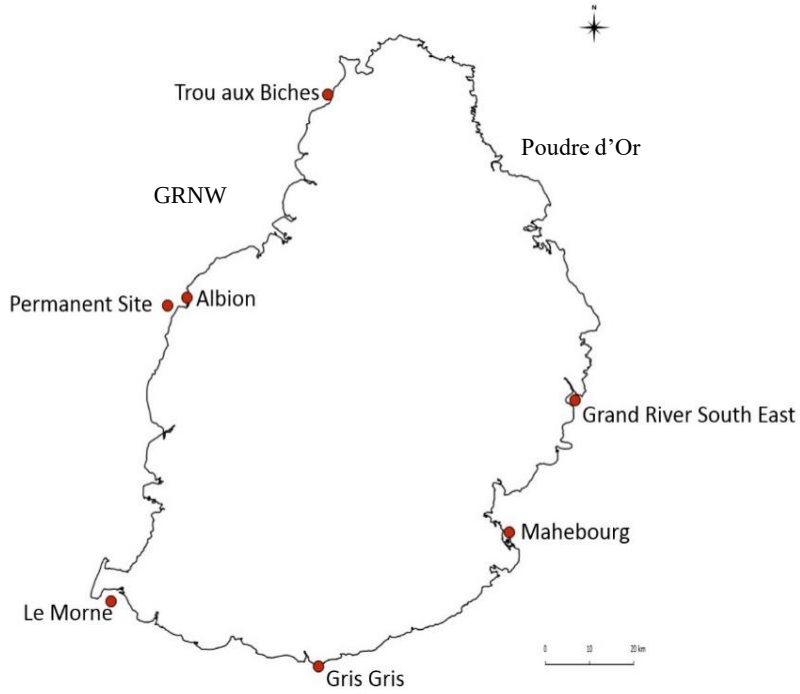
Objectives

- To design of standard method to evaluate the distribution of microplastic in the coastal and oceanic environment.
- To develop a method to extract and evaluate the amount of plastic in marine organisms.
- To evaluate the distribution of microplastics in the marine environment.
- To assess the migration of microplastics within the trophic web.
- To implement surveillance programmes of microplastic in the region of high microplastic accumulation
- To propose management instruments to control plastic pollution at sea supported by scientific data.

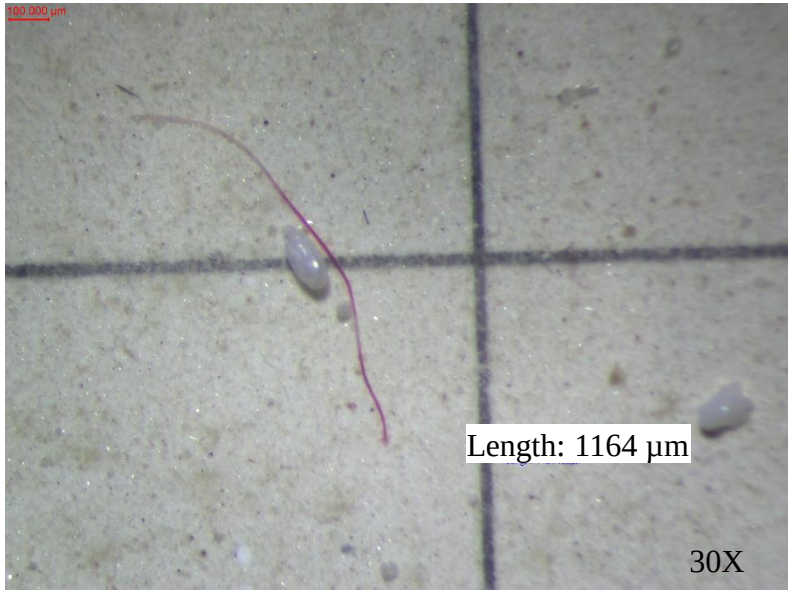
WAY FORWARD

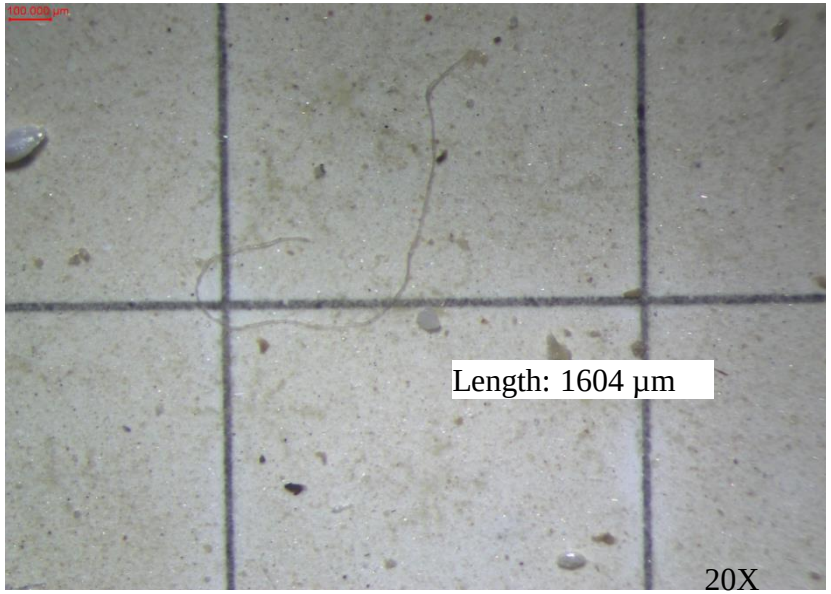
Deliverables

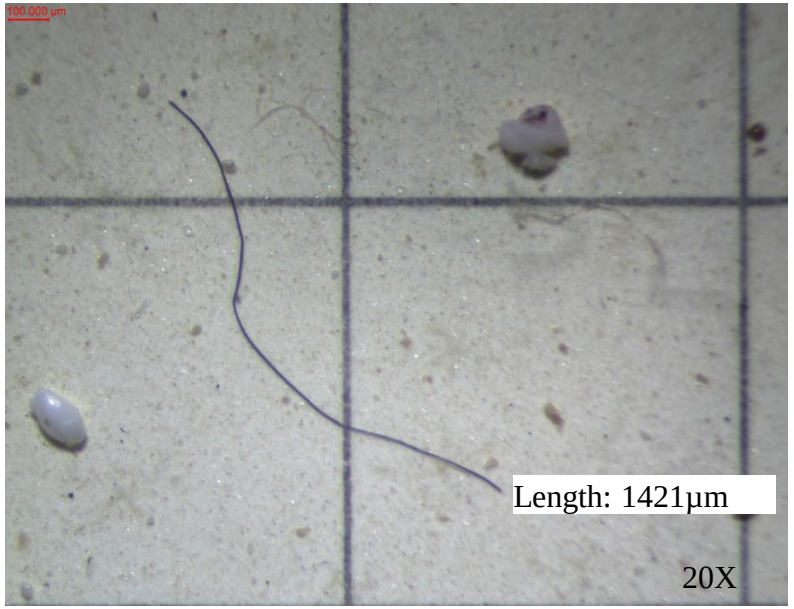
- Standard Operating Procedure developed to assess microplastics in sediments
- Standard Operating Procedure developed to assess microplastics in marine mobile and sessile organisms.
- 8 sites around Mauritius to be investigated to identify the density of plastic in the water, sediments and marine organisms.
- 5 proxy species, representative of the trophic web, to be investigated for plastic distribution.
- 3 additional surveillance stations, including beaches, to complement the existing programme.
- Management instruments proposed supported by the data collected.

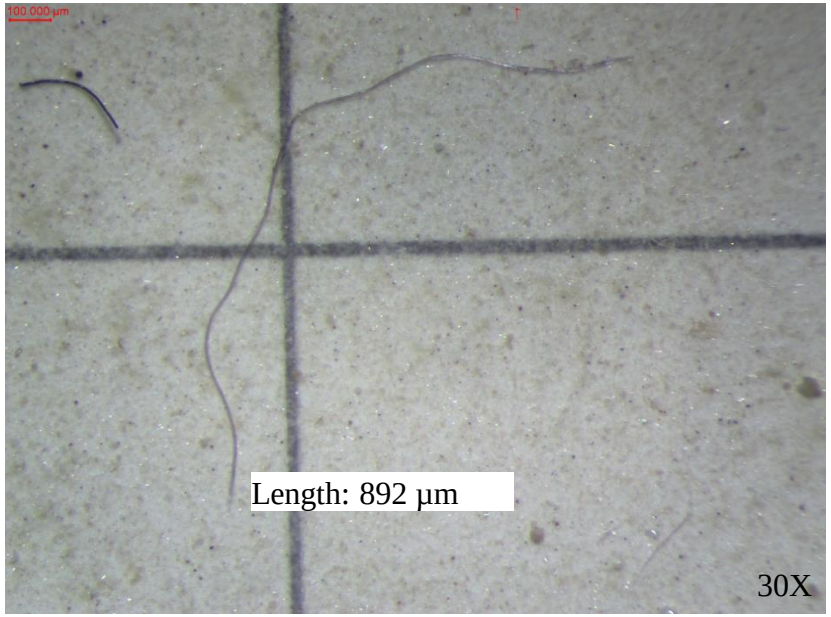


MICROPLASTIC IDENTIFIED IN ONE SEDIMENT SAMPLE





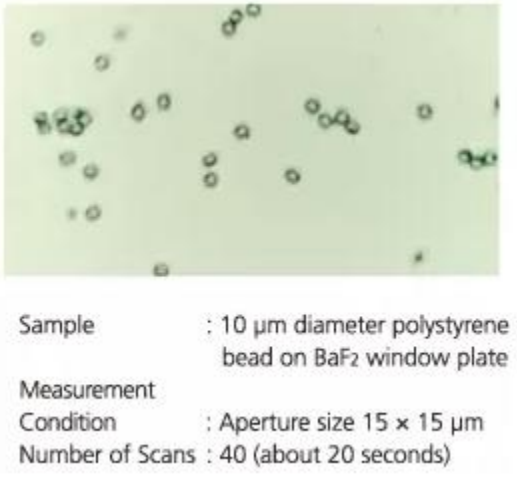


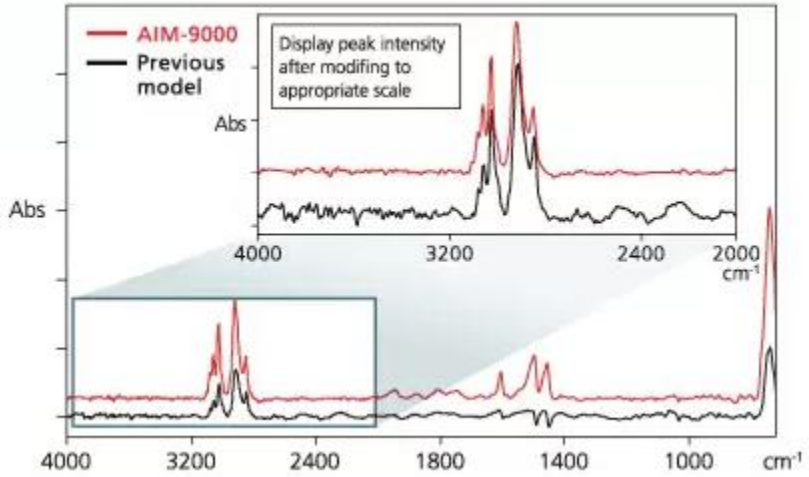


WAY FORWARD

Management instruments to limit the impact of plastic pollution on marine life

Purchase of FTIR microscope – for microplastic analysis





Acknowledgments

Ministry of Environment Solid Waste Management and Climate Change

Ministry of Ocean Economy, Marine Resources, Fisheries and Shipping

MAURITIUS OCEANOGRAPHY INSTITUTE