Microbial Oceanography Laboratory

Toolkit for Quantifying Microplastics in the Marine Environment: Sampling Methods

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Toolkit Contents

Introduction

Microplastics are small plastic particles less than 5mm in size that result from the degradation of macro-plastics in the marine environment (Arthur et al., 2009). The oceans are increasingly becoming contaminated with microplastics, posing a serious threat to marine life and ecosystems (Hale et al., 2020). Effective sampling, processing and quantification of microplastics in water and sediments is crucial to understand the extent and nature of their distribution in the marine environment, and for developing appropriate strategies to mitigate their impact (Prata et al., 2019).

This manual provides a guide to sample microplastics from water and sediments in the marine environment. The sampling procedures are designed to be accessible and replicable by researchers, policy makers and citizen scientists given the proper resources. The activities outlined in this manual are intended to be complemented with laboratory work as documented in "Toolkit for Quantifying Microplastics in the Marine Environment: Laboratory Procedures."

References

Arthur, C., J. Baker and H. Bamford (eds). (2009). Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Microplastic Marine Debris. Sept 9-11, 2008. NOAA Technical Memorandum NOS-OR&R-30.

Hale, R. C., Seeley, M. E., La Guardia, M. J., Mai, L., & Zeng, E. Y. (2020). A global perspective on microplastics. Journal of Geophysical Research: Oceans, 125(1). https://doi.org/10.1029/2018jc014719

Prata, J. C., da Costa, J. P., Duarte, A. C., & Rocha-Santos, T. (2019). Methods for sampling and detection of microplastics in water and sediment: A critical review. TrAC Trends in Analytical Chemistry, 110, 150–159. https://doi.org/10.1016/j.trac.2018.10.029

Site Selection

The beach sites for microplastics survey should be selected according to the following criteria:

Inagawan, Puerto Princesa City, Palawan

- **Sandy or pebble shoreline**
- **A minimum length of 100 m parallel to the water**
- **Low to moderate slope (15 to 45 degrees)**
- **Clear access to the sea (no breakwater or jetties)**
- **Accessible to survey teams year round**
- **Must not be part of a clean-up program (if possible)**

Note that these criteria are guidelines to allow smooth conduct of fieldwork. However, not all sites exactly align to these criteria and any deviations should be noted.

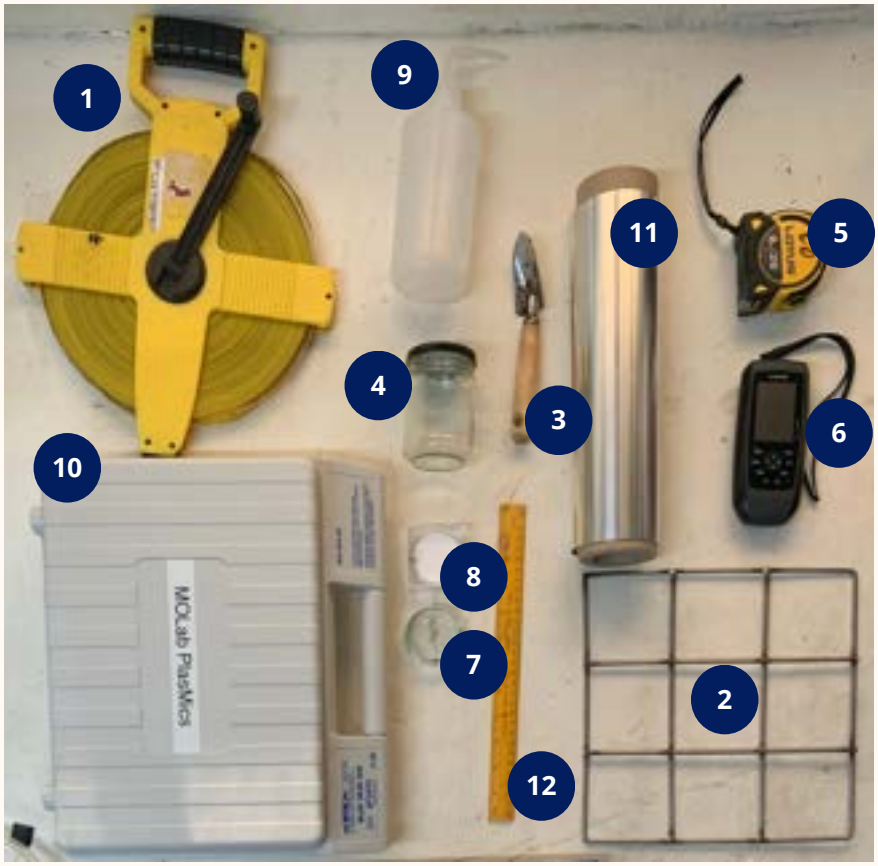
Recommended Attire

- **Cap / Hat**
- **Rash guard / arm sleeves (Cotton)**
- **Long pants (cotton)**
- **Closed non-slip shoes (preferably non-synthetic)**
- **Cotton safety gloves**
- **Sunscreen**

The use of natural-fiber based clothing decreases the amount of microplastics contamination in samples.

Materials (Sediments)

1. Surveyor's Tape
2. Quadrat (25 x 25 cm)
3. Scoop / Trowel
4. Sampling Bottle (250 mL)
5. Tape Measure
6. GPS
7. Petri dish (3 pieces)
8. Filter paper (GF/C)
9. Wash bottle with filtered distilled water
10. Multiparameter meter
11. Aluminum foil
12. Ruler
13. Wind app and randomizer app on phone



Sediment Sampling

Adapted from "Microbial transformation of plastics in SE Asian seas: a hazard and a solution" (MicroSEAP)

1. **For beach sites, lay three 30 m transects at the strandline.**
    a. **The strandline is the part of the beach where debris accumulate.**
    b. **Lay transects during periods of low tide to maximize study area.**
2. **The transects are laid parallel to the shoreline (Fig. 1, in red). The minimum distance between two consecutive transects should be at least 2 m apart or wider. For larger study sites, the distance between two consecutive transects can be larger.**
    a. **For smaller sites that cannot fit 3 x 30 m transects, shorter transect length (e.g., 15 or 20 m) may also be adopted, but the number of transects at each tidal zone should still be three.**

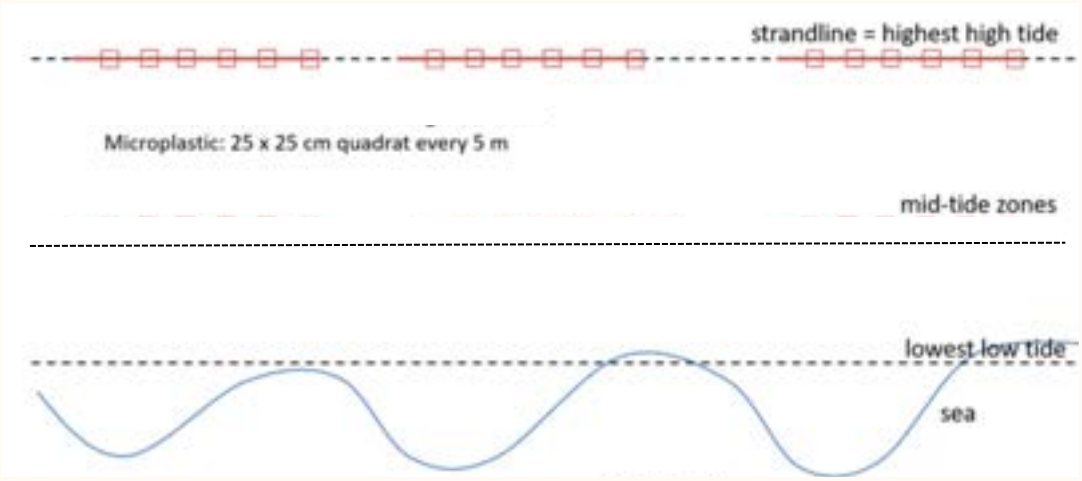


Figure 1. Survey area (30m x 4m) along beach strandline

Sediment Sampling

Adapted from "Microbial transformation of plastics in SE Asian seas: a hazard and a solution" (MicroSEAP)

3. Prepare air contamination controls: place a GF/C filter inside the petri dish and dampen with filtered distilled water from the wash bottle. Close when not in use.
4. One air contamination control per transect should be used.
5. Lay one 25 cm by 25 cm quadrat every 5 meters of the transect line.
6. Randomly select 1 grid out of 9 from the quadrat (Figure 2).
7. Sample coastal sediment equal to the volume obtained by the 8" x 5" corer or approximately 100 g, or the upper 5cm of the sediment surface.
8. Place sampled sediment in 250 mL glass jars.
9. Cover the glass jar mouth with clean aluminum foil before covering it with a metal lid.
10. Fill-out datasheet for other information on site characteristics.

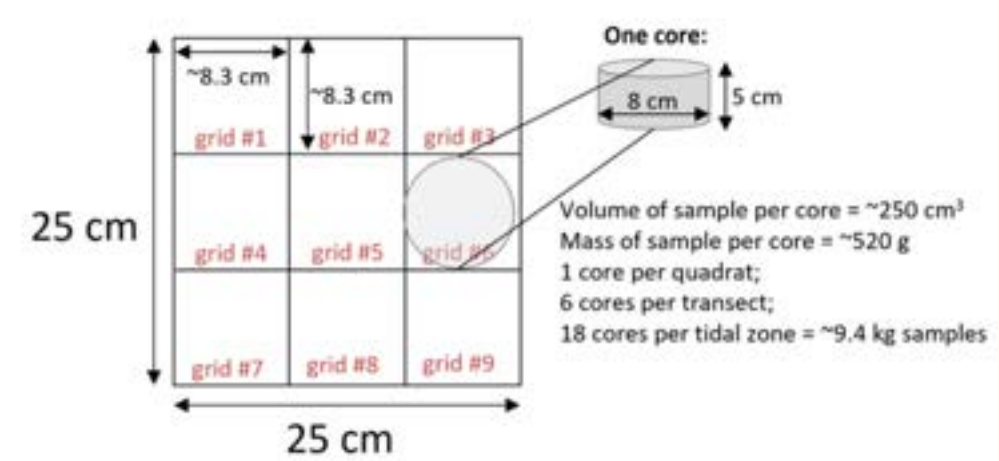


Figure 2. Quadrat layout and numbering

Sediment Sampling (Schematic Guide)

1 Lay 30 m transects at the strandline.

2 Set up air contamination controls.

3 Place quadrats after every 5 meters.

4 Randomly select one grid and collect sediment.

5 Continue for a total of 6 samples.

6 Fill out information on site characteristics.

Materials (Water)

1. Sampling net / Tow sampler
2. Niskin bottle / Grab sampler
3. Petri dish
4. Filter paper (GF/C)
5. Wash bottle with filtered distilled water
6. GPS
7. Multiparameter meter
8. Sampling bottles (1 L)
9. Aluminum Foil
10. Wind app and stopwatch on phone

Water Sampling

Adapted from "Microbial transformation of plastics in SE Asian seas: a hazard and a solution" (MicroSEAP)

1. **Wash net and discard content from cod end three times.**
2. **Prepare air contamination controls: place a GF/C filter inside the petri dish and dampen with filtered distilled water from the wash bottle. Close when not in use.**
3. **Place three air contamination controls near the sampling point.**
4. **Record starting coordinates using GPS.**
5. **Collect 1 L of grab sample at the starting location.**
6. **Deploy net at the side of the vessel.**
7. **Tow net for 10 minutes at a relatively slow, constant pace.**
8. **Bring net overboard and transfer contents of cod end to 1 L sampling bottle.**
9. **Wash net with sample water and transfer contents of cod end twice.**
10. **Collect 1 L of grab sample at the ending location.**
11. **Record ending coordinates using GPS.**

Water Sampling (Schematic Guide)

1 Record starting coordinates.

2 Set up air contamination.

3 Collect grab sample at start position.

4 Tow net for 10 minutes and collect sample.

5 Collect grab sample at end position

6 Record end coordinates.

Next Steps

1. **Inspect that water and sediment sample jars are tightly sealed to avoid air contamination.**
2. **Seal petri dishes properly to avoid accidental opening during transport.**
3. **Identify laboratories that are capable of processing samples for microplastics. A list of laboratories are uploaded onto the PlastiCount portal (https://plasticount.ph/) for reference.**

NOTE: It does not end here!

Refer to "Toolkit for Quantifying Microplastics in the Marine Environment: Laboratory Procedures" for information on laboratory processing of environmental samples.

Appendix:
Data Sheets

MICROPLASTICS DATASHEET – SITE CHARACTERISTICS

This should be filled out per site.

Surveyor name:	Survey date:
Site name:	Country:
GPS start:	GPS end:
SHORELINE CHARACTERISTICS	
Habitat type: beach mangrove seagrass coral reef	
Backshore type: cliff seawall urban building forest/tree shrub mangrove other:	
Shore exposure: cove/bay straight headland	
Tidal distance (m):	
LAND-USE CHARACTERISTICS	
Access: vehicular trail isolated	
Major site usage: tourism fishing protected isolated other:	
Nearest town distance (km):	Nearest river distance (km):
River input: yes no	Pipe/drain input: yes no
Evidence of dumping: none construction household other:	
Evidence of recent activities: none clean-up/rubbish removal apparent spilled trash storm/flood strong winds public event other:	
Notes (*include descriptions on landmarks, coastal hydrography, etc*):	

Notes:
GPS start: GPS coordinates of the start of the first transect
GPS end: GPS coordinates of the end of the third transect
Tidal distance: the maximum horizontal distance between the low- and high-tide line
Access: vehicular (you can drive to the site), trail (you must walk), isolated (you need a boat/plane)
Nearest town distance: nearest distance to villages / residences / towns / human populations

WATER GRAB SAMPLING DATASHEET

Surveyor name(s):					Sample date:			
Site name:					Country:			
Water sampler:			Volume (L):			Sampling depth (m):		
ENVIRONMENTAL CONDITIONS (three readings per site)								
Weather: clear rain/storm overcast drizzle								
Sea surface temp (°C):					Salinity (psu):			
Dissolved O_2 (mg/L):					Total suspended solids (mg/L):			
Nitrate (mg/L):					Phosphate (mg/L):			
LAND-USE CHARACTERISTICS								
Major site usage: tourism fishing protected isolated other:								
Nearest town distance (km):					Nearest river distance (km):			
River input: yes no					Pipe/drain input: yes no			
Evidence of dumping: none construction household other:								
Evidence of recent activities: none clean-up/rubbish removal apparent spilled trash storm/flood strong winds public event other:								
Notes (*include descriptions on landmarks, coastal hydrography, etc*):								

Sample details	#1	#2	#3
Wind speed (m/s)			
Wind direction			
Latitude			
Longitude			
Time			
Note			

PLANKTON TOW DATASHEET

Surveyor name(s):					Tow date:			
Site name:					Country:			
Net type:			Mesh size:			Net mouth diameter:		
ENVIRONMENTAL CONDITIONS (three readings per site)								
Weather: clear rain/storm overcast drizzle								
Sea surface temp (°C):					Salinity (psu):			
Dissolved O_2 (mg/L):					Total suspended solids (mg/L):			
Nitrate (mg/L):					Phosphate (mg/L):			
LAND-USE CHARACTERISTICS								
Major site usage: tourism fishing protected isolated other:								
Nearest town distance (km):					Nearest river distance (km):			
River input: yes no					Pipe/drain input: yes no			
Evidence of dumping: none construction household other:								
Evidence of recent activities: none clean-up/rubbish removal apparent spilled trash storm/flood strong winds public event other:								
Notes (*include descriptions on landmarks, coastal hydrography, etc*):								

Tow details	#1	#2	#3
Wind speed (m/s)			
Wind direction			
Start latitude			
Start longitude			
Start time			
Start flow meter count			
End latitude			
End longitude			
End time			
End flow meter count			
Average boat direction			
Average depth (m)			
Note