Microbial Oceanography Laboratory

Guidelines for Quantifying Macroplastics in the Marine Environment

A Citizen Science Toolkit

Guidelines for Quantifying Macroplastics in the Marine Environment

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Toolkit Contents

Introduction

Plastics are synthetic hydrocarbon polymers used by humans for its durability and wide range of applications (Thompson et al. 2009). We continually produce plastics because of our dependence on the material, but as synthetic polymers with chemical additives, these take hundreds of years to decompose, accumulating in landfills or in natural environments (Geyer et al. 2017). In 2010, Jambeck et al. (2015) estimated that 4.8 to 12.7 million metric tons of plastics was released into the ocean. Plastic wastes remain afloat at sea or sink down the seafloor. However, majority of these wastes were estimated to accumulate in coastal regions (Lebreton et al. 2019), leaving coastal areas and sediments at risk to plastic pollution (Barnes et al. 2009; Pinnell and Turner 2019). Thus, it is important to quantify plastic debris in coastal areas to measure the extent of pollution.

This document outlines methods for macroplastic assessment in coastal areas. The supplied methods will determine the debris density (# of plastic pieces/unit area) and the type of debris materials.

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Site Selection

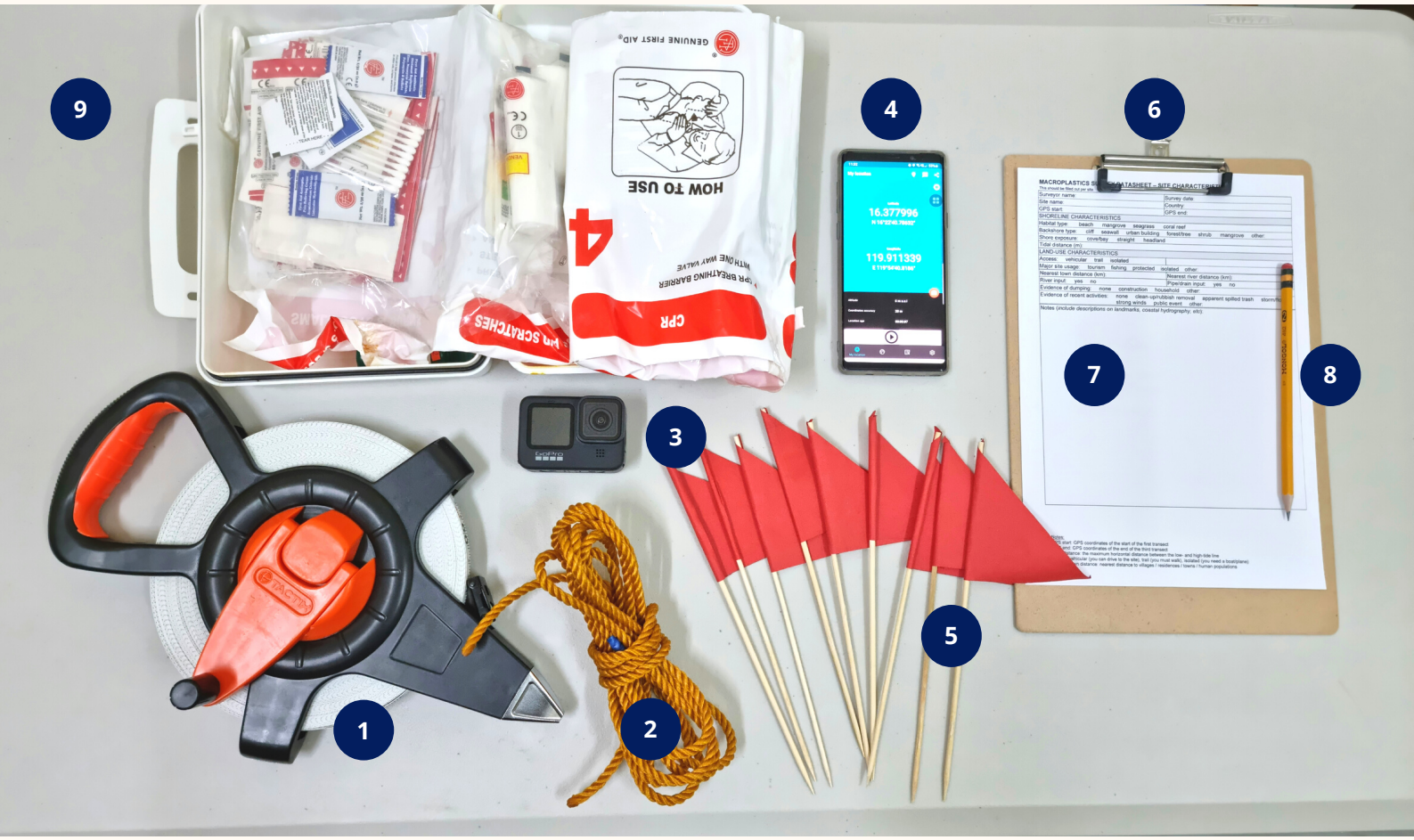
The beach sites for macroplastics survey should be selected according to the following criteria:

San Rafael III, Noveleta, Cavite

- **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)**

Materials

1. Transect tapes, at least 30 m (x 3)
2. Rope, 4 m
3. Digital camera
4. Phone (with apps for GPS and wind compass)
5. Flag markers
6. Clipboard for each surveyor
7. Data sheets
8. Pencils for data recording
9. First aid kit



Field Survey

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.**
2. **The transects are laid parallel to the shoreline (Fig. 1). 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.**

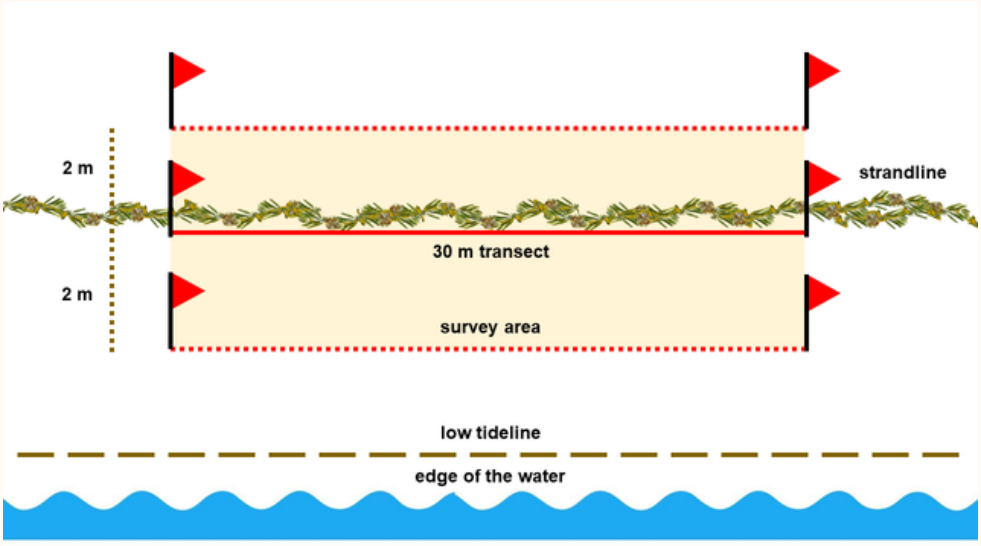


Figure 1. Survey area (30m x 4m) along beach strandline

Field Survey

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

3. To mark the survey area, use the 4 m rope to measure 2 m to the left and right of the strandline.

4. Place flaglets to mark the edges of the survey area.

5. For sampling macro-litter (> 25 mm in size, bigger than a bottle cap), record the following information for each litter item found within 2 m to the left and 2 m to the right of the transects (i.e., 4 m total width x 30 m total length belt transect).

6. Record debris counts while walking across the survey area in a pattern (Fig. 2).

6. If you find litter items that are not in the list of debris types in the datasheets, take a photo for documentation.

7. Fill-out datasheet for other information on site characteristics after the field survey.

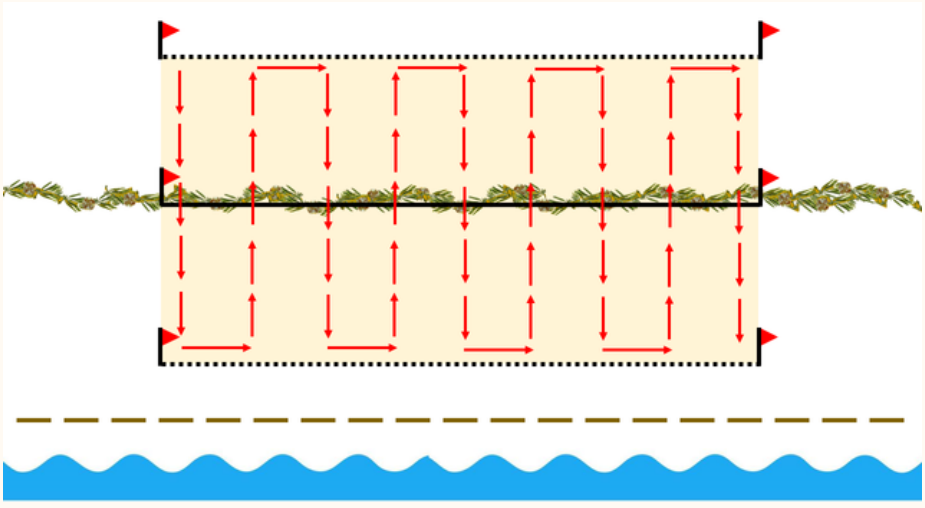


Figure 2. Field survey walking pattern

Field Survey

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

The macrodebris item concentration (number of debris items/m^2) per transect is calculated as follows:

$$C = \frac{n}{wl}$$

Where

C = concentration of debris items (# of debris items/square meter)
n = # of macro-debris items observed
w = width (m) of shoreline section (i.e. transect width)
l = length (m) of the shoreline sampled = 30

For a given sampling event, take the mean concentration at each transect to calculate an overall site concentration (± standard deviation) for that date.

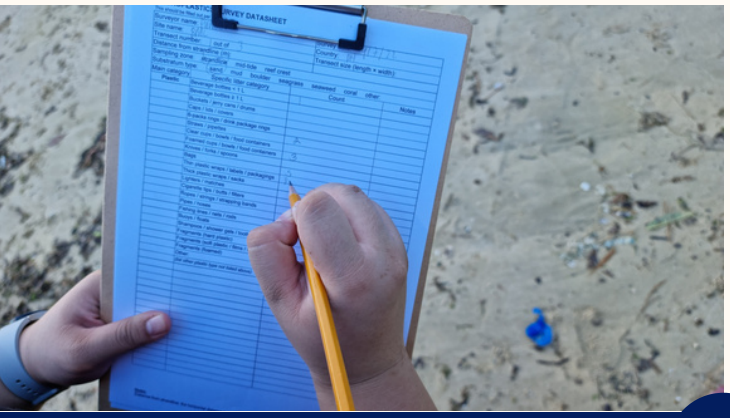
Field Survey (Schematic Guide)

1 Lay 30 m transects at the strandline.

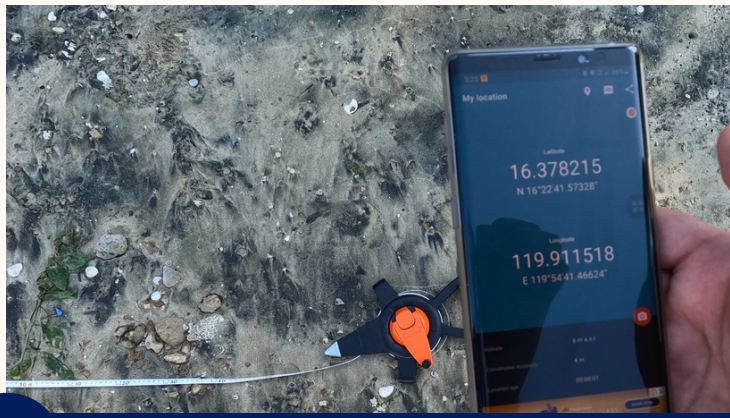
2 Mark survey area using a 4 m rope.

3 Place flaglets at the edges of the survey area.

4 Mark survey area using a 4 m rope.



5 Record debris counts in the datasheet.



6 Fill out information on site characteristics.

Appendix A:
Data Sheets

MACROPLASTICS SURVEY 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

MACROPLASTICS SURVEY DATASHEET

This should be filled out per transect.

Surveyor name:	Survey date:
Site name:	Country:
Transect number: out of	Transect size (length × width):
Distance from strandline (m):	
Sampling zone: strandline mid-tide reef crest	
Substratum type: sand mud boulder seagrass seaweed coral other:	

Main category	Specific litter category	Count	Notes
Plastic	Beverage bottles < 1 L		
	Beverage bottles ≥ 1 L		
	Buckets / jerry cans / drums		
	Caps / lids / covers		
	6-packs rings / drink package rings		
	Straws / pipettes		
	Clear cups / bowls / food containers		
	Foamed cups / bowls / food containers		
	Knives / forks / spoons		
	Bags		
	Thin plastic wraps / labels / packagings		
	Thick plastic wraps / sacks		
	Lighters / matches		
	Cigarette tips / butts / filters		
	Ropes / strings / strapping bands		
	Pipes / hoses		
	Fishing lines / nets / rods		
	Buoys / floats		
	Shampoos / shower gels / toothbrushes		
	Fragments (hard plastic)		
	Fragments (soft plastic / films / sheets)		
	Fragments (foamed)		
	Other:		
	(list other plastic type not listed above)		

Notes:
Distance from strandline: the horizontal distance between the strandline and transects

Main category	Specific litter category	Count	Notes
Glass	Bottles / jars		
	Light bulbs / tubes / globes		
	Fragments		
	Other:		
Wood	Cigarette packs		
	Lighters / matches		
	Paper / newspaper / pieces of papers		
	Crates / boxes / cardboards		
	Fishing traps / pots		
	Ice cream sticks / chopsticks / toothpicks		
	Fragments		
	Other:		
Cloth	Clothes / towels / rags		
	Sacking / gunny sacks / canvas		
	Diapers / sanitary pads		
	Fabric pieces		
	Other:		
Rubber	Slippers / flip-flops / shoes / gloves		
	Tires		
	Balloons, balls		
	Rubber bands		
	Other:		
Metal	Aluminium / tin / aerosol cans		
	Bottle caps		
	Buckets / drums		
	Nails / irons		
	Fishing related (lures, hooks, sinkers)		
	Other:		
Other	Batteries		
	Appliances, electronics		
	Furniture		
	Contraception / condoms		
	Masks / gloves / face shields		
	Syringes		