UF UNIVERSITY of FLORIDA

UF/IFAS Extension, Flagler and St. Johns Counties
Florida Sea Grant

150 Sawgrass Road
Bunnell, FL 32110
(386) 437-7464
mpmcg@ufl.edu
stjohns.ifas.ufl.edu/sea/seagrant.htm

Sampling for Microplastics in Beach Sand

(Maia McGuire, PhD, UF/IFAS Extension Sea Grant Agent)

Microplastics can be found in the sediment and in the water column. Here are some simple methods for investigating this type of pollution in beach sand samples. These methods are appropriate for upper elementary school-aged students through adults. They do not require the use of chemicals. METHOD 1 is recommended if you have limited time at the beach but will be able to process your sample over a few days (e.g. in a classroom). With some additional materials, this method can be used to investigate microscopic plastic in the sand (e.g. fibers). METHOD 2 can be done entirely at the beach. This method only counts plastics that are visible with the naked eye.

METHOD 1

Materials needed: Quadrat (0.25 m' x 0.25 m'—see construction description at the end of this document), container to hold sand (gallon zipper-seal bag, sealable bowl or tub), small trowel or large spoon, paper plate(s), sieve (window-screen size, or 0.25 mm if using graded sand sieves), tweezers, 2-3 large cups, water[1]

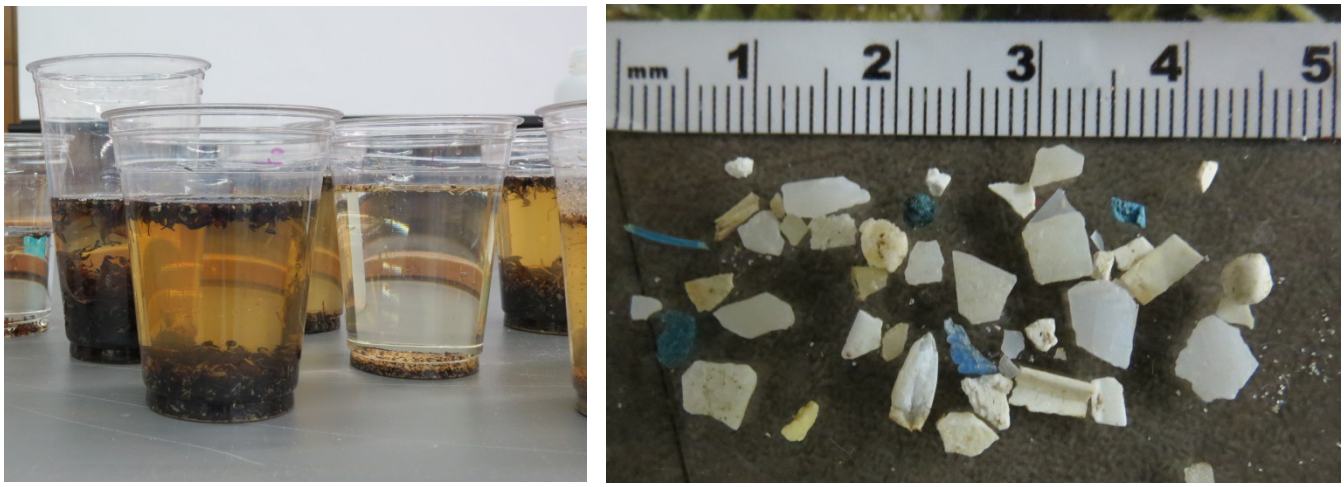
Procedure:

1. At the field site, randomly place the quadrat in the area of the wrack line.
2. Use the trowel/spoon to scrape about the top cm of sediment/wrack and scoop it into a container or bag (see footnote below). Seal the container.
3. Indoors, pour the contents of the container onto paper plates and spread out the sediment to dry (see footnote below). Leave at least overnight. If the sediment is already dry, you can skip this step.
4. Sift the sediment through the sieve. Capture the fine sand that comes through the sieve and save it to return it to the field location.
5. Visually look through the sediment and debris left in the sieve (you can pour it back onto a clean paper plate to help with this step.) Look for any obvious pieces of plastic and pick them out. Set them aside in a small container.
6. Take the remaining sediment/debris and pour it into one or more large cups. Fill the cups about ¾ full with tap water (or filtered water, if you will be looking for microscopic plastics.) Stir well. If you

[1] If you want to analyze the sample for microscopic fibers, be sure to use pre-filtered water and pre-rinse containers that will be used three times with pre-filtered water. You will need to take steps to prevent contamination of samples (see information in section titled "In the water.")

see plastic pieces rise to the surface, go ahead and pick them out and add them to the ones previously found.

7. If there is plant material in the debris, it will also float (as will pieces of crab shell and small snail shells that have air trapped in them). The longer the plant material soaks, the more likely it will be to sink. If possible, leave the cups overnight and stir and check them again the next day before discarding the contents. If you will be analyzing for microscopic plastics, be sure to cover the cups at this point.
8. If you wish to look for microscopic plastics, analyze as described in the section below.



Sediment/wrack samples soaking (left); microplastics found in beach sand (right): Photo credits: Maia McGuire

To isolate microscopic plastics from your sand sample:

Materials needed: Vacuum filter apparatus that can take 47-mm filters; 0.45 micron gridded filters; filter forceps; 1-liter side-arm erlenmeyer flask; vacuum pump; squirt bottle; tap water; 1-liter separatory funnel and stand/clamp, dissecting microscope (20-30 or 20-40 X).

Procedure:

1. Run about 100 ml of tap water through a 0.45 micron filter (vacuum filter it). Use this to rinse the inside of the side-arm flask (the one you've used to collect it in) and discard. Repeat 2 more times. (Essentially you are triple-rinsing the flask with filtered water). Similarly triple rinse a squirt bottle with filtered tap water. Collect the next 500 ml of filtered water and use it to stock the squirt bottle. You will use this filtered water for rinsing the funnel, etc.
2. When ready to process your sample, triple rinse a 1-L separatory funnel. Pour the sample into the funnel (supported by a clamp on a heavy-duty stand). Let sample stand for at least a few minutes. Drain off the sand/silt from the bottom of the sample into a cup (this will be discarded). If the sample contains large pieces of plant material (e.g. Sargassum seaweed), you will probably not be

able to drain it through the separatory funnel. Instead, you will need to carefully pour as much of the liquid into the filter apparatus as you can without getting the plant material on the filter.

3. With no filter inserted, rinse the inside of the filter apparatus three times with pre-filtered water. Use a petri dish or other flat object as a cover for the filter apparatus (only remove when adding more sample). This will help reduce environmental contamination of the sample (e.g. by lint in the air).
4. Insert the filter (gridded) into the apparatus. Add sample to fill the filter funnel. Put the separatory funnel back on the clamp and allow to further settle (keep the separatory funnel stoppered). Drain sediment from the separatory funnel as needed.
5. With the cover over the filter funnel (leaving a small gap to allow SOME air through), vacuum filter the sample. Continue to add more sample until it has all been filtered. Rinse the sides of the filter funnel with a small amount of filtered water and let the vacuum pull this water through the filter.
6. If you get large pieces of plant material on the filter, carefully pick them off with forceps and rinse with filtered water (so the water runs back onto the filter) before discarding.
7. Release the vacuum pressure. Remove the filter and place into a clean petri dish. Cover with the petri dish lid. Remember to label the sample (either on the petri dish lid, or with a small strip of paper placed inside the petri dish, but not on the filter).
8. Let the filter dry at least overnight before viewing under a microscope (not required, but it's easier to differentiate plastics from plankton once the plankton have dried out somewhat. It's also easier to scan without the reflection from the wet filter).
9. If processing several samples collected in the same general location one right after the other, you do not need to rinse the separatory funnel or filter funnel in between...but should do so before switching sample locations.
10. Observe the filter papers under a microscope at 20X-40X magnification. Scan the filters systematically, moving row by row to prevent double-counting or missing plastics. Plastic will generally be milky/white or colored (not clear). Sand grains are easily mistaken for plastics. Many of the fibers seen on the filters will be extremely small.

METHOD 2

Materials needed: Quadrat (0.25 m' x 0.25 m'—see construction description at the end of this document), tweezers, clipboard and data sheet, small container (e.g. film canister), magnifying glass (optional).

Procedure:

1. At the field site, randomly place the quadrat in the area of the wrack line.
2. Use tweezers to pick out any pieces of plastic seen within the quadrat.
3. Put each piece of plastic in the small container, and keep track of the number of pieces found on the data sheet (tally marks work well for this).
4. When you have removed all of the pieces of plastic from within the square, use the tweezers to trace around the inside of the quadrat, and to make a large X between the corners. This will prevent you from re-sampling an area that has already been sampled.
5. Repeat steps 1-4 for a total of 16 samples (this will equate to having sampled 1 m^2).
6. Add up the total number of plastic pieces found.

Hint: It is sometimes difficult to tell the difference between pieces of shell and pieces of plastic. Most shell or rock will sink if placed in water. Most plastic found on the beach will float when placed in water. To test buoyancy, use tweezers to submerge the object in the water, then release it from the tweezers (this will break the surface tension of the water).

Microplastics Data Sheet

Instructions: Randomly place the 1/16 m^2 quadrat on the upper part of the beach (at or below the high tide line). Collect every piece of plastic that you can see within the square. Have someone double check to make sure you didn't miss anything. Use tweezers if needed to pick up the small pieces. Put all of the collected plastic into the film canister. Record the number of pieces of plastic on the data sheet. Repeat this for a total of 16 times.

Quadrat #	# of pieces of plastic
1	
2	
3	
4	
5	
6	
7	
8	
Sub-total:	

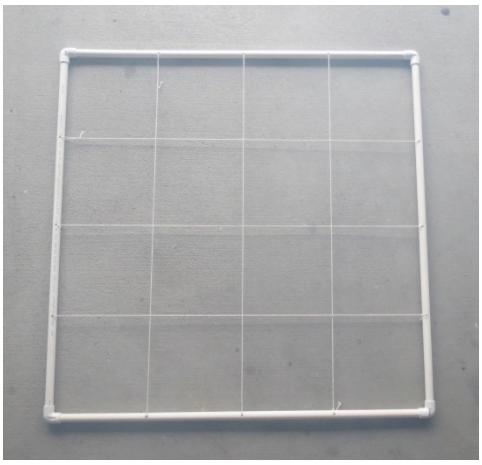
Quadrat #	# of pieces of plastic
9	
10	
11	
12	
13	
14	
15	
16	
Sub total:	

Total # of pieces of plastic found in 1 m^2 (add two sub-totals): _____

Making a Quadrat

Quadrats are relatively simple and inexpensive to make. You will need the following materials and supplies for one 0.25 m x 0.25 m quadrat (1/16 m^2).

- Approximately four feet of ½ or ¾" PVC pipe (there are different grades of pipe—look for the cheapest kind)
- 4 ea. ½ or ¾" PVC elbows (90°)
- PVC cement (optional)
- Hacksaw or PVC cutters
- Tape measure



Home-made quadrat. This version is 1 meter x 1 meter. A 0.25 m x 0.25 m quadrat will not need the strings to divide it up. Photo credit: Maia McGuire

Instructions:

1. Cut the PVC pipe into four 25-cm pieces
2. *(This step is optional.)* Working in a well-ventilated area, use PVC glue to attach elbows to one piece of PVC. It is best to do this on a flat surface, so you can make sure that the elbows are in the same plane. Use PVC glue to attach the rest of the PVC together in a square.
3. The inside dimensions of the finished product should be approximately 0.25 meters (25 cm) on each side.

To make a larger quadrat, simply increase the size of the PVC to the desired length. Larger quadrats can be subdivided into sections using string that is run through holes that have been drilled through the PVC, as in the photo above.