Sampling & Processing Guide Book

CITIZEN SCIENCE MARINE DEBRIS MONITORING & OUTREACH

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MISSISSIPPI STATE UNIVERSITY COASTAL RESEARCH & EXTENSION CENTER | DAUPHIN ISLAND SEA LAB | NOAA MARINE DEBRIS PROGRAM | MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

This project:

Marine debris is a global issue that is reducing the quality of life in coastal environments. One increasingly abundant type of plastic marine debris is microplastic; plastic pieces smaller than 5 mm. Microplastics are a growing environmental problem and are prevalent in coastal sediments of the northern Gulf of Mexico (Wessel et al. 2016). This project will increase awareness of the microplastic marine debris issues by connecting with and involving the public in a citizen science based monitoring project and developing educational materials to be distributed by project partners and trained volunteers. The data collected will go towards further research in finding out where microplastics are originating and how we can possibly prevent them from entering our oceans.

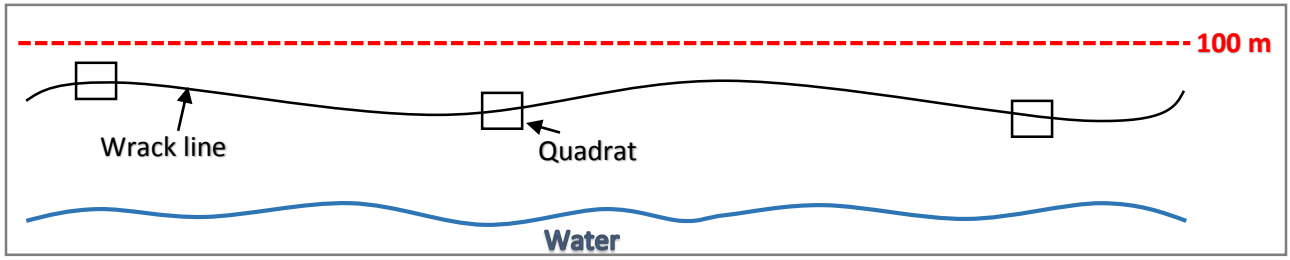
We would like to thank all of the volunteers who have put the time and work into this project. A special thanks to our funder (Gulf of Mexico Alliance – Gulf Star Program) and affiliates for making all of this possible.

MASGP-17-110

A few things before we get started:

- The only time samples MUST be taken is around the time of your state's **2017 & 2018 Coastal Cleanup events**. These events normally occur around mid-September. Standardizing collection time around Coastal Cleanup will allow for a snapshot sampling of microplastics along the entire US Gulf Coast.
- You will have enough supplies to collect many more samples, but any sampling outside of the Coastal Cleanup period is at the discretion of the partner agency.
- Please send us the data if you do sample during other time periods too! (How to submit data described later.)
- The samples to be collected must include, but are not limited to:
    - **THREE** beach samples along a 100 meter transect on the wrack line (within 100 meter of wrack line, take 3 separate beach samples).
    - **THREE** water samples near the area beach samples were taken.

  * At one site, that is 3 beach and 3 water samples.
- **REMEMBER: if you take a beach sample, you must take a corresponding water sample. But you can take water samples without taking beach samples.**
- Collecting samples and waiting a couple days, or weeks, to process them is OK! Depending on the turbidity of your water sample, it is best to allow the sediment to settle out. Large amounts of sediment in the water will quickly clog your filter paper. Make sure you store your samples in a controlled environment if you are not going to process them right away.
- GPS coordinates are important! The compass app on iPhones gives latitude and longitude, or you can look up your location on Google Earth.
- At the end of this handbook, there is a summarized list of what to do in the field you can make copies of and take with you when collecting samples. There is also a Microplastic Data Log Sheet for when you analyze the processed samples.
- You will receive a digital Microplastic Data Log to fill out and send to us.
- Double check your supply list to make sure you have everything you need. If you are missing anything, please email coastalextension@gmail.com as soon as you can and we will get the supplies to you!



Beach Sampling:

1. Find the **high, high tide** line (also called the wrack line or storm line), this is an area where debris that washes in with the tide will accumulate in a line (Picture #1).

2. Randomly select a location along the wrack line. Place your quadrat in the sand with the wrack line running through the middle (Picture #2). The suggested quadrat size is ¼ m^2, which has individual side lengths of 50 cm.

3. Remove any large pieces of natural debris from the quadrat area if there are any. Shake any loose sand off of the debris into your quadrat (Picture #3 & 4).

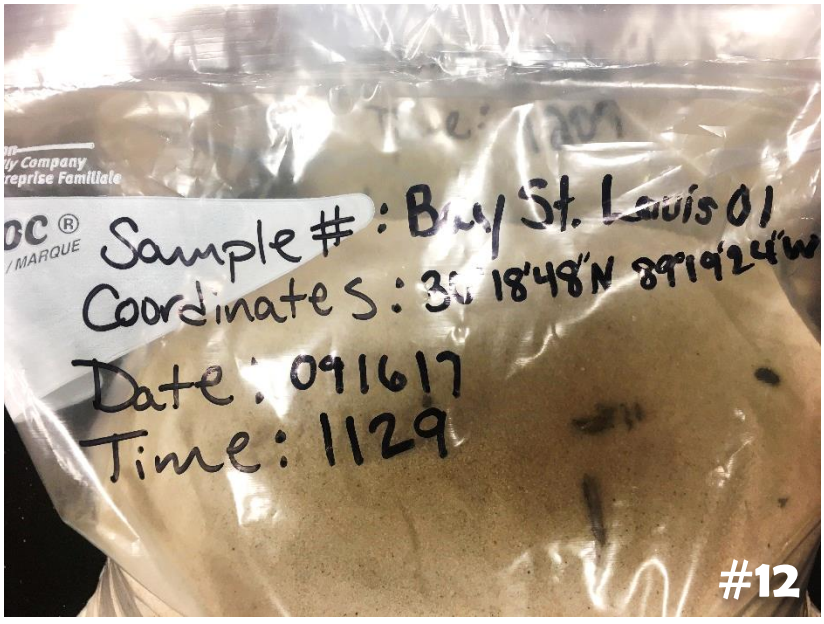
4. Use your scoop to pick up the top 3 cm of sand (about 1 inch) that is within your quadrat (Pictures #5 & 6).

5. Set sieve on a five gallon bucket (Picture #7). Pour each scoop through the 5mm sieve, collecting the sand into the 5 gallon bucket (Pictures #8 - 10); anything that doesn't pass through the sieve can be discarded.

6. Once you have poured all the top layer sand through the sieve and into the bucket, pour the sand from the bucket into a 1 GALLON sized Ziploc bag (Picture #11).
    - You should fill one Ziploc bag for EACH quadrat you sample**.**

   If you accurately scoop up the top 3cm of sand in your quadrat, you should fill a gallon sized Ziploc bag.

7. Make sure to label your samples with **sample #, GPS location, and date/time** using a sharpie (*BeachName*01, GPS coordinates, date/time; *BeachName*01, GPS coordinates, date/time; etc.)(Picture #12). Take the samples back to the lab to be filtered through the density separator (described later).



Processing Sediment Samples:

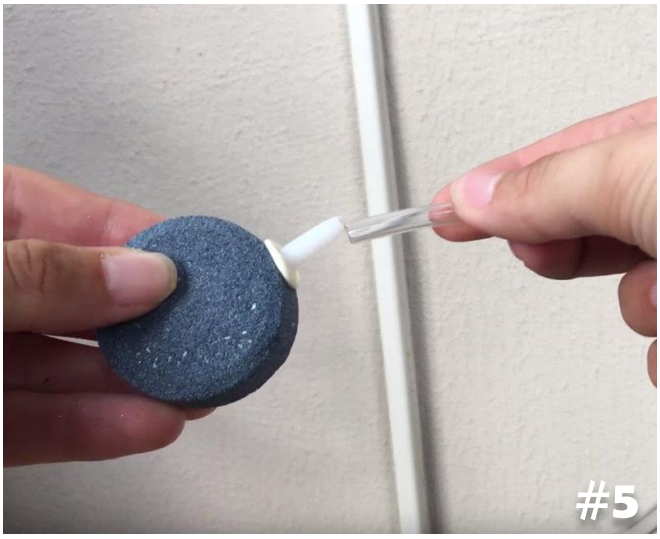
1. Secure density separator to garbage can (a bungee cord works perfectly) near your **SALT** water reservoir, or fill garbage can halfway with **SALT** water (Picture #1). Target salinity 25 ppt. Avoid using fresh water for your water reservoir. Sample recovery is highest with salt water since it is denser than fresh water.
   **Keep in mind you will need an electrical outlet for the water pump AND aerator to be plugged into.

#1

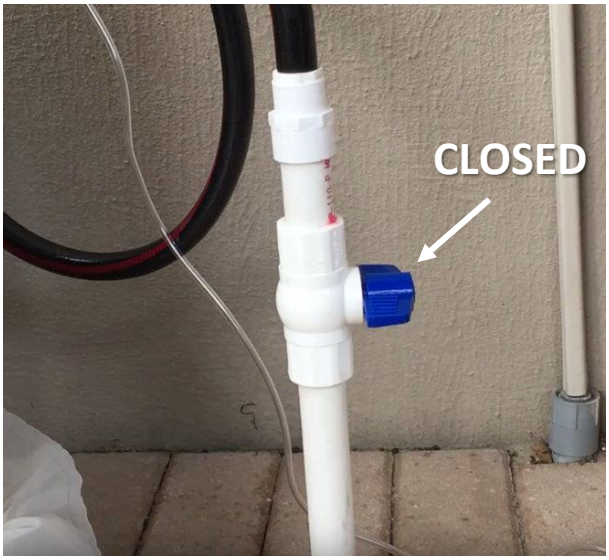
2. Attach one end of the hose to the water pump (Picture #2), and the other end to the density separator (Picture #3).

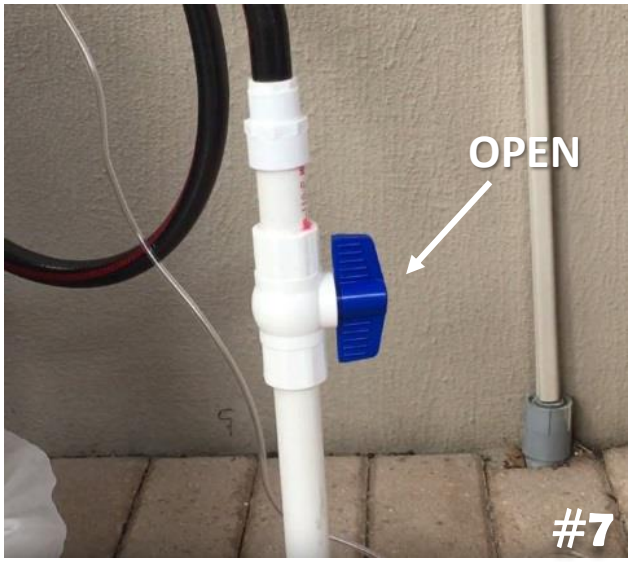
3. Place water pump into salt water reservoir (Picture #4).

4. Attach air stone to flex tubing (Picture #5). Lower air stone to bottom of separator and turn on (Picture #6).



5. Make sure ball valve is open and turn on water pump (Picture #7).





6. Fill the density separator with just enough water so you can see the water level (Picture #8); then shut off water by turning ball valve to CLOSED. Keep in mind: water will rise when you add in the sediment sample, so you don't want to fill the density separator with too much water, causing the water and your sample to spill out the top of the density separator.

7. **Air on** until uniform bubbles.

8. Add sand (Picture #9). You can do half a sample at a time, or the whole sample if the sand is clear of sticks and other debris.

9. Adjust air if needed.

10. Turn water on (open valve) **slowly.**

11. Adjust water (using valve) so it barely splashes over into 55um sieve (**start timer**).

** Hold or place sieve on a support for the duration of the separation (Picture #10).

12. Adjust water again, if needed.

13. Rinse top of tube with water to knock any loose sand that got caught into the density separator.

14. At **7** minutes run time: **Turn off air for 10 seconds then turn back on.**

15. At **9** minutes run time: **Unplug water pump for 10 seconds then plug back in.**

16. At **10** minutes run time: **Turn air off for 10 seconds then turn back on. ****This is to ensure a mix up of the sediment to release any stuck microplastics.

17. Run **26 minutes** total.

*If you are processing your sand sample half a bag at a time, midway through the 26 minutes, close the ball valve to stop the water flow. Unplug the water pump and

then open the ball valve. This is to lower the water level in the density separator. Once the water is at the same level as show in Picture #8 (above), add the remaining half bag of sand into the density separator and continue from Step 9.

18. Rinse and then remove any large debris (sticks, leaves, etc.)(Picture #11).
19. Rinse sieve into shallow analysis dish with water.

20. Remove air stone. Detach density separator from hose, dump remaining sediments out of tube, and rinse out with water.

21. Repeat with next sample.

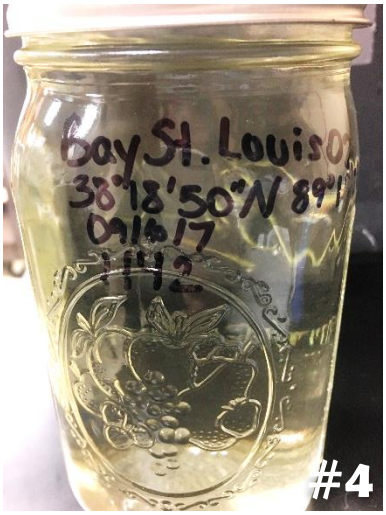
Water Sampling:

1. In the same area you took your beach sample, walk out past where the waves are breaking (to avoid getting a bunch of sediment in the sample) to a depth about 2 feet and remove the lid from the jar.

2. Take a surface water sample by dipping the jar in the water (Picture #1).

3. Slowly tilt the jar upright to completely fill it with water and remove any air bubbles (Picture #2). If your sample does have some sediment in it, wait for the sediment to settle out before processing the sample.

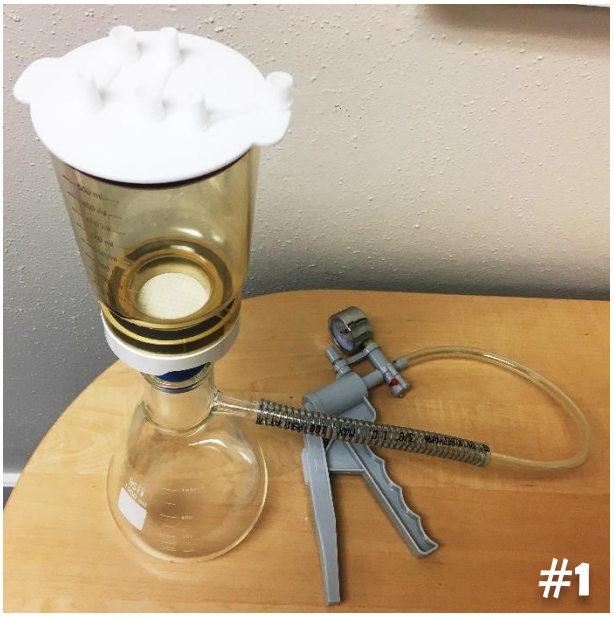
4. Put the lid back on the jar (Picture #3). Make sure to note the number on the jar and fill out the associated data sheet with the **sample #, GPS coordinates, date, and time** where the sample was collected from (*Water*01, GPS coordinates, date/time; *Water*02, GPS coordinates, date/time; *Water*03, GPS coordinates, date/time) (Picture #4).



5. Take these samples back to the lab for water filtering (described later). Water samples can be stored at room temperature indefinitely. If the water samples contain a lot of sediment, allowing the sediment to settle makes water filtering easier.

Filtering of Water Samples:

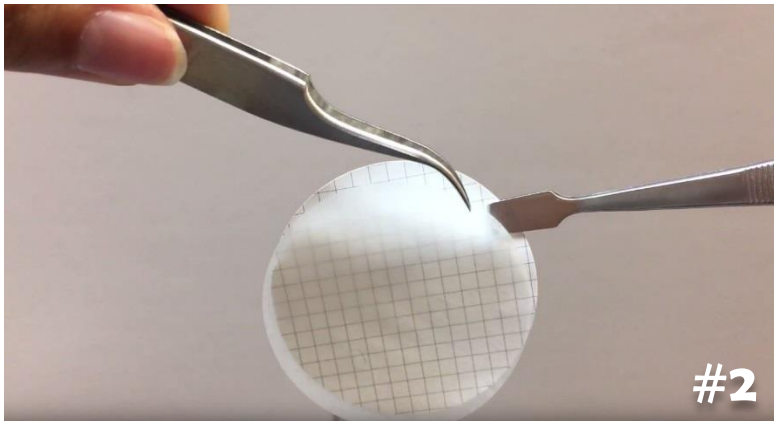
1. Set up filter apparatus by placing the filter funnel on filtering flask and attaching the vacuum pump to flask (Picture #1).

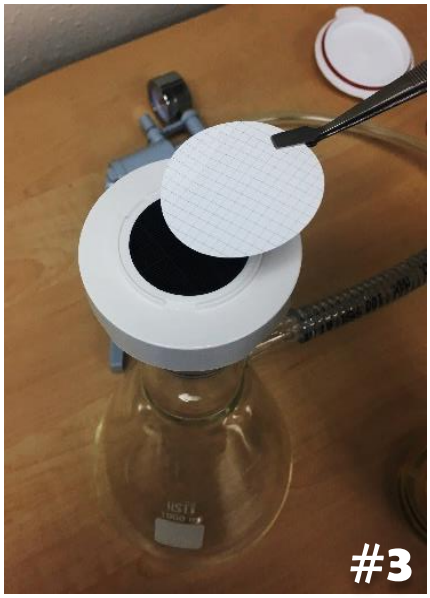


2. Remove funnel from funnel holder and make sure you triple rinse the funnel using filtered water to get rid of any contaminants before you start each filter.

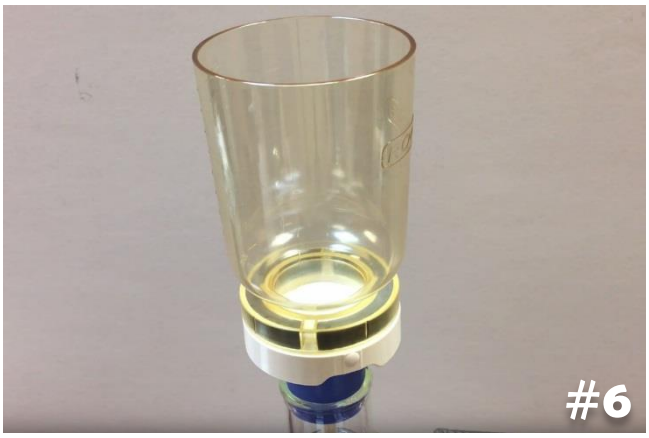
3. Using forceps, place a piece of filter paper on to filter funnel holder – **gridlines facing up** (Pictures #2 – 4). Be sure to remove any protective sheeting from the filter during this step. *Do not touch filter paper with your hands.

* Use only the forceps to remove the protective covers, place filter on the funnel stand, and to remove filter paper from funnel stand.





4. Attach funnel to filter holder (Pictures #5 & 6).

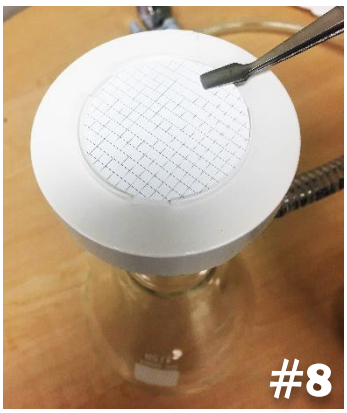


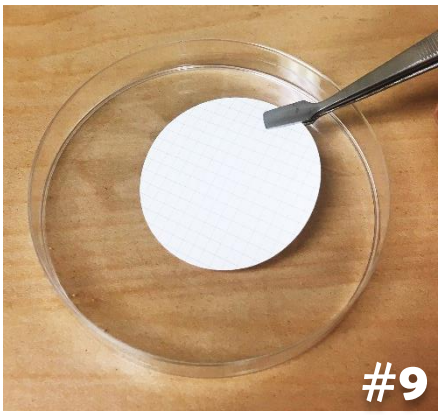
5. Take water sample and fill the funnel (Picture #7). Place lid on funnel. *Immediately place lid back on sample bottle and **open the tabs** on the funnel lid so it does not become vacuum sealed to the funnel once you begin filtering.

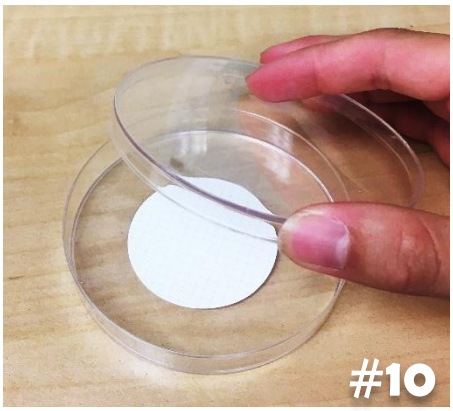
6. Turn on (or squeeze if using the hand-held version) vacuum.

7. Continue adding water from the sample jar until the entire liter has been run through the filter. If your filter gets clogged, you can switch to a clean filter (See “Clogged Filter” section below).

8. Once the water sample is filtered, carefully use forceps to grab the filter paper by the edge and place it in a petri dish. Place cover on petri dish (Pictures #8 – 10).



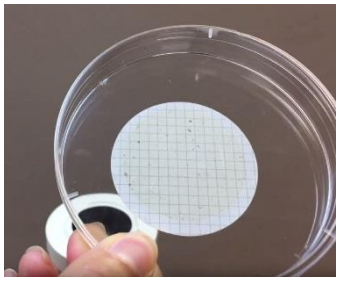




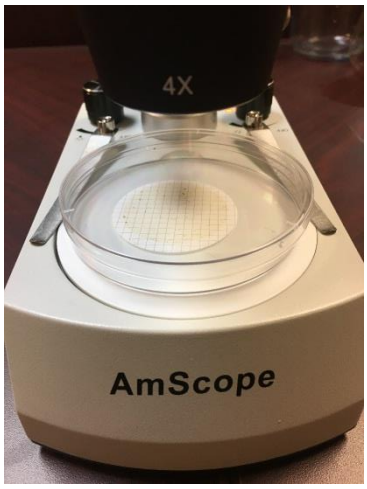
9. **Label** petri dish, using tape, with **sample jar # and processing date**.
10. Repeat with all water samples.

Clogged Filter:

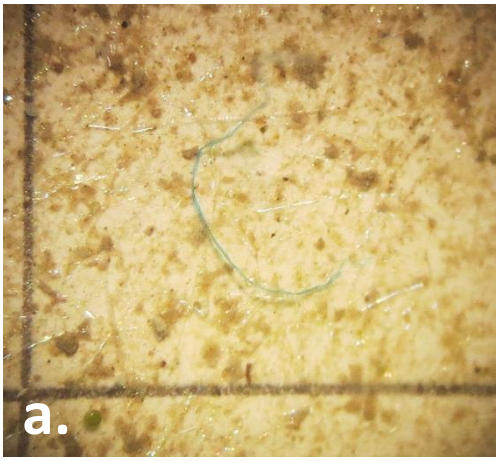
If you notice the process of water filtering has slowed/stopped. You can switch to a new filter: remove the filter funnel from the flask (pictured below), dump the sample back in the original sample jar, remove clogged filter and replace with a new filter using the forceps. Make sure you put the clogged filter into a petri dish and label it with the respected jar's sample # (in some cases you will have multiple filters for the same water sample).

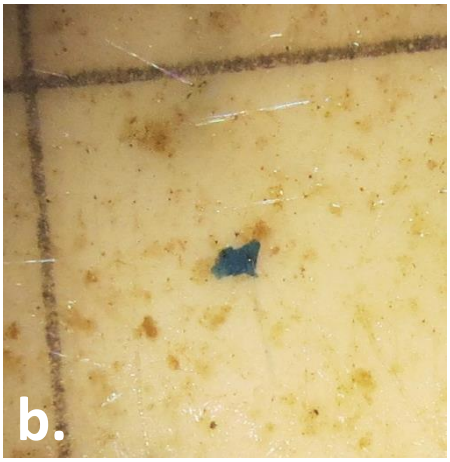


How to ID microplastics under the microscope:

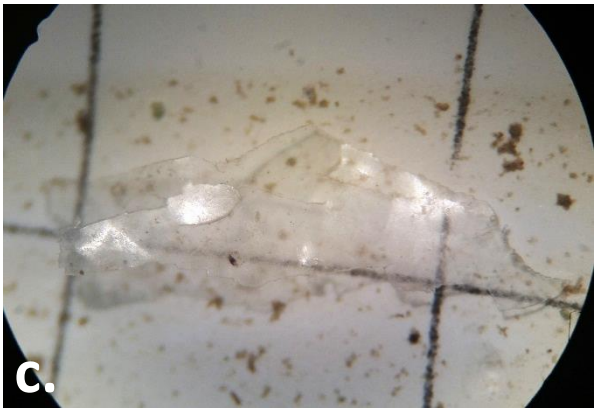


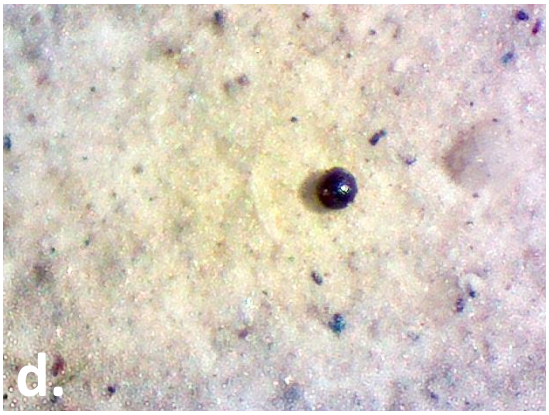
1. Observe the filter paper under a microscope with at least 40X magnification. The top light on the scope works best for identifying microplastics.
2. Scan filter paper in a row by row movement to prevent missing any plastic pieces.
3. Microplastics are categorized into the groups: fibers, fragments, microbeads, and film.
    a. Fibers – look like thin threads and are often colored.
    b. Fragments – pieces of plastic with varying shapes.
    c. Film – thin pieces of plastic (like grocery bags and plastic food wrappers)
    d. Microbeads – spherical plastic pieces.
4. Record the number of each plastic on data sheet (data sheet template found on last page of guide).

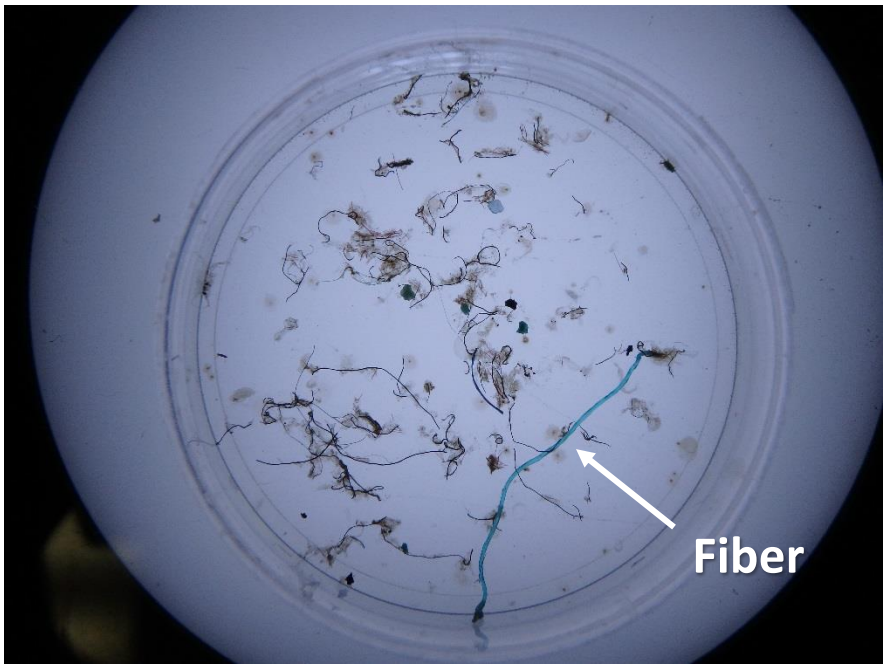


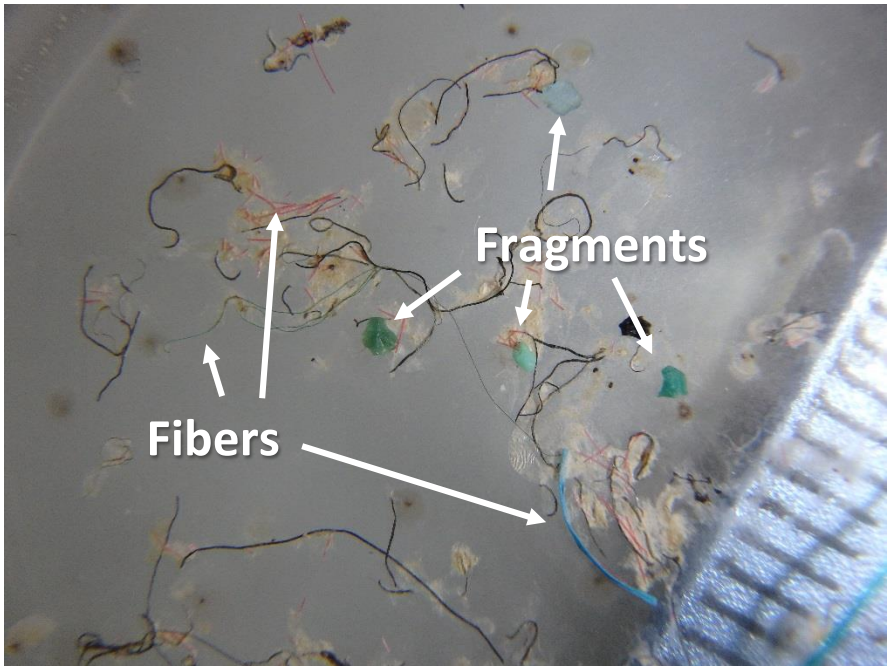


Pictures from Florida Microplastic Awareness Project Website.






Fiber


Fragments
Fibers

Not sure if it is a microplastic?

Whether you are looking at your processed water or sediment sample, determining what is and is not a microplastic can be a little challenging. Sand, sea weed, and little organisms can be mistaken for microplastics. These tips should help:

- ✪ Plastics will often be colored.
- ✪ Squeeze test! If you cannot tell if a particle is plastic or not, use your fine tip tweezers to squeeze the particle. If it squishes apart then it is most likely not plastic; plastic will keep its shape or bounce back to its shape.
- ✪ Only count what you are confident IS a microplastic.
- ✪ Have 2-3 people look at the filter and microplastics. Having different eyes look and count will increase the likeliness of getting the most accurate identification and count.

If you would like to keep the filters containing microplastics, just fold them in half (sample side in), wrap in aluminum foil, and store in a controlled environment.

For any questions about the filtering process, refer to
http://stjohns.ifas.ufl.edu/sea/microplastics/index.html

You may also refer to the video training modules at
https://www.youtube.com/channel/UC2_H2QgjhCxuv-baDK6n_8w

Identifying microplastic samples from the density separator (beach samples):

- Visually examine sample captured in sieve and remove any non-microplastic materials (glass & organics like sticks)
- Rinse contents in sieve, using wash bottle, into petri dish.
- Sort microplastics by type using a dissection microscope (refer to “How to ID microplastics under microscope” section).
    - Setting petri dish on gridded/graph paper may help with the counting of microplastics through the microscope.
- Record on data sheet (data sheet template found on last page of guide).
- If you want to keep, store microplastics in a dark controlled environment.

Submitting your data to us:

Volunteers will put data for each site into an excel data sheet (excel data sheets will be emailed to you). Project partners will send your excel sheet of data or a scanned version of the data log to coastalextension@gmail.com.

How to access other materials:

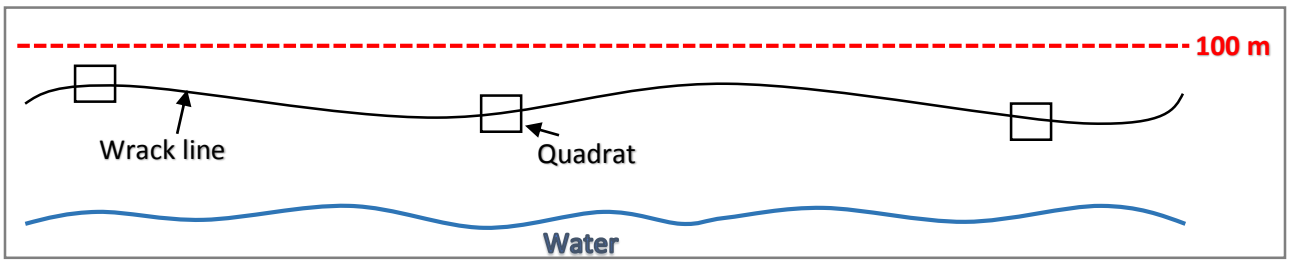
If you need any access to project materials, please email Amanda Sartain at coastalextension@gmail.com or sampling visit the link below for anytime access to this guidebook, the How to Assembly a Density Separator Guidebook, data log, supply list, and "how to" videos on our Citizen Science Marine Debris Monitoring Project Google Drive:

https://drive.google.com/open?id=0B4zSdDRKvJcqYlpGNERWbG9KSmc

Thank you!

Beach Sampling

- ☐ Find the high, high wrack line.
- ☐ Along 100 meters of wrack, place your quadrat in 3 different areas and collect the beach sediment.
- ☐ Remove any large pieces of natural debris (sticks, leaves, etc.) from quadrat.
- ☐ Scoop up the top 3cm of sand within your quadrat.
- ☐ Pour sediment through 5mm sieve into your gallon Ziploc bag OR set sieve on a 5 gallon buck, pour sediment through sieve into bucket, and empty bucket into gallon Ziploc.
- ☐ Discard anything that does not pass through the sieve.
- ☐ Label <u>each</u> sample bag with **sample #, GPS location, and date/time.** (*BeachName*01, GPS coordinates, date/time)
- ☐ Take bags of samples to lab for processing.



Water Sampling

- ☐ Near where you took your beach samples, walk into the water out passed where the waves are breaking (to avoid getting a bunch of sediment in the sample).
- ☐ Take 3 surface samples of water by dipping the jar into the water and tilting it slightly upright to let all the air bubbles escape.
- ☐ Put lid on jar.
- ☐ Label each jar with **sample #, GPS coordinates, date, and time.** (*Water*01, GPS coordinates, date/time)
- ☐ Take water samples back to the lab for filtering.

MICROPLASTIC DATA LOG SHEET

Sample #	Water Sample	Sediment Sample	Sample collected by (name/group)	Sample collection date/time	Sample collection location (name and GPS coordinates)	Sample processed by (name/group)	Sample processing date	Weight (sediments only)	Microplastics counted by (name/group)	# of plastic FIBERS	# of plastic FRAGMENTS	# of plastic MICROBEADS	# of plastic FILM
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