## Collecting Microplastics

Microplastics are plastic particles <5mm in their longest dimension, some of which are created this size for their function (known as primary microplastics) while others are formed from the breakdown of larger plastic items or textiles (known as secondary microplastics). However they are formed there are a lot of them in the environment and we want to know how many and where they are. Yet collecting microplastics and separating them from other particles can be difficult and all of them have limitations. The most common collection methods are:

1. Net tow samples, Neuston or Manta Nets are most used though plankton ring nets and stream nets are also used. Most commonly 333um mesh is used and this becomes the cut off for microplastics.
    a. PROS: you can sample large volumes of water, skim the surface of water bodies, you can do vertical integrations
    b. CONS: you are limited to size studied by mesh size, you can lose particles through mesh (especially fibers), you need to separate the plastics from the biological (problem in coastal or upwelling areas). Hard to do in shallow water. Possible contamination from net. Cost
2. Water Grab: usually done with glass bottles or metal pails.
    a. PROS: clean samples, whole water (no size limit on collection).
    b. CONS: limited sample volume, depth is not clear.
3. Pumps similar to Nets – large volume sampling from a set depth that needs to be processed through a screen mesh.
    a. PROS: you sample a large volume of water which gives potential for higher counts and collection of rare microplastics.
    b. CONS: you need to filter water through a mesh and usually at speed so you can lose particles, especially fibers. Possible contamination from pump. Potentially you need to separate plastics from other particles.
4. Niskin Bottles similar to water grab – set water volume from a depth.
    a. PROS: whole water no size limit on the collection
    b. CONS: limited sample volume. Possible contamination from the gear.
5. Sediment Sample: Dig sediment (sand, mud, etc) from benthos/ground. Collect with sediment trap.
    a. PROS: You get all particle present
    b. CONS: You need to separate the plastics from all the particles, need to dry the sample.

## Separating Plastics from your sample

1. Sieving
2. Density Separation
    a. Pros: Looking at a smaller subset of the sample

    b. Cons: test for recovery, increased chances of contamination, limited by visibility and or the density of the solution, doesn't remove the inorganics or organic particles that are either the same size or density.
3. Digestion
    a. Pros: removes biological material (too some extent)
    b. Cons: can change appearance of the plastic, test for recovery, increased chances of contamination, doesn't remove inorganics.

Understanding the concentration of microplastics present (exposure for the risk) is dependent on the method used and we most be aware of the limitations of the methods when analyzing our data and when reading the literature.

Implications of Microplastics

The size of microplastic is important in how it may impact an organism. Smaller microplastics and nanoplastics are more likely to cross cell membranes and be incorporated into the plant or animal. Large microplastics will cause more physical damage. Microplastics have both physical, chemical and biological potential dangers and the impacts range from molecular to population levels. We will go over some of these potential dangers and discuss the limitations on our current knowledge.

Risk of microplastics is related to exposure (both concentration and duration). While current risk assessments suggest there is no or little risk of MP at current environmental concentrations, the risk studies in the laboratories are done with MP that do not match the most abundance in nature so the exposure.

Assessing the risk of microplastics is hard as all plastic is not equal. There is much that needs to be done to fully evaluate the risk of microplastics.

**Hands-on Remote Activity**

Density Separation – works for sediment samples or water samples collected in the surf zone or from shallow streams or in combination with digestion of biological samples. So we are going to try this……..
In your kit are 3 glass jars, a bottle of salt, a container of coffee filters (about 15), a coffee filter, a hand lens, a data sheet, a paper bag marked testing standards, a paper bag marked field sample, two pieces of cardboard and 8 pins. Other than step 1, we could do this via zoom to talk and teach. We would need to mail out the kits.

1. **Make a saturated salt solution: 24 h before the meeting** add salt to a quart jar of tap water (room temperature). Add salt and shake and keep doing this until you see that you can't shake in the salt. Then set the filter device on top of the second quart jar, place a coffee filter in the device, fill the device with your salt solution and let it drip through. Once it has dripped through remove the coffee filter and add a clean filter and keep doing this until you have filtered the whole jar of salt water. Put the lid on the full jar of salt water and save for the meeting. Rinse the other jar out with freshwater and place upside down to dry.
2. Empty the bag marked testing standards into the small glass jar and add 200 ml salt solution to the jar. After you put the top on the small glass jar – shake it up and set it to the side of the table. Record the time.
3. Empty the bag marked with field sample into the large empty glass jar.
4. Add 200 ml of salt solution to fill the jar. Cap the jar and shake it and set it to the side of the table. Record the time.
5. Once 20 - 30 min have past (usually we would let this go 30-120 min). Place a coffee filter in the filter apparatus and set it onto of the jar with the salt solution. Decant the liquid from the small glass jar by pouring quickly into the coffee filter. You do not want to pour any of the sand.
6. Once the water has drained through the filter remove the filter and stake it onto one of the pieces of cardboard using 4 pins. Set aside.
7. Repeat step 4 with your field sample but leave the filter in the filter device. Add more saline solution to your field sample and shake and let settle for at least 30 min.
8. Using your hand lens count the plastic pieces on the testing standard filter and record this on the data sheet. Calculate your percent recovery based on x fibers, x fragments, x films that were initially in the sample.
9. Repeat steps 4 - 5 with your field sample after the second 30 min settling period, do step 6.
10. Count and record your field sample data – send it to me.
11. Blank pour 200 ml the saline solution through a clean coffee filter. Look at this filter and record any plastic present on the filter.

While we are waiting for the samples to settle, I will show a ppt on collection methods and a second ppt about the potential impacts of microplastic. At the end there will be a question answer time.

So order of events for 2 h (Events 1-6 should take 2 h)

1. Introductions (5-10 min)
2. Set- up separation jars and set them aside for 30 min settling (this should take 15 min)
3. PPT on collection methods (take around 30 min for talk and questions)
4. Take 15 min to repeat separation on field sample and stake out the standard and observe and count it.
5. PPT on impacts of microplastics (take 30 min for talk and questions)
6. Take 15 – 20 min to stake out field sample and observe and count
7. Use any remaining time for questions