

DETAILED WASTE CHARACTERIZATION PROTOCOL – FOR A DEEPER DIVE

Purpose: To create a harmonized procedure to characterize and quantify the debris found in Trash Capture Devices (TCDs) deployed across the globe. This protocol is intended for any group interested in quantifying and characterizing the anthropogenic debris found in a TCD. The data collected using this SOP can be synthesized across locations to quantify our total impact and compare across sites since it is collected in a systematic way. *We suggest following this protocol for at least 5-10 times each year to obtain an accurate representation of the contents in your TCD. Aim to capture at least 1 – 2 wet events per year (to be considered a wet event, the amount of rainfall must be > 10mm over 24h). When measuring a wet event, ensure that there are 5 days in-between each wet event to ensure enough debris has collected on the streets.*

NOTE:

- *This protocol was developed for Seabins, and has been tested and used with a LittaTrap. We hope this protocol can be used, and adapted if needed, for other types of TCDs. We would be happy to advise on how if relevant to your situation.*
- *We do not expect to see animals in a TCD, but if you find any live animals in your TCD place them back into the water safely. If you come across any that are dead, please note it down on the datasheet and keep a record of the species (if possible) and count. If you encounter this more than once, consider moving your device to another area to avoid an impact to aquatic organisms.*
- *If characterizing waste from different TCDs at different waterbodies please ensure to thoroughly rinse and wash your materials to avoid introducing any non-native plants into your local waterbody or spreading invasive species from one location to another.*

Safety Notes:

- Prior to retrieving your TCD, if near a waterbody put on your lifejacket.
- If your device has an external energy source, check if it the power needs to be OFF prior to collecting the debris from the device. If left on it may damage and clog the pump inside the device.
- When retrieving the debris from some devices you may need a tool to help extract it and bring it ashore. This is dependent on the type and size of your device; we recommend an extension pole, pike pole or pool net.
- When sorting through debris **DO NOT** place your hand in and grab debris to put it on the tarp, instead dump the all of the debris onto the tarp to ensure you do not grab anything unexpectedly.
- Wear gloves while sorting through the debris and be cautious when submerging arm into 5-gallon bucket (wear elbow-high gloves for this).
- If dangerous materials are found dispose of it with care; e.g., a used syringe should be placed in a Sharps Container. A sharps container can just be a plastic container (i.e. yogurt container or butter tub) labeled 'Sharps' to safely store them for proper disposal.

Materials

- Reusable gloves (e.g. garden /dishwashing gloves)
- At least 1-gallon Ziploc bags or trash bag (pre-weighed)
- At least 1 clean pre-weighed jars/container for microplastic (pre-weighed)
- Luggage scale
- Kitchen scale (which can go to 2 decimal places)
- Clipboard
- Datasheets on waterproof paper
- Pencils/Sharpies
- Label tape
- Large rectangular >2mm sieve
- 2 x 28cm diameter sieves with mesh 2-3cm wide.
- Squirt bottle(s)
- Camera
- First aid kit

- 2 x 5-gallon buckets
- Elbow high rubber/latex gloves
- Sharps Container (or used yogurt or butter tub)
- 2 x Tweezers
- Metal spoon
- Tarp
- Garbage bags
- Sunscreen, water, hat, sunglasses
- Hose
- Water source to plug in the hose

Methods:

Step 1: *Before collecting any debris from your Trash Capture Device:*

1. Ensure your plastic jars or container (without the lid) and Ziploc or garbage bags are pre-weighed and recorded on the datasheet. Label each with location, TCD ID, Time, Date, and your initials. Label the Ziplocs as “large debris” and the jars/cups as “small debris”. Depending on how full your TCD is, you may need multiple bags and plastic jars/containers. In this case, you label all the Ziplocs and cups/jars with the same information.
2. Record the time and date at which the device was last emptied, and the time and date the device were removed.
3. Note the weather and wind conditions during retrieval; note whether there was a wet event while the device was deployed (to be considered a wet event, the amount of rainfall must be > 10mm over 24h).
4. Use your Personal Protective Equipment (PPE), including gloves.

Step 2: *Extract the compartment that captures the debris from your Trash Capture Device:*

5. When retrieving the debris from some devices you may need a tool to help extract it and bring it ashore. This is dependent on the type and size of your device; we recommend an extension pole, pike pole or pool net. Beware while extracting the device when full to the brim, it may require two people as it can become very heavy. Once the device is extracted, give it a good shake to remove the majority of the water.
6. Weigh the contents captured in the device using the luggage scale. If the compartment where the debris is stored in the device is non-detachable, dump the contents into a garbage bag and weigh it inside the bag. Ensure it's set to measure in **kilograms**. Record the weight on a datasheet.
7. Record how full the device was (full to the brim, half full, quarter full).
8. Make sure to fill out the rest of the top part of your datasheet, i.e. Name, Date and Time TCD retrieved, when the TCD was last emptied, what are the current wind and weather condition and if there was a wet event during deployment.
9. Take a picture of the contents caught in your device, and ensure it clearly indicates how full the device is.
10. Place a tarp down on the area you will be sorting through debris.

Step 3: *Characterizing the anthropogenic debris from the Trash Capture Device:*

11. Attach hose to a water source.
12. After weighing the device with the debris inside, dump all of its contents onto the tarp. Depending on how compact the debris is, you may have to help guide the material out (with gloves). When all the material removed from the device, shake it 3 times over the tarp to remove any debris stuck to the sides.
13. Weigh the empty compartment of where the debris is stored and mark it on the datasheet. If a garbage bag was used, weight the empty garbage bag and record it on the datasheet.
14. Once all the material is laid out on the tarp, place the device back into the water/ground.
15. Take a picture of the debris on the tarp.

Quantify and characterize the large anthropogenic debris (bigger than 3cm)

16. Begin going through the material caught section by section to remove any large debris entangled inside. **See Figure 1 to correctly identify the size of large debris.**
17. For each piece of large debris: Record a new type (material & item; e.g., bottle cap, cigarette butt, plastic straw, paper receipt) on the datasheet and tally types of debris that have already been listed. Rinse it with a

squirt bottle if it is dirty or has small debris attached to it and place it in the Ziploc bag. Make sure you don't miss any large debris that may be entrained in other organic material or other contents caught in your TCD. If you have a lot of large debris, you may need another Ziploc.

Quantify and characterize the small anthropogenic debris (smaller than 3cm and >2mm)

18. Once cleaned of the large debris, take 2 large handfuls of the leftover contents caught by your TCD and place at the bottom of the 5-gallon bucket.
19. Place the hose inside the bucket with the contents inside and turn it on at a high pressure.
20. Begin filling up the 5-gallon bucket, spraying down the contents while doing so until the bucket is just over $\frac{3}{4}$ full. This will allow the contents to loosen up and release any small debris entangled inside.

NOTE: If any sharp/dangerous materials are seen floating in the bucket, dispose of them immediately (and log it on your datasheet if anthropogenic). If there are any large natural debris that can be easily removed without removing any anthropogenic material, e.g. sticks, branches etc. floating at the top of the bucket, remove them and rinse each piece into the bucket. Leave the rest of the plant material/natural debris such as algae in the bucket.

21. Once the bucket is filled $\frac{3}{4}$ full, let it settle for about ~1 minute to allow small debris to float to the surface.
22. If there are any large pieces of debris found floating that were missed in the initial removal, place them in your Large Debris Ziploc bag and tally it on your datasheet.
23. Place the 28cm diameter sieve into the bucket and slowly push it down toward the bottom of the bucket, to wherever it becomes stuck.
24. Wait for another minute or so to allow the small debris to resurface through the sieve while the remaining contents or materials are bound to the bottom of the bucket.
25. Place the 2mm sieve on the ground and with the 28cm diameter sieve placed at the bottom of the bucket, slowly pour the contents of the bucket into the sieve, **avoid any splashing** as this will cause small debris to be lost from the sample. Pour until the bucket is empty.
26. Once the bucket is empty and all that remains are the remaining contents stuck at the bottom, repeat steps 18 - 24 twice more. In total you will rinse each 2 handfuls of material 3 times. Once triple-rinsed, remove the material from the bucket and place to the side where it can later be properly disposed of.
27. Next, repeat steps 18 – 25 until you have extracted debris from the whole pile of material.
28. Throw all extracted materials into the garbage bin, **DO NOT THROW BACK INTO THE WATER**. This is because small pieces of debris (sometimes many pieces) will likely remain attached to the material even after 3 rinses.
29. Now all that should remain on the 2mm sieve are small pieces of anthropogenic debris and SOME small pieces of plant material/non-organic material.
30. Decide whether counting all of your small anthropogenic debris is possible. If there are too many pieces (e.g., more than 50-100), you can subsample. If so, go down to the “*Subsampling your small debris*” steps below. If not, check No under “Did you subsample” on your datasheet and go straight to step 31.
31. Gather all your small pieces of debris in a pile on the sieve, make sure to scrape the sides of the sieve with a metal spoon to get all the small debris in the center.
32. Remove the pile from the sieve and onto the tarp.
33. Begin to count all small pieces and tally as hard fragment, foam, pellet, film or if another category of small anthropogenic debris, fill out in other. **See Table 1 and Figure 1 below to correctly identify the size and types of small pieces of debris.**
34. Once tallied, place the counted small anthropogenic debris in the clean pre-weighed plastic jar/cup.
35. Next, weigh the plastic jar with the small debris inside without the lid on and record on your datasheet under “Weight of small debris sample in jar”.
36. Fill in the rest of your datasheet, including “Final Count” of each category, the “Total count of small debris” which is the sum of all your final counts, and “Final weight of subsample/sample” which is “Weight of the small debris sample” minus “Weight of the plastic jar”.

Subsampling your small debris:

37. If there are too many pieces in your sieve to count (more than 50-100), check Yes under “Did you subsample” on your datasheet.

38. To subsample, gather all the debris in the center of the sieve into a small pile ensuring you scrape the corners and sides of the sieve with a metal spoon. Once it's all in a pile, divide it into four smaller equal piles.
39. To reduce bias, have another person pick which pile you will quantify and characterize, this will be your subsample.
40. Remove the subsample onto the tarp and place the three remaining debris piles into the garbage.
41. Begin to count all small pieces and tally as hard fragment, foam, pellet, film or if another category of small anthropogenic debris, fill out in other. **See Table 1 and Figure 1 below to correctly identify the size and types of small pieces of debris.**
42. Once tallied, place all counted small anthropogenic debris into the pre-weighed plastic jar/cup. Weigh and record on your datasheet under "Weight of sample/subsample". Next calculate your final weight as stated in step 36 and extrapolate your subsample weight by multiplying your "Final weight of subsample/sample" by 4. Record this extrapolated number under "Extrapolated weight of subsample" on your datasheet.
43. Next multiply the count of each type of debris by 4 to represent the total amount of small debris in the full bin.
44. Now that you have collected all large debris, weigh it and record the weight under "Weight of large debris in Ziploc". To fill in "Final weight of large debris" subtract "Weight of large debris in Ziploc" from "Weight of Ziploc".


Step 4: Upload data

At the end of the day, enter all your data from your datasheets onto an excel spreadsheet. Please use the template provided. Lastly, send us the excel spreadsheet you have compiled each time you complete this protocol to trashtrapnetwork@gmail.com.



Figure 1: Markers to identify between large and small debris.

Table 1: Identifying microplastics

MICROPLASTIC	DESCRIPTION	IMAGE
Hard Fragment	Fragments have a rigid structure and sometimes irregular shape. They are not always equally thick throughout and can appear twisted or curled. Shavings, droplets, and seams from plastic manufacturing fit within this category. Fragments can be any color or combination of colors ¹ .	 <p>Image: (Kovač Viršek et al. 2016)</p>
Foam	Foams are soft, compressible, and cloud-like. They are usually white and/or opaque but can be any color ¹ .	 <p>Image: Rochman et al. 2019</p>
Pellets	Pellets (sometimes called “nurdles”) are often rounded or cylindrical in shape. Pellets can be any color ¹ .	 <p>Image: Patricia Corcoran</p>
Film	Films are flat, thin, and malleable. Films can fold or crease but do not break apart easily. Films are typically partially or fully transparent and are found in a range of colors ¹ .	 <p>Image: (Kovač Viršek et al. 2016)</p>

1. Rochman et al. 2019