| Filtering Criteria: Media | | | | | | | | | | | Filtering Criteria: Particle Size Range | | | | | | | |
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| Surface Water | Wastewater | Stormwater | Drinking Water | Groundwater | Soil | Sediment | Biosolids | Pore Water | Air | Biota | All Size Fractions | Limited Size Fractions | Sample Method | Description | Equipment | Advantages | Considerations / Disadvantages | Relative Cost |
| X | X | X | | | | | | | | | X | | Grab (Water Body)<br>• Surface Water<br>• Wastewater<br>• Stormwater | Submerge sample bottle/pail directly off the side of a boat or at edge of water body<br>(Pivokonsky et al. 2018, Pivokonský et al. 2020) | Stainless steel pails, if desired<br>Telescopic sampling pole, waders, or boat, if desired<br>Sample container | Easy to collect<br>Minimal sampling equipment needed<br>Lower likelihood of cross-contamination during sampling due to minimal sampling equipment used | Low sample volume, resulting in discrete sample result | Low |
| X | X | X | | | | | | | | | | X | Field-Filtered Grab (Water Body)<br>• Surface Water<br>• Wastewater<br>• Stormwater | Collect sample from water body surface using telescopic sampling pole, stainless steel bucket, or submerged sample container<br>Pour sample through stainless-steel sieves for filtration<br>Cover sieves with aluminum foil for transport to lab<br>(Leslie et al. 2017, Magni et al. 2019, Murphy et al. 2016, Tagg et al. 2015) | Telescopic sampling pole or stainless-steel bucket, if desired<br>Stainless-steel sieves<br>Aluminum foil<br>Sample container | Easy to collect<br>Provides more representative sample than basic grab sample due to larger sample volume | Moderate sample volume (typically 10-30 L), resulting in discrete sample result<br>Potential for sample contamination from ambient air during sample sieving<br>Moderately time and labor intensive depending on method<br>Size range is limited by filter size | Low to Moderate |
| | X | | X | | | | | | | | X | | Grab (Water Utility)<br>• Drinking Water<br>• Wastewater | Fill sample container directly from drinking water source or treatment plant raw water inlet or treated water outflow<br>(Wang, Lin, and Chen 2020) | Sample container | Easy to collect<br>Minimal sampling equipment required<br>Lower likelihood of cross-contamination during sampling due to minimal sampling equipment used | Low sample volume, resulting in discrete sample result | Low |
| | X | | X | | | | | | | | X | | Time-Integrated Grab (Water Utility)<br>• Drinking Water<br>• Wastewater | Fill sample container directly from drinking water source or treatment plant raw water inlet or treated water outflow<br>Collect samples every 8 hours over a 24-hour period | Sample containers | Easy to collect<br>Provides a more representative result using multiple grab samples collected over an extended time period | Moderately time and labor intensive | Low to Moderate |
| X | X | X | | | | | | | | | | X | Volumetric Reduction with Net<br>• Surface Water<br>• Wastewater<br>• Stormwater | Drag net behind boat or place in flowing water (typical durations 15 to 60 minutes)<br>Measure water velocity<br>Rinse collected material from net into stainless steel pan/ sample container<br>(Eriksen et al. 2013, Free et al. 2014, Lenaker et al. 2019, Sutton et al. 2016) | Neuston net, ring net, or manta trawl (for water surface); bongo net (for water column)<br>Water velocity measurement device<br>Boat, depending on location<br>Stainless steel pan<br>Sample container | Provides a larger sample volume, resulting in a more representative concentration<br>Can target specific depth intervals | Potential for sample contamination from net fibers, from incomplete net decontamination between sampling, from ambient air during sample processing, or from rinse water<br>Sample processing is time consuming and labor intensive<br>Size range limited by net mesh size (typically 333 um) | Moderate to High |
| X | | | | | | | | | | | | X | Volumetric Reduction with Net (Autonomous Drone)<br>• Surface Water | Portable drone autonomously samples a user-defined area, dragging manta-style net<br>Measure water velocity<br>Rinse collected material from net into stainless steel pan/ sample container<br>(Norwegian University of Science and Technology 2022) | Portable autonomous drone, with manta-style net<br>Boat, depending on location<br>Stainless steel pan<br>Sample container | Provides a larger sample volume, resulting in a more representative concentration | Potential for sample contamination from net fibers, from incomplete net decontamination between sampling, from ambient air during sample processing, or from rinse water<br>Sample processing is time consuming and labor intensive<br>Size range limited by net mesh size (typically 333 um) | Moderate to High |
| X | X | | X | X | | | | | | | | X | Volumetric Reduction with Sieves<br>• Surface Water<br>• Wastewater<br>• Groundwater<br>• Drinking Water | Install/submerge piping/tubing to desired sample depth<br>Pump water through flow meter and record flow rate/duration<br>Direct water flow through stainless steel sieves<br>Cover sieves with aluminum foil for transport to lab for analysis<br>(ASTM 2020, Mason et al. 2016, Okoffo et al. 2019) | Pump<br>Flow meter<br>Piping/tubing (ideally non- polymer-based material, such as copper tubing)<br>Stainless steel sieves (355, 125, 63, and 43 µm)<br>Aluminum foil | Provides a larger sample volume, resulting in a more representative concentration<br>Can target specific depth intervals<br>Can install sampling system set-up for routine sampling<br>Relatively easy to collect once sampling set-up is installed | Large volume needed (400 – 1,400 gallons)<br>Upfront sample system set-up required<br>More sampling equipment needed than other options<br>Potential for sample contamination from ambient air during sample sieving<br>Size range limited by sieve size | Moderate to High |
| | X | | | | | | | | | | | X | Volumetric Reduction with Sieves (Submerged)<br>• Wastewater | Install sampling device placed at desired sampling point in wastewater treatment plant<br>Allow water to flow through submerged device<br>Cover sieves with aluminum foil for transport to lab for analysis<br>(Dyachenko, Mitchell, and Arsem 2017, Sutton et al. 2016, Ziajahromi et al. 2017) | Stainless steel sieves installed inside a cover<br>Water velocity measurement device, if desired<br>Aluminum foil | Provides a larger sample volume, resulting in a more representative concentration<br>Can target specific depth intervals<br>Can install sampling system set-up for routine sampling<br>Relatively easy to collect once sampling set-up is installed | Large volume needed (typically 1,500 gallons)<br>Upfront sample system set-up required<br>More sampling equipment needed than other options<br>Size range limited by sieve size | Moderate to High |

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| | X | | X | | | | | | | | | X | Volumetric Reduction with In-Line Filters<br>• Wastewater<br>• Drinking Water | Install stainless-steel filters/containment to inlet tube attached directly to a water tap or hydrant<br>Filter drinking water samples in parallel through filter containment<br>(Coffin 2022, Kirstein et al. 2021, Yuan et al. 2022) | Stainless steel filters placed in custom modified stainless steel filter holders attached via stainless steel pipes<br>Sample containers | In-line filtration minimizes potential for contamination<br>Provides a larger sample volume, resulting in a more representative concentration<br>Can install sampling system set-up for routine sampling<br>Relatively easy to collect once sampling set-up is installed | Large volume needed (200-1,100 liters)<br>Upfront sample system set-up required<br>Size range limited by sieve size | Moderate |
| | | X | | | | | | | | | X | | Grab (Stormwater)<br>• Stormwater | Submerge sample container beneath flowing water surface at center of stormwater outfall<br>Allow water to enter directly into sample container<br>If sampling for compliance with National Pollutant Discharge Elimination System (NPDES) permit, sampling within 30 minutes of a Qualifying Storm Event may be required<br>Record sampling conditions (e.g., precipitation event intensity, presence of floating/suspended/settled solids etc.) | Telescopic sampling pole, if desired<br>Sample container | Easy to collect<br>Low likelihood of cross-contamination during sampling due to minimal sampling equipment used | Low sample volume, resulting in discrete sample result | Low |
| | | | | | X | X | X | | | | X | | Grab (Solids)<br>• Soil<br>• Sediment<br>• Biosolids | Collect sample from top of surface<br>Remove gross vegetation, if present<br>Transfer to sample container | Stainless steel sampling tool (e.g., shovel, stainless steel spoon), if desired<br>Sample container | Easy to collect<br>Minimal sampling equipment needed | Limited to top of soil/sediment column<br>Less discrete sample depth interval<br>Higher loss/suspension of sediment into surrounding water column for sediment sampling | Low |
| | | | | | X | | | | | | X | | Hand Auger<br>• Soil | Push auger into soil surface<br>Remove sample from auger and isolate desired sample interval<br>Transfer to sample container | Hand auger<br>Stainless steel tray<br>Sample container | Can collect discrete sample intervals at deeper portions of soil column<br>Can be collected using hand tools | Moderately time and labor intensive, depending on field conditions<br>Requires slightly more specialized sampling equipment<br>May generate excess investigation-derived waste that requires management | Low to Moderate |
| | | | | | | X | | X | | | X | | Direct Push Sampler/Probe<br>• Sediment<br>• Pore Water | Push auger into soil/sediment surface<br>Remove sample from auger and isolate desired sample interval<br>Transfer to sample container | Stainless steel direct push sampler/probe/modified piezometer<br>Stainless steel tray<br>Sample container<br>Waders or boat, depending on location | Can collect discrete sample intervals at deeper portions of sediment column<br>Can be collected using hand tools | Moderately time and labor intensive, depending on field conditions<br>Requires slightly more specialized sampling equipment<br>May generate excess investigation-derived waste that requires management | Low to Moderate |
| | | | | | X | X | | | | | X | | Drill Rig<br>• Soil<br>• Sediment | Drill rig pushes split spoon sampler into soil column<br>Open split spoon sampler<br>Collect sample from desired depth interval<br>Transfer to sample container | Drill rig<br>Split spoon sampler<br>Stainless steel tray<br>Sample container | Can collect discrete sample intervals at deeper portions of soil/sediment column<br>Allows for deeper sample collection than hand auger methods<br>Minimally time and labor intensive<br>Faster drilling rates/sample collection than hand methods | Requires specialized sampling equipment<br>Sample locations may be limited due to drill rig access<br>Higher quantity of excess investigation-derived waste that requires management | High |
| | | | | | | X | | X | | | X | | Sediment Grab Sampler Devices<br>• Sediment<br>• Pore Water | Submerge sampler into sediment surface and close sampler bucket<br>Release sample into pan to process<br>Transfer to sample container<br>(Lenaker et al. 2019) | Ponar, Van Veen, Ekman, Smith McIntyre, or Hammon sampler<br>Stainless steel tray<br>Sample container | Relatively easy to collect<br>Can collect samples in deeper water columns than standard grab sampling<br>Reduces sediment loss/suspension into water column | Moderately time and labor intensive, depending on field conditions<br>Requires slightly more specialized sampling equipment<br>May generate excess investigation-derived waste that requires management | Low to Moderate |

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| | | | | | | | | | X | | X | | Passive Atmospheric Dust • Air | Place aluminum tray/funnel and weather station in desired study area<br>Allow ambient deposition for desired study period<br>Record meteorological data<br>Pour deionized water along aluminum tray/funnel surface to rinse<br>Pour rinsate back into deionized rinse water bottle<br>(Wright et al. 2020) | Aluminum tray/funnel<br>Weather station<br>Deionized rinse water<br>Sample container | Easy to collect | Assesses deposits only rather than suspended particles<br>May underestimate low-density microplastic polymers<br>Units are correlated to surface area rather than air volume, resulting in less meaningful data with respect to risk assessments | Low |
| | | | | | | | | | X | | | X | Active Pump Sampler • Air | Place total suspended particulate sampler in desired study area<br>Allow sampler to pump air through filter<br>Record flow rate and duration<br>Using metal forceps, remove filters and immediately transfer into non-plastic, sealed sample collection container<br>(Brander et al. 2020, Liao et al. 2021) | Total suspended particulate sampler, equipped with glass microfiber filters<br>Metal tripod, pending sample location<br>Inline flow meters or totalizer<br>Metal forceps<br>Sample container | Provides a larger sample volume, resulting in a more representative concentration<br>Provides more meaningful volumetric data than passive air sampling methods | Requires more specialized sampling equipment<br>Size range limited by filter size | Moderate to High |
| | | | | | | | | | X | | | X | Cascade Impactor • Air | Place cascade impactor sampler in desired study area<br>Allow sampler to pump air through cascade impactor<br>Record flow rate and duration<br>Cover sieves with aluminum foil for transport to lab for analysis<br>(Velimirovic et al. 2021) | Cascade impactor sampler<br>Metal tripod, pending sample location<br>Inline flow meters or totalizer<br>Aluminum foil | Allows for simultaneous collection of airborne particles of different size fractions<br>Provides a larger sample volume, resulting in a more representative concentration<br>Provides more meaningful volumetric data than passive air sampling methods<br>Can be adapted for stationary or personal air sampling | Method currently used to sample indoor dust, so may require further development for specific application to MP sampling<br>Requires more specialized sampling equipment<br>Size range limited by sieve size | Moderate to High |
| | | | | | | | | | X | | | X | Transmission Electron Microscopy Grid • Air | Place transmission electron microscopy (TEM) grid sampler in desired study area<br>Allow sampler to pump air through TEM grid<br>Record flow rate and duration<br>Using metal forceps, remove TEM grid and immediately transfer into non-plastic, sealed sample collection container<br>(Velimirovic et al. 2021) | TEM grid sampler<br>Metal tripod, pending sample location<br>Inline flow meters or totalizer<br>Metal forceps<br>Sample container | Provides a larger sample volume, resulting in a more representative concentration<br>Provides more meaningful volumetric data than passive air sampling methods | Method currently used to sample indoor dust, so may require further development for specific application to MP sampling<br>Requires more specialized sampling equipment<br>Size range limited by grid size | Moderate to High |
| | | | | | | | | | | X | X | | Fish (Whole) • Biota | Capture fish in net, use of electrofishing optional; or direct collection from fish farms or from commercial fish markets<br>Euthanize<br>Remove externally adhered plastics prior to treatment by washing the study organism with water, saline water or using forceps<br>Wrap in aluminum foil and place on ice<br>Choice of preservation technique depends on the research question being considered, 4% formaldehyde and 70% ethanol are commonly used fixatives<br>(Bessa et al. 2019, Lusher et al. 2017, Parker et al. 2020) | Trammel, seine, or gill net; bottom trawl; or electrofishing gear<br>Euthanasia solution<br>Aluminum foil<br>Ice<br>Preservative | Provides data applicable to determine human health risk from ingestion | Handling stress, physical movement, and the physiological and behavior of the sampled organism may result in the loss of microplastics prior to animal preservation; some animals might egest microplastic debris prior to analysis | Moderate to High |

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| | | | | | | | | | | X | X | | Fish (tissue/parts) • Biota | Capture fish in net, use of electrofishing optional; or direct collection from fish farms or from commercial fish markets<br>Euthanize<br>Remove externally adhered plastics prior to treatment by washing the study organism with water, saline water or using forceps<br>Wrap in aluminum foil and place on ice<br>Choice of preservation technique depends on the research question being considered, 4% formaldehyde and 70% ethanol are commonly used fixatives<br>Dissect in lab for target tissue/parts<br>(Bessa et al. 2019, Lusher et al. 2017, Parker et al. 2020) | Trammel, seine, or gill net; bottom trawl; or electrofishing gear<br>Euthanasia solution<br>Aluminum foil<br>Ice<br>Preservative | Provides data useful for toxicity studies and risk assessments | Tissue fixative can affect the structure, microbial surface communities, chemical composition, color, or analytical properties of any microplastics within the sample | Moderate to High |
| | | | | | | | | | | X | X | | Invertebrates • Biota | Capture invertebrate; or direct collection from shellfish farms or from commercial markets<br>Euthanize<br>Remove externally adhered plastics prior to treatment by washing the study organism with water, saline water or using forceps<br>Where dissection is prohibitive (e.g., mussels) fluorescent microplastics can be quantified by physically homogenizing tissues<br>Choice of preservation technique depends on the research question being considered, 4% formaldehyde and 70% ethanol are commonly used fixatives<br>(Bessa et al. 2019, Lusher et al. 2017) | Grabs, traps, and creels; Kick or D-net; Bottom trawl; or Manta or bongo nets (planktonic and nektonic invertebrates)<br>Euthanasia solution<br>Aluminum foil<br>Ice<br>Preservative | Relatively easy to collect or purchase from biological supply vendors | Handling stress, physical movement, and the physiological and behavior of the sampled organism may result in the loss of microplastics prior to animal preservation; some animals might egest microplastic debris prior to analysis | Moderate to High |
| | | | | | | | | | | X | X | | Vertebrates • Biota | Capture vertebrate, or direct collection from commercial markets<br>Euthanize<br>Remove externally adhered plastics prior to treatment by washing the study organism with water, saline water or using forceps<br>Wrap in aluminum foil and place on ice<br>Choice of preservation technique depends on the research question being considered, 4% formaldehyde and 70% ethanol are commonly used fixatives<br>Dissect in lab for target tissue/parts<br>(Bessa et al. 2019, Lusher et al. 2017, Parker et al. 2020) | Traps<br>Euthanasia solution<br>Aluminum foil<br>Ice<br>Preservative | Provides data useful for toxicity studies and risk assessments | Tissue fixative can affect the structure, microbial surface communities, chemical composition, color, or analytical properties of any microplastics within the sample | High |
| | | | | | | | | | | X | X | | Plants • Biota | Purchase vegetables and fruits from local markets or collect from the environment<br>Wash, peel as needed, weigh, process in blender<br>Heat to reduce water content<br>Sample aliquots (0.1 g) and transfer into transparent glass tubes<br>Mineralize, digest, and extract<br>(Oliveri Conti et al. 2020) | Blender<br>Oven<br>Glass tubes<br>Centrifuge | Easy to collect | Low sensitivity of the method | Moderate |

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| | | | | | | | | | | X | X | | Biofilm<br>• Biota | Prepare batch reactors in duplicate to continuously stir 100 mL batches<br>Add polystyrene beads to batch reactors<br>Sieve into two size classes<br>Incubate composited wastewater influent or freshwater<br>grab samples<br>Incubate duplicate reactors for two days<br>Recover beads and rinse<br>Transfer to<br>lysing tubes for biofilm DNA extraction<br>Extract DNA from the microparticles and concentrated filtrate samples<br>(Glaser 2020, Parrish and Fahrenfeld 2019) | Series of batch reactors<br>Polystyrene and glass beads<br>Sieves<br>Oven<br>Lysing<br>tubes<br>Commercial DNA extraction kit | Formation of biofilms on microplastics is widely observed and can significantly alter properties important<br>to environmental and human health<br>Useful for determining fate and effect of microplastics on environmental and human health | Methods to identify plastics may not be simultaneously compatible with methods used to study<br>biofilms<br>Oxidation and density separation remove biofilm | Moderate to High |