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Supplementary material

Questions of size and numbers in environmental research on microplastics: methodological and conceptual aspects

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Table S1. Microplastics in aquatic systems. location, type of sample, sampling procedure, initial separation and sample treatment methods, and identity verification in published studies

Studies are listed in chronological order, starting with the most recent

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
Sediments							
[1]	Norderney Island, Germany	Tidal mudflats	Drift lines (2) and dune valley (1), upper 3 cm layer	3; 36	Sieving 1 mm mesh	>1 mm: none <1 mm: flotation (saturated NaCl, d = 1.2 g cm^{-3} + NaI, d = 1.8 g cm^{-3}); as described in Nuelle et al.[2]	32 random particles analysed by TD-Pyr-GC/MS, 47% confirmed
[3]	Singapore	Mangroves	Top 3–4 cm at low tide	7; ?	No sieving mentioned	Flotation (concentrated saline solution, d = 1.18 g dm^{-3}), addition Tween-80, filtration 0.1 cm and 1.6 µm	'a representative group of microplastics' identified by ATR-FTIR'
[4]	Atlantic Ocean, Mediterranean Sea, Indian Ocean	Deep-sea sediments (some 12 years old)	~1000 m deep 8: upper 1 cm; 4: 2, 5 cm	12	No sieving mentioned	8 samples: flotation (concentrated NaCl), filtration (size not given)[5] 4 samples: flotation (Ludox-TM 40), centrifugation, filtration 32 µm[6]	FTIR
[7]	Portugal coast	Beaches	Top 2 cm at high tide level	10; not given (3–5 replicates for each location)	Sieving ~3-mm metal mesh	As described in Martins and Sobral[8]	µ-FTIR in some resin pellets

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[9]	Lake Garda, Italy	Lake beaches	Top 5 cm	2; 6	No sieving mentioned	Flotation (1.6–1.7 kg dm^{-3} $ZnCl_2$), filtration 0.3 µm; as described in Imhof et al.[10]	Raman microspectroscopy
[11]	Mumbai, India	Beaches	High-tide mark, top 2 cm	4; 240?	Sieving 1 mm	Flotation (140 g dm^{-3} NaCl)	No
[12]	Near Nakdong estuary, South Korea	Beaches	Strandline, upper 5 cm	6; 90?	Tyler sieves 5, 1 mm		No
[13]	Belgian Continental Shelf	Beaches	Upper 5 cm, at the low- and high-water mark	4; 8	Sieving 1 mm	Elutriation, sieving 35 µm, flotation (1.6 g cm^{-3} NaI), filtration 5 µm, as described in Claessens et al.[14]	No
[15]	Atlantic Ocean Mediterranean Sea	Deep-sea sediments (1176–4844 m deep) Nile deep sea fan	Only top 1 cm of the cores considered	4; 11	Wet sieving 1 mm, then 35-µm mesh	Flotation (1.6 g cm^{-3} NaI), filtration 0.8 µm	Raman microspectroscopy
[16]	Venice Lagoon, Italy	Shallow water sediments (<1m depth)	0–5 cm sediments (box-corer)	10; 20	No sieving mentioned	Flotation (120 g dm^{-3} NaCl), sieving 32 µm, filtration 0.7 µm; as described in Thompson et al.[5]	Surface chemical mapping of filters by µ-FTIR; observation by ESEM-EDS
[17]	Lake Geneva, Switzerland	Lake beaches			2, 5-mm sieves	Flotation (water)	No
[18]	East Frisian islands: Spiekeroog, Kachelotplate	Beaches and tidal flats	Upper 1 cm	11 (from figure); ?	No sieving mentioned	OM H2O2 digestion, flotation (1.5 g cm^{-3} ZnCl2), filtration 1.2 µm	No

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[19]	Ocean Beach, San Diego, California, US	Beaches	Upper 1 cm of sand	1; 16?	Sieving 2 mm	No details	No
[20]	Hawaiian Archipelago (Kamilo, Waikapuna beaches)	Beaches	25 cm sediment cores	2; 30	No sieving mentioned	Flotation (1.2 g cm^{-3} NaCl); brass US sieves (4, 2, 1, 0.5, 0.25 mm)	248 plastic fragments analysed by FTIR
[21]	Belgian coast	Harbours	Subtidal sediments	3; 11	No sieving mentioned	Flotation (concentrated saline solution), sieving 38-µm mesh; as described in Thompson et al.[5]	'Particles of each type' analysed by FTIR
		Beaches	High, subtidal, middle	3			
		Coastal shelf	Subtidal sediments	6			
[8]	Portugal	Beaches	Last high tide mark, top 2 cm sand	5	A: No sieving	A: Flotation (140 g dm^{-3} NaCl), filtration 1 µm	Some 'selected' items analysed by FTIR
					B: In situ sieving 2.5 × 3.5-mm metal mesh	B: 'plastic set apart from the remained debris' How?	
[22]	Lake Huron, Canada	Lake beaches	–	7	No sieving mentioned	Air-drying, sonication	45 particles analysed by FTIR
[23]	Tamar estuary, UK	Strandlines	Underlying 3 cm of sediment	6; 30	No sieving mentioned	Flotation (saturated solution of NaCl); as described in Thompson et al.[5]	FTIR
[24]	Boa Viagem, Recife, Brazil	Beach	Strandline, upper 2 cm of sand	1; 9	Sieving 1 and 0.5 mm wire cloths	Washing in filtered seawater	No

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[25]	Fernando de Noronha, Equatorial Western Atlantic	Beaches	Strandline, upper 2 cm of sand	11; 15	Sieving 1 mm	–	No
[26]	Singapore	Beaches	0.5 m away from the ocean tideline; some points top 1 cm; some at 10–11-cm depth	7; 26	No sieving mentioned	Flotation (1.2 kg dm^{-3} saline solution), filtration 1.6 µm; as described in Thompson et al.[5]	FTIR analysis for all suspected particles
[27]	Hawaiian archipelago	Beach	High-tide line and bern, top 5.5 cm sand	9; 22	Only particles 1–15 mm retained (nested sieves: 4.75, 2.8, 1 mm)	– Dry sort: none – Wet sort: cleaning with water	No
[5]	Around Plymouth, UK	Beach (sandy intertidal) Estuarine sediment (intertidal) Subtidal sediment	Strandline	6; 30	No sieving mentioned	Flotation (1.2 kg dm^{-3} NaCl), filtration	FTIR
Water							
[28]	Bay of Calvi, Corsica, Italy	Coastal surface seawater	First 0.2 m of sea surface	1; 38	Floating wp2 net (200-µm mesh)	Plastic particles separated from organic tissue by gravity in graduated cylinders	No

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[29]	Worldwide open oceans	Surface seawater		141 sites; 3070	Neuston net (200-µm mesh)	Mixed with 0.2-mm-filtered seawater	Raman applied to a random subset of particles (n = 67)
[30]	NE Pacific Ocean Coastal British Columbia, Canada	Subsurface seawater	4.5-m depth	2 cruises; 34	Pumped, (saltwater intake system of the vessel), filtration 5 mm	Cu sieves (250, 125, 62.5 µm), each fraction OM acid digestion (conc HCl), filtration 47 µm	'Plastics identified according morphological characteristics and physical response features (e.g., response to physical stress)'
[31]	Lake Hovsgol, Mongolia	Lake water		9 transects	Manta trawl (333-µm mesh)	Tyler sieves (0.355–0.999, 1.00–4.749, >4.75 mm), each fraction OM H2O2 digestion, flotation (1.62 g cm^{-3} salt water)	No
[32]	Portuguese coastal waters (Aveiro, Lisboa, Costa Vicentina, Algarve)	Coastal surface seawater	Upper 20 cm of water column except with plankton recorder (25 m deep)	4; 152	Neuston net (280 µm), plankton recorder (335 µm)	Filtration mentioned but no pore size given, just diameter of filter!	µ-FTIR, number of analysed samples not clear
[33]	Seto Inland, Japan	Coastal surface seawater		4; 15	Neuston net (350 µm)	–	µ-FTIR, number of analysed samples not clear
[34]	Goiana estuary, Brazil	Estuarine waters	Surface and bottom hauls	1; 216	Plankton net (300 µm)	'Floating plastics' sieved 45-µm mesh	No

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[35]	Highly urbanized river, Chicago, US	River water		2; 8	Neuston net (333 µm)	Stacked sieves (2 mm, 350 µm), OM H_2O_2 digestion, flotation (NaCl)	No
[36]	Tamar estuary, England	Estuarine waters	Surface water	4?; 36?	Manta net (300-µm mesh)	Set of sieves (3 mm, 1 mm, 270 µm)	FTIR on 50% of the pieces from each size group
[37]	Coastal areas close to Nakdong River, South Korea	Coastal surface seawater	SML (150–400 µm) waters	10; 20?	SML, bulk water, hand net (50-µm mesh): filtration, manta trawl (330-µm mesh)	SML: filtration 0.75 µm Bulk water: filtration 1, 0.75 µm Hand and trawl: sieving 2 mm: >2 mm counted, <2 mm: H_2O_2 digested, filtered 0.75 µm	All SML: FTIR Other: only 'selected'
[38]	Yangtze estuary, China East China Sea	Estuarine and surface seawater	estuary: 1 m deep	1; 7 3; 15	Estuary: pumped, sieving 32 µm Sea: neuston net (333 µm)	OM H_2O_2 digestion, flotation (saturated $ZnCl_2$ solution),[18] filtration 1.2 µm	No
[39]	Jade System, Southern North Sea	Coastal seawater	20-cm depth	14; 2 replicates	100 mL PE bottles filling, filtration 1.2 µm	In one case: 40-µm sieve, OM H_2O_2 digestion	No
[40]	Laurentian Great Lakes (Erie, Huron, Superior)	Lake surface water		3 lakes; 21	Manta trawl (333-µm net)	Flotation (salt water), Tyler sieves (0.355–0.999, 1.00–4.749, >4.75 mm)	All particles <1 mm analysed by SEM-EDS

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[41]	South Pacific subtropical gyre	Surface seawater		transect; 48	Manta trawl (333-µm net)	Flotation (salt water), Tyler sieves (0.355–0.999, 1.00–4.749, >4.75 mm)	No
[42]	Northeast Pacific Ocean	Seawater	Surface	2 cruises; 147	Manta tow (333-µm mesh	–	Subset (n=557) analysed by FTIR; all confirmed to be plastic
			Subsurface, max depth 210 m	1 cruise; 119	Bongo tow (202-µm mesh)		
[43]	Saint Peter and Saint Paul Archipelago, Equatorial Atlantic	Surface seawater	0–0.6 m from the surface	3; 88	Plankton net (300-µm mesh)	Filtration 0.45 µm	No
[44]	Waters around Australia	Surface coastal seawater	–	57; 71	Neuston net (335-µm mesh) or Manta net (333-µm mesh)	Flotation (seawater)	Random 200 particles analysed by FTIR
[45]	North Western Mediterranean Sea	Surface seawater	Top 10 cm of the sea surface	40	Manta trawl net (333-µm mesh)	Plastic particles separated from organic tissue by gravity in graduated cylinders	No
[17]	Lake Geneva, Switzerland	Surface water	–	1	Manta trawl net (300-µm mesh)	Sieve 5 mm	No
	Mediterranean Sea			2			

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[46]	Northeast Pacific Ocean: Southeast Bering Sea, off US West coast	Seawater	Upper 10–15 cm ~212-m depth	6; 271 4; 324	Nets (505-µm mesh)	–	'Plastic was confirmed by analyst experience including knowledge of morphological and physical response properties'; when in doubt (21 particles): FTIR
[47]	Western North Atlantic Ocean and Caribbean Sea	Surface seawater	22-year data set (1986–2008)	6136	Plankton net tows (335-µm mesh)	–	No
[48]	Western North Atlantic Ocean	Surface seawater	Samples archived from past cruises	11	Neuston tow (335-µm mesh)	–	Density measurements (for all) combined with elemental analysis (for 19 particles)
[49]	North Pacific Ocean, Kuroshio Current area	Seawater	Surface water	7 cruises; 76	Newton net (330-µm mesh)	–	No
[26]	Singapore's coast	Coastal seawater	SML (50–60 µm deep), subsurface layer (1 m deep)	2 × 2; 20	SML: rotating drum sampler Subsurface: pump	Filtration 1.6 µm	FTIR

Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[50]	Santa Monica Bay, California, US	Seawater	Surface, 5 m depth, near bottom (20 cm from bottom)	2	Manta trawl, bongo net, epibenthic sled. All: 333-µm nets	Flotation (freshwater), Tyler sieves (4.75, 2.80, 1.00, 0.71, 0.50, 0.35 mm)	No
[5]	Atlantic Ocean: routes between Aberdeen and Iceland	Archived (since 1960) plankton samples	10-m depth		Scrolling 280-µm mesh silkscreen	–	Unusual fragments identified using FTIR
[51]	Coastal zone near Long Beach, California, US	Surface coastal seawater	Before and after storm	5; 10	Manta trawl (333-µm mesh)	Tyler sieves: 4.75, 2.80, 1.00, 0.70, 0.50, 0.35 mm	No
[52]	North Pacific subtropical high	Surface seawater		2 transects; 11	Manta trawl (333-µm mesh)	Flotation (seawater), Tyler sieves (4.76, 2.80, 1.00, 0.71, 0.50, 0.35 mm)	No
[53]	North Pacific Ocean	Surface seawater		27	Neuston sampler (0.053 mm mesh)	Tyler sieves (1.000, 0.710, 0.500, 0.250, 0.053 mm)	No
[54]	North Atlantic: Sargasso Sea, Caribbean, shelf and slope water	Surface seawater		>420	Neuston net (333 or 500-µm meshes)	–	No
[55]	North western Atlantic	Surface seawater		243 (in 3 zones; 305	Neuston net (0.947 mm mesh)	–	No

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Reference	Location	Type of system	Type of sample	Number of sampling points; number of samples[A]	Sampling or initial size separation	Sample treatment[B]	Verification
[56]	Sargasso Sea	Surface seawater		–; 11	Neuston net (330-µm mesh)	–	No

[A]Number of samples information is particularly difficult to extract from publications; probably inaccurate.

[B]d, density.

Table S2. Microplastics in aquatic systems. size definition, counting method and results in published studies

Studies are listed in chronological order, starting with the most recent.

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
Sediments								
[1]	Norderney Island, Germany (tidal mudflats)	None Upper limit: sieve	Stereomicroscope (6.5–40×) with camera	<1 mm: 59	Not given	1 mm	1–2 # kg^{-1}	No, <1 mm: 26 out of 36 Fibres: yes
[3]	Singapore (mangroves)	Diameter? (diameter written in a figure)	Optical microscope (10×)	Not given	*1.6 μm*	>5000 μm	36.8 # kg^{-1} Calculation of # in a given size range from % in figure and mean value above possible	Yes
[4]	Atlantic Ocean, Mediterranean Sea, Indian Ocean (deep-sea sediments)	None	Binocular microscope	Not given	8: unknown 4: *32 μm*	Not given	1.4–40 # per 50 mL	Yes
[7]	Portugal (beaches)	None Upper limit: sieve	See Martins and Sobral[8]	Not given	Not given	3 mm	2397 # m^{-2}	Not said

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[9]	Lake Garda, Italy (beaches)	None	Raman microspectroscopy (10–50×)	Not given	*0.3 µm*	>5 µm	North shore: 1108 # m^{-2} South shore: 108 # m^{-2}	Not said, probably yes
[11]	Mumbai, India (beaches)	'length measured to the nearest mm along the longest axis' Lower limit: sieve	Visual?	Not given	1 mm	5 mm	*28.8 # m^{-2}* (calculated for 1–5 mm from total plastics = 68.83 # m^{-2})	Not said, probably yes
[12]	South Korea (beaches)	None Upper, lower: sieve	Visual?	Not given	1 mm	5 mm	May (before raining season): 8205 # m^{-2} September (after): 27,606 # m^{-2}	Not said, probably yes
[13]	Belgian Continental Shelf (beaches)	None Upper: sieve	No details given	Not given	*5 µm*	1 mm	13 # kg^{-1}	Yes
[15]	Atlantic Ocean (deep-sea sediments), Mediterranean Sea (Nile fan)	'measurement of both length and width'	Visual inspection; details not given	5 (sizes: 118, 75, 161, 83, 125 µm)	*0.8 µm*	1 mm	–	No, found in 3 out of 4 locations

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[16]	Venice Lagoon, Italy (superficial sediments)	None	Optical microscope	Not given	*0.7 μm*	Not clear	672–2175 # kg^{-1}	Yes
[17]	Lake Geneva, Switzerland	None Upper: sieve	Visual, no details given	11	<2 mm	5 mm	–	Yes
[18]	East Frisian islands Spiekeroog, Kachelotplate (beaches and tidal flats)	None	Dissecting microscope (80×)	Not given	*1.2 μm*	Not clear	Kachelotplate: 0–496 # per 10 g (granules) Spiekeroog: 0–38 # per 10 g (granules) Tidal flat: 36, 136 # per 10 g (granules)	Not said, apparently not
[19]	Ocean Beach, San Diego, California, US (beaches)	None	No details given	<5 mm: *1668* (calculated from 2453 all plastic items, 68%)	2 mm	50 mm	–	Not said
[20]	Hawaiian Archipelago (beaches)	None PSD by sieving	Size classification by sieving and weighting	Not given	<0.25 mm	>4 mm	Results in percentage by weight	Not said, apparently yes

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[21]	Belgian coast (harbours, beaches, coastal shelf)	None	Binocular microscope	Not given	*38 μm*	1 mm	Means: H: 166.7 # kg^{-1} B: 92.8 # kg^{-1} CS: 97.2 # kg^{-1}	Yes
[8]	Portugal (beaches)	None 'plastic pieces classified, counted and weighted, according to Ogi and Fukumoto[57]'	Stereoscopic microscope	<5 mm: *12,637* (calculated from 17,799 all plastic items, 71%)	<1 mm	>10 mm	*137 # m^{-2}* (calculated for <5 mm from total plastics = 185.1 # m^{-2}, 71%)	Yes
[22]	Lake Huron, Canada (beaches)	None	No details given	3209 (all sizes included)	Not given	Not given	Not given, except for the beach with 94 % of the total: 408 # m^{-2}	No, only in 4 out of 7 beaches
[23]	Tamar estuary, UK (strandlines)	Maximum diameter	No details given	<1 mm: *619* (calculated from 952 all plastic items, 65%)	Not given	Not given	Not given	Not said
[24]	Boa Viagem, Recife, Brazil (beach)	None Sieving	Stereomicroscope	2751	<1 mm	20 mm	0.29 # cm^{-2} ('plastics'), 0.01 # cm^{-2} (pellets)	Yes

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[25]	Fernando de Noronha, Western Atlantic (beaches)	None Lower: sieve	Material was sieved and weighted'	*81* (calculated as 39% of 207 plastic items but microplastics?)	1 mm	5 mm	–	Debris in 87%
[26]	Singapore (beaches)	None	Scan with FTIR microscope (1000×) on selected areas of filters	25	*1.6 μm*	Not given	[E]	No, 4 out of 26
[27]	Hawaiian archipelago	None Upper, lower, PSD: sieving	No details given	19,100	1 mm	15 mm	–	Yes
[5]	Around Plymouth, UK (beach and estuary)	None	Microscope (30×)	Not given	Not given	Not given	[F]	No, present in 23 out of 30
Water								
[28]	Bay of Calvi, Corsica, Italy	None Net	Binocular microscope	Not given	0.2 mm	5 mm	5.1 # 100 m^{-2}	No, <2 mm: found in 24 out of 38 samples, 2–5 mm: found in 26 out of 38 samples

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[29]	Worldwide open oceans	'maximum linear length' Net	Dissecting microscope	7359 (all sizes)	0.2 mm	Not given	Results in g km^{-2} for each ocean	88% occurrence of plastic, but microplastic?
[30]	NE Pacific Ocean Coastal British Columbia, CA	'longest dimension' PSD by sieving	Stereomicroscope	Not given	<100 µm (smallest detected: 64.8 µm)	>5000 µm (largest detected: 5810 µm)	2080 # m^{-3}	Yes
[31]	Lake Hovsgol, Mongolia	None Net PSD by sieving	Light microscope	Not given	0.333 mm	>4.75 mm	<4.75 mm: *16,429 # km^{-2}* (all: 20,264 # km^{-2})	Yes
[32]	Portuguese coastal waters	None Net	Stereoscopic microscope	684	280, 335 µm, depending on sample	Not given	Four sites: 0.002, 0.033, 0.036, 0.014 # m^{-3}	No, only present in 61% of samples
[33]	Seto Inland, Japan coastal waters	'longest length' Net	Stereomicroscope + camera	991	0.350 mm	30 mm	PSD in figures (# m^{-3} for four sites)	Not said
[34]	Goiana estuary, Brazil	None	Stereomicroscope (5×) + camera	14,724	0.300 mm	5 mm	26.04 # per 100 m^{-3}	Not said

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[35]	Highly urbanized river, Chicago, US	None Net	Dissecting microscope	Not given	0.330 mm	2 mm	Upstream WWTP: 1.94 # m^{-3} Downstream WWTP: 17.93 # m^{-3}	Yes
[36]	Tamar estuary, England	None Net	No details given	172 <5 mm: *140*	0.300 mm	>5 mm	–	Not said
[37]	Coastal areas close to Nakdong River, South Korea	SML: 'maximum size' Others: ?	SML: FTIR microscope Others: dissecting microscope	Not given	<50 µm	>1000 µm	<50–1000 µm: *209 # m^{-3}* (all: 211 # m^{-3})	Not said
[38]	Yangtze estuary, China East China Sea	None Sea: net	Dissecting microscope (80×)	Estuary: 1489 Sea: 375 (<5 mm: *342*)	*32 µm*	>5 mm	Estuary: 4137 # m^{-3} Sea: 0.167 # m^{-3}	Yes
[39]	Jade System, Southern North Sea	None	Dissecting microscope (80×)	Not given	*1.2 µm*	Not clear	152 # dm^{-3}	Not present in all samples (% given)

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[40]	Laurentian Great Lakes	None PSD by sieving	Dissecting microscope	2078 but in 16 sites <20 particles counted/site	0.333 mm	>4.75 mm	Superior: 5391 # km^{-2} Huron: 2779 # km^{-2} Erie: 105,503 # km^{-2}	No, found in 20 out of 21 net tows
[41]	South Pacific subtropical gyre	None PSD by sieving	Dissecting microscope	Not given	0.333 mm	>4.75 mm	<4.75 mm: *24,498 # km^{-2}* (all: 26,898 # km^{-2})	No, found in 46 out of 48 net tows
[42]	Northeast Pacific Ocean	2D surface area and maximum diameter Net	Dissecting microscope (6–12×), particles digitally imaged (resolution 10.6 μm)	2009: 30 518 (surface) + 324 (subsurface) 2010: 1572 (surface)	Surface: 0.333 mm Subsurface: 0.202 mm	Not clear	Median : 0.448 # m^{-2} (2009), 0.021 # m^{-2} (2010)	Not said
[43]	Saint Peter and Saint Paul Archipelago, Equatorial Atlantic	None Net	Stereomicroscope (5×)	71	0.300 mm	>5 mm	1 per 100 m^3 of seawater	No, only 41% of the 88 tows contained at least 1, and a maximum of 8, microplastics

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[44]	Waters around Australia	'Length' Net	Visual; no details given	839	0.330 mm	82.6 mm	4256 # km^{-2}	No, 80% of net tows and 93% of net stations had at least one piece
[45]	North Western Mediterranean Sea	None Net Net	Binocular microscope	4371	0.333 mm	5 mm	0.116 # m^{-2}	No, 90% of the stations yes, 30% of the samples >0.1 # m^{-2}
[17]	Lake Geneva, Switzerland	None	Stereomicroscope	LG: 107	0.300 mm	<5 mm	LG: 48,146 # km^{-2}	Yes
	Mediterranean Sea	Net		MS(1): 1290 MS(2): 126			MS(1): 314,609 # km^{-2} MS(2): 14,389 # km^{-2}	
[46]	Northeast Pacific Ocean	'longest dimension' Net	No details given	Not given	0.505 mm	>10 mm	Range: 0.004–0.19 # m^{-3}	Not present in all samples: – surface: 8.8–84% – subsurface: 1 out of 4 cruises (in this: 28%)

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[47]	Western North Atlantic Ocean and Caribbean Sea	None Net	Visual; no details given	64,000 plastic pieces	0.335 mm	Not clear	Caribbean Sea: 1414 # km^{-2} Gulf of Maine: 1534 # km^{-2} 29° to 31°N: 20,328 # km^{-2}	62% of all net tows contained detectable amounts of plastic debris
[48]	Western North Atlantic Ocean	'longest edge' Net	Visual; no details given	748 (88% <10 mm)	0.335 mm	420 mm	–	Not said
[49]	North Pacific Ocean, Kuroshio Current area	'longest length' 'plastic pieces were categorized following Ogi and Fukumoto[57]'	No details given	Not given	1 mm	>11 mm	1–10 mm: 15,000 # km^{-2} (all: 174,355 # km^{-2})	No, plastics detected in 72% stations
[26]	Singapore's coastal water	None	No details given	13	*1.6 μm*	Not given	–	Not found in many sites (7 out of 20; when found, only 1 or 2 particles per sample

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[50]	Santa Monica Bay, California, US	None Net PSD by sieving	No details given	Not given	0.355 mm	>4.75 mm	3.92 # m^{-3}	Yes
[5]	Atlantic Ocean	None Net	No details given	Not given	*0.280 mm*	Not given	[G]	Not said
[51]	Coastal zone near Long Beach, California, US	None Net PSD by sieving	Dissecting microscope	Not given	0.355 mm	>4.750 mm	7.25 # m^{-3} (PSD available in %; most in the >4.750 fraction in many cases!)	Yes
[52]	North Pacific subtropical high	None Net PSD by sieving	Dissecting microscope	27,698 (including >4.760 mm)	0.355 mm	>4.760 mm	<4.760 mm: *309,506 # km^{-2}* [H] (all: 334,271 # km^{-2})	Not said
[53]	North Pacific Ocean	None Net PSD by sieving	Light microscope	Not given	0.053 mm	>10 mm	Results for size classes	No, 11 out of 27 locations
[54]	North Atlantic: Sargasso Sea, Caribbean, Shelf and slope water	None Net	No details given	Not given	0.330 or 0.500 mm	No upper limit	2100 # km^{-2}	No, present in 68% of all tows

Reference	System	Size definition[A]	Counting method	Actual number of particles counted[B]	Range[C]		Particle concentration[B,D]	Did all samples contain microplastics?
					Lower limit	Higher limit		
[55]	Northwestern Atlantic	None Net	Visual; no details given	Not given	0.947 mm	Not given	Results g km^{-2}, mainly in figures	No
[56]	Sargasso Sea	None Net	Visual; no details given	228	0.330 mm	Not given, probably largely outside MP range	35,000 # km^{-2}	Yes, but only 1 particle found in 2 samples

[A]Parameter measured, when quoted.

[B]When possible, values in the microplastic size range have been calculated; calculated values are given in italic.

[C]Information difficult to extract: often limits are expressed as '>' or '<', lower limits given by filtration of extracted samples (quoted in italic) cannot be taken as real lower limits because of the limitations imposed by the visual counting method.

[D]Values given are mean ones except when ranges or otherwise stated; # = number of particles.

[E]0.16 # kg^{-1} sediment given in Nor and Obbard[3] for this publication but it is never expressed like it in the original one; the value probably comes from 4 particles being found in one sample (but two in two replicates) of 250 g of sediment.

[F]Values from a digitised figure: Sandy: 0.66 fibre per 50 mL^{-1} of sediment, estuarine: 2.3 fibre per 50 mL^{-1} of sediment, subtidal: 5.2 fibre per 50 mL^{-1} of sediment.

[G]Values from a digitised figure: 1960, 1970: 0.011 fibre m^{-3}, 1980: 0.045 fibre m^{-3}, 1990: 0.035 fibre m^{-3}.

[H]2.23 # m^{-3} in Moore et al.[51] but only values in # km^{-2} appear in the original publication.

Table S3. Microplastics in aquatic systems. Particle size distributions in the microplastic size range in published studies

Studies are listed in chronological order, starting with the most recent.

Reference	Figure/table[A]	Size ranges[B]	Data represented (*y*-axis or table legend)[C]	Sizing method	Number of sites
Sediments					
[3]	Figure	<20, **20–40**, **40–60**, **60–80**, **80–100**, **100–500**, **500–1000**, **1000–2000**, **2000–5000**, >5000 µm	% distribution of each size class by number of particles	Visual	Average
[16]	Figure	<100, **100–500**, >500 µm	None *(pie)*	Visual	Average
[20]	Table	<0.25, **0.25–0.5**, **0.5–1**, **1–2**, **2–4**, >4 mm	Grain size distribution (percent, mm categories)	Sieving	By site and core depth
[8]	Table	<1, **2**, **3**, **4**, **5**, 6, 7, 8, 9, 10, >10 mm	Average distribution of plastic abundance (items m^{-2})	According to Ogi and Fukumoto[57]	By site
	Figure	Idem	Plastic abundance (%)		Average
	Figure	Idem	Plastic weight average (%)		Average
[27]	Table	**1–2.8**, **2.8–4.75**, >4.75 mm	Numbers of plastic pieces	Sieving	Average
Water					
[28]	Text	**0.2–2**, **2–5**, 5–10 mm	Particles/100 m^2	Visual	Average
[29]	Figure	Size limits of the bins followed a 0.1–log series of l. From 220 mm to ~10 cm	Abundance of plastic (items); normalized abundance of plastic (items mm^{-1})	Visual	Average
[30]	Table	**<100** (*65*), **100–500**, **500–1000**, **>1000** (5810) µm	% of total	Sieving	Average per system
[31]	Table	**0.333–0.999**, **1.000–4.749**, >4.75 mm	Average microplastic density (particles km^{-2})	Sieving	Average

Reference	Figure/table[A]	Size ranges[B]	Data represented (y-axis or table legend)[C]	Sizing method	Number of sites
[33]	Figures	**<0.3–4 mm**, each 0.1 mm; 4–10 mm, each 1 mm; >10 mm, each 10 mm	Pieces/m^3	Visual	Per site
[36]	Figure	**<1** (*0.300*), **1–3**, **3–5**, >5 mm	Number of pieces	Sieving	Average
[37]	Table	<50, **50–100**, **100–200**, **200–500**, **500–1000**, >1000 μm	Abundance (particles/L)	Visual	Average
[38]	Table	**0.5–1**, **1–2.5**, **2.5–5**, >5 mm	Percentage	Visual	Average (also total values for each site)
[40]	Table	**0.355– 0.999**, **1.00–4.749**, >4.75 mm	Abundance of plastic particles (counts/km^2)	Sieving	Average
[41]	Table	**0.355–0.499**, **0.500–0.709**, **0.710–0.999**, **1.00–2.79**, **2.800–4.749**, >4.75 mm	Abundance of plastic pieces (items km^{-2})	Sieving	Per type
[42]	Figures	x-axis: particle area in square centimetres, from 0.001 to 100	Number of particles	Visual	Average per sampling campaign
[43]	Figure	**≤1** (*0.330*), **1.1–5**, >5 mm	Total number of microplastics	Visual	Average
[44]	Figure	**<2.4** (*0.330*), **2.5–4.9**, 5–9.9, >10 mm	Number of plastic pieces	Visual	Average
[46]	Figures	**<1** (*0.505*), **1–2.5**, **2.5–5**, 5–10, >10 mm	Mean concentration (no/m^3)	Visual	Average per system
[48]	Figure	0 to 15 mm, each mm, >15 mm	Sample count	Visual	Average
[49]	Table	**1**, **2**, **3**, **4**, 5, 6, 7, 8, 9, 10, >10 mm	Mean abundance (pieces/km^2)	According to Ogi and Fukumoto[57]	Average
[50]	Table	**0.355–0.499**, **0.500–0.709**, **0.710–0.999**, **1.000–2.799**, **2.800–4.749**, >4.750 mm	Percentage density	Sieving	Average

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Reference	Figure/table[A]	Size ranges[B]	Data represented (*y*-axis or table legend)[C]	Sizing method	Number of sites
[51]	Table	**0.355–0.499**, **0.500–0.709**, **0.710–0.999**, **1.000–2.799**, **2.800–4.749**, >4.750 mm	Percentage of each debris	Sieving	Per station
[52]	Table	**0.355–0.499**, **0.500–0.709**, **0.710–0.999**, **1.000–2.799**, **2.800–4.759**, >4.760 mm	Abundance (pieces km^2)	Sieving	Average
[53]	Figures	**0.053**, **0.250**, **0.500**, **0.710**, 10 mm	Normalized density (= density for each size class divided by the width of that size class), objects km^{-2} mm^{-1}	Sieving	Average

[A]Values in figures digitised with http://arohatgi.info/WebPlotDigitizer/app/.

[B]In bold, the size classes that 'can be used', i.e. 'not open' and in the microplastic size range; values in italic in parentheses: size limit according to sampling procedure or other information given in the article.

[C]The exact text in the publication is quoted here.

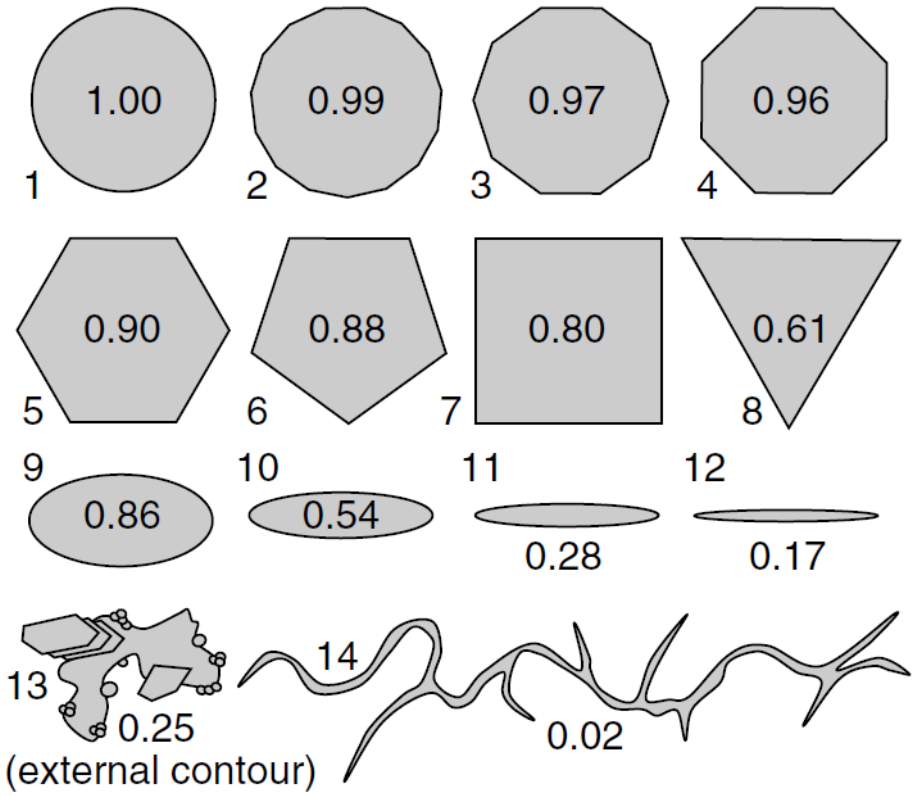

Fig. S1. Examples of variation of the shape factor (SF = 4π area/perimeter) of geometric objects. Reproduced with permission from Mavrocordatos et al.[58]

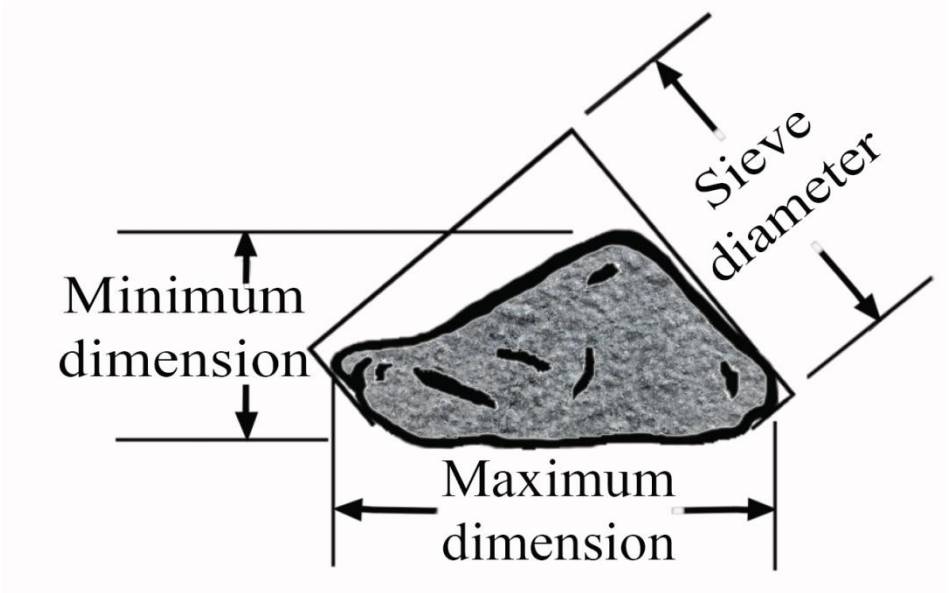

Fig. S2. Schematic illustration of dimensions of a particle and its equivalent sieve diameter.

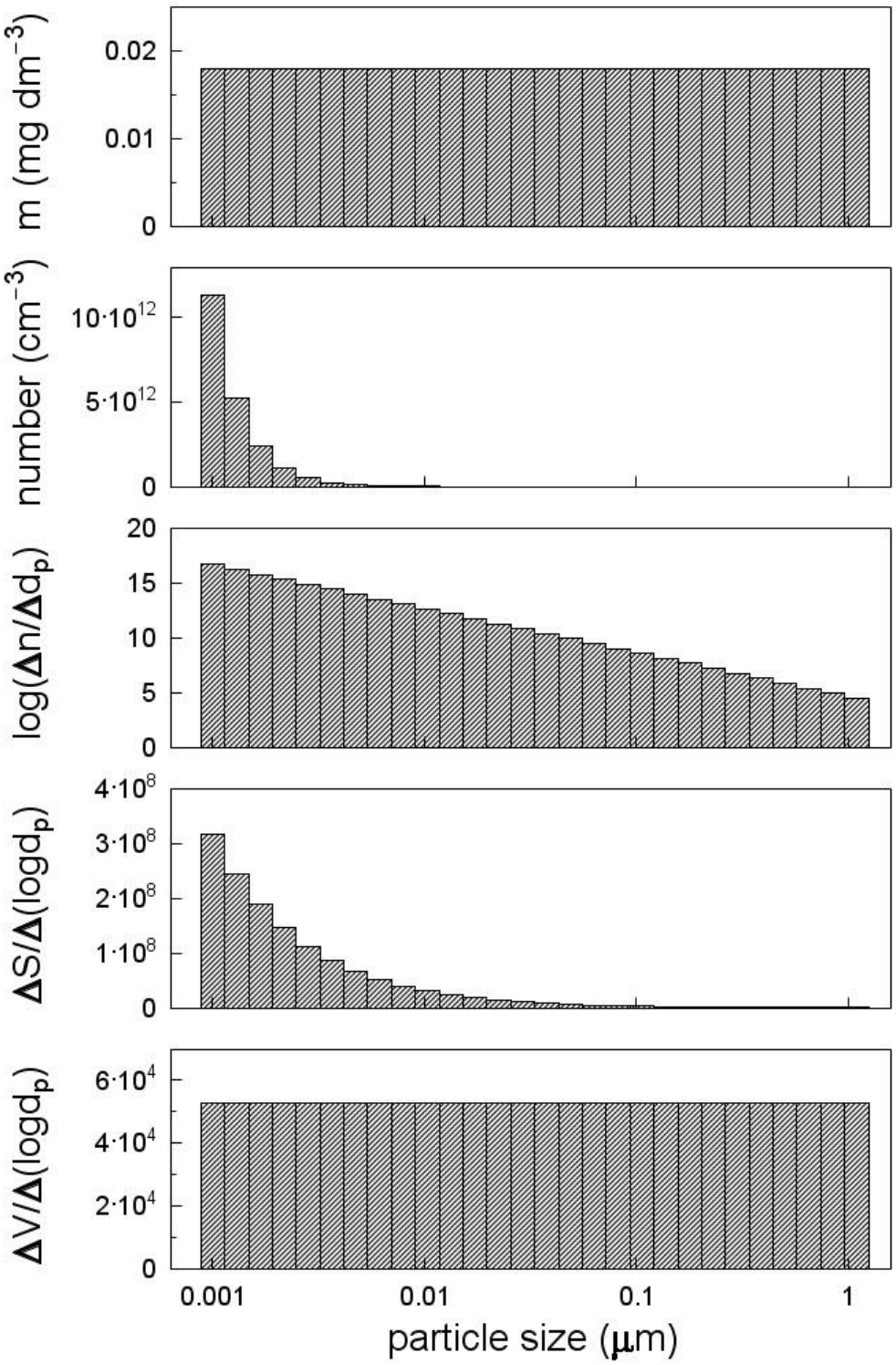

Fig. S3. Different types of representation for the same particle size distribution. Conditions: spherical particles following a power-law distribution with β = 4, total mass: 0.5 mg dm^{-3}, particle density: 3 × 10^{-12} g μm^{-3}.

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List of abbreviations

- ATR- FTIR, attenuated total reflectance–Fourier transform infrared
- β, slope of a power law distribution ($n(d_p) = (\Delta N/\Delta d_p) = Ad_p^{-\beta}$) where ΔN is the number of particles with a diameter in the size interval Δd_p per unit volume of fluid.
- d, density
- DT-Pyr-GC/MS, thermal desorption pyrolysis gas chromatography mass spectrometry
- ESEM-EDS, environmental scanning electron microscopy–energy dispersive spectroscopy
- FTIR, Fourier transform infrared
- OM, organic matter
- PE, polyethylene
- PSD, particle size distribution
- SEM, scanning electron microscopy
- SF, shape factor
- SML, surface microlayer
- WWTP, waste water treatment plant

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