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Supplementary Information: Suspension Feeders - Diversity, Principles of Particle Separation, and Biomimetic Potential

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Table SI-1: Selection of literature identified through the four search approaches with the SFs mentioned in them. The original spelling of the reference was adopted. (*) indicates that species were grouped under a higher taxonomic category.

1. Scientific reviews on the biology and ecology of suspension feeders			
Title	**Ref**	**Book/Journal**	**Found suspension feeders**
Biology of suspension feeding	[1]	Book	*Porifera, Coelenterata, Rotatoria, Brachiopoda, Echiuroidea, Polychaeta, Crustacea, Insecta, Gastropoda, Bivalvia, Echinodermata, Tunicata, Acrania, Entoprocta, Polyzoa (Bryozoa), Phoronida, hemichordate Pterobranchia, Pogonophora; vertebrate suspension feeders: ammocoetes larvae of lamprey, basking shark, teleosts, anuran tadpoles
A revised classification of suspension feeders	[2]	Tuatara: Journal of the Biological Society	Impingement Feeders: Lophophorata, some rotifers, some ciliates, Pelecypoda; Ciliary feeders: entoprocts, serpulimorph polychaetes, mollusc veligers, Pelecypods, Conochilus (Rotifera); Filter feeders: sponges, Chaetopterus, Nereis, Urechis, some gastropods, ascidians, cephalochordates, larvaceans, crustaceans, pelecypods; Collision feeders: some vermetid gastropods, radiolarians, planktonic foraminiferans, some echinoderms, plankton feeding coelenterates
Comparative physiology of suspension feeding	[3]	Annual Review Physiology	*Bivalves, zooplankton crustaceans, ascidians
Convergent and alternative designs for vertebrate suspension feeding	[4]	Book	*Fishes, tadpoles, whales, birds, elasmobranchs, ammocoetes
Benthic suspension feeders and flow	[5]	Book	*Corals, hydrozoans, bryozoans, brachiopods, some polychaetes, bivalve molluscs, some echinoderms, some crustaceans
Comparative ecophysiology of active zoobenthic filter feeding, essence of current knowledge	[6]	Journal of Sea Research	*Sponges, cnidarians, bryozoans, copepods, polychaetes, bivalves, ascidians, gastropods, lancelets, brachiopods
Suspension feeders	[7]	Book (Encyclopaedia of Ecology)	*Protists, *Porifera, *Cnidaria, *Ctenophora, *Rotifera, *Entoprocta, *Cycliophora, *Sipuncula, *Echiura, *Annelida, *Mollusca, *Arthropoda, *Bryozoa, *Phoronida, *Brachiopoda, *Echinodermata, *Hemichordata, *Chordata
2. **Scientific reviews on suspension-feeding mechanisms**			

Title	**Ref**	**Book/ Journal**	**Found Suspension Feeders**
The mechanics of filter feeding: some theoretical considerations	[8]	The American Naturalist	Mussels, oysters, scallops, copepods, echinoderm larvae, gorgonian corals, zoanthids, brittle star, rotifers, sea anemone
Some hydrodynamic aspects of filter feeding with rectangular-mesh nets	[9]	Journal of Theoretical Biology	Lamellibranch bivalves, *Urechis caupo*, Stentor, Vorticella, Artemia, various insect larvae, barnacles
Ciliary and mucus-net filter feeding, with special reference to fluid mechanical characteristics	[10]	Marine Ecology Progress Series	Sabellid polychaetes, brachiopods, bivalves, gastropods, ascidians
Physical mechanisms and rates of particle capture by suspension feeders	[11]	Oceanopr. Mar. Biol. Annu. Rev.	Protozoans, anemones, corals, barnacles, copepods, crinoids, sea pens, insect larvae, daphnia, bivalves, polychaetes, sea cucumbers, phoronids, gorgonians, bryozoans, echinoderms, rotifers
Filter-feeding in marine macro-invertebrates: pump characteristics, modelling and energy cost	[12]	Biololgical Reviews of the Cambridge Philosophical Society	Sponges, polychaetes, bivalves, ascidians
Some aspects of water filtering activity of filter-feeders	[13]	Hydrobiologia	*Eudiaptomus gracilis* (copepod), *Brachionus calyciflorus*, *Dreissena polymorpha*, *Sphaerium corneum*, brachiopods, bivalves, *Crassostrea gigas*, *Ceriodaphnia cf. dubia*
Particle capture mechanisms in suspension-feeding invertebrates	[14]	Marine Ecology Progress Series	Sponges, bivalves, polychaetes, ascidians, bryozoans, crustaceans, cnidarians, ctenophores, cladocerans, suspension feeding insects, phoronids, brachiopods, gastropods, salps, appendicularians, lancelets, larvae of echinoderms, jellyfish, anthozoans
3. **Scientific literature regarding biomimetics**			
Title	**Ref**	**Book/ Journal**	**Found suspension feeders**
Naturorientierte Lösungsfindung (in German)	[15]	Book	Baleen whales, barnacles, whale sharks, gorgonians, sea lilies, sponges, caddisfly larvae, oyster
Biomimetics - Biologically Inspired Technologies	[16]	Book	Aquatic insect larvae (e.g., flies)
Comparative Biomechanics	[17]	Book	Sponges, anemones, jellyfish, bryozoans, annelids, bivalve molluscs, barnacles, microcrustaceans, aquatic insect larvae, brittle stars, fish, amphibian tadpoles, a few birds, baleen whales
4. **Online biomimetic databases**			
Transfer Tool	**Link**	**Search term**	**Found suspension feeders**
AskNature	asknature.org	filter; filtration	Paddlefish (*Polyodon spathula*), basking shark (*Cetorhinus maximus*), Venus' flower basket (*Euplectella aspergillum*), peacock worm (*Sabella pavonina*), sea cucumber (Cucumaria), salps (*Pegea confoederata),* blue whale (*Balaenoptera musculus*); Andean flamingo (Phoenicopterus), fiddler crab (*Uca spp*.), ascidians (Ascidiacea), common water flea (Daphnia)

Table SI-2: Short description of the SFMs and higher taxa. Numbers refer to Figure 1.

Taxa	**#**	**SF**	**Description**
Porifera	1	Porifera	Most sponges are SFs, sometimes in combination with other feeding methods. The fluid flow through the body can vary depending on asconoid, syconoid, or leuconoid forms, but the basic principle is the same. The water streams into the body through the pores and incurrent canals, passes the flagellated chambers, and exits through the excurrent canals and osculum. Larger particles are retained within the channels, by choanocytes in the flagellated chambers with their collar, or particles adhere to the choanocyte's surface to be phagocytosed [18,19].
Cnidaria			Within the cnidarians, polyp forms as well as medusan forms are able to suspension feed. Aside from many SF corals (Anthozoa), this has been observed particularly in gorgonians (Alcyonacea), sea pens (Pennatulacea), and some medusan species such as the moon jelly (*Aurelia aurita*).
	2	Alcyonacea	Gorgonians (Alcyonacea) are soft corals that grow planar and oriented perpendicular to flow. The colonial polyps on the branches have tentacles with pinnules. The water current streams through the gorgonian and food particles are retained by the tentacles of the polyps [20]. Another SF group within the Octocorallia are the sea pens (Pennatulacea), in which a primary polyp is branched into secondary polyps with pinnate tentacles [21].
	3	*Aurelia aurita*	During the jet propulsion to move forwards, water is driven towards the bell margin and subumbrellar surfaces. Particles are retained by mucus on these surfaces or by the sieving tentacles and transported by cilia towards the gut [22].
Ctenophora	*4*	*Mnemiopsis leidyi*	A well described lobate species is *Mnemiopsis leidyi*. Cilia on the lobes create a laminar feeding current to transport non-motile prey to the tentillae [23] and inner lobes, where the prey adheres to mucus on the inner surfaces, whereas motile prey impinges on the surface. Afterwards, prey is transferred to ciliated oral groves and transported to the mouth [24].
Entoprocta	5	Entoprocta	The mouth is surrounded by tentacles. The cilia on the tentacles induce a current and direct particles towards cilia closer at the mouth, which transport the particle into the mouth [25].
Brachiopoda	6	Brachiopoda	Brachiopods filter the water within the mantle cavity with the lophophore, which consists of one or two rows of tentacles covered with cilia. Lateral cilia produce a feeding current to retain particles between the tentacles and cilia. Fine layers of mucus on the ciliary surfaces accumulate and transport the particles [10,26] .
Phoronida	7	Phoronida	Phoronids extrude a lophophore with ciliated tentacles from their tubes in the sediments. The cilia stream water into the lophophore, where particles are retained by the screen formed by tentacles and cilia or by tentacles flicking particles towards the mouth [27].
Bryozoa	8	Bryozoa	Each individuum of the colony (zooid) has a lophophore, which can be retracted into the housing. The lophophore is organised in a ring of ciliated tentacles with the mouth in the centre of its base. The cilia induce a water current towards the mouth and out between the tentacles. The tentacles act as a sieve or actively flick a particle towards the mouth [28].
Rotifera	9	Rotifera	With two bands of cilia at the head (corona), SF rotifers induce a current and sweep particles towards the buccal region. Particles are transported to the mouth by cilia [29,30].
Annelida			Within the annelids, several SFMs evolved, especially within the Polychaeta. Two main mechanism can be distinguished: filtration with the gill crown, e.g., in the tube dwelling sabellid worms (Sabellidae) or filtration with mucus nets in burrows in the sediment, which can be found in spionids (Polychaeta), *Nereis diversicolor* (Polychaeta) or *Urechis caupo* (Echiura) [31–35].
	10	Sabellidae	When feeding, the gill crown surrounding the mouth is expanded outside the tube. The filaments of the gill grown have two rows of side branches, i.e. pinnules. Cilia on the pinnules create a feeding current towards the crown, where particles are retained by the cilia [36].
	11	*Urechis caupo*	The innkeeper worm lives in U-shaped burrows in the sediment. A mucus net is secreted and attached to the wall of the burrow. By peristaltic movement of the worm, water is drawn into the burrow and through the net, where particles are retained. The net is eaten with the particles [35].
Mollusca			Bivalves are a large group of filter feeders with similar SFMs within the molluscs [37]. The best studied representative is the blue mussel *Mytilus edulis*. Within the gastropods, only some species have adapted SF, e.g., *Dendropoma maximum*.
	12	*Mytilus edulis*	Lateral cilia on the gill filaments induce a current into the mantle cavity and through the gill filaments. Particles are retained by cirri between the filaments and transported by cilia towards the mouth. The water exists through the exhalant chamber [37].
	13	*Dendropoma maximum*	*Dendropoma maximum*, a wormlike snail (Gastropoda), lives in tubes and secretes a mucus net to retain particles. The net with the particles is ingested afterwards [38].
Crustacea			SFs can be found in all major groups of crustaceans: Branchiopoda, Maxillopoda, and Malacostraca. The feeding strategies can differ, but all use their head or thorax appendages. One example of each group will be described, daphnids

Taxa	#	SF	Description
			(Branchiopoda), barnacles (Cirripedia, Maxillopoda) and *Euphausia superba* (Malacostraca).
	14	Daphnia	The 3rd and 4th thoracal limbs have setae with setulae and form filter combs. With stroking movements, the limbs induce a water current towards the food groove inside the carapace to retain particles with the filter combs and other limbs [39].
	15	*Euphausia superba*	Six long limbs form the filter basket. The setae with setulae on the limbs close it on all sides and form a mesh. While swimming, the legs stream water into the basket through coarse filtering elements and is expelled through fine filtering elements [40].
	16	Cirripedia	Six pairs of long and short cirri with setae on head and thorax are involved in SF. The long cirri are extended into the water current and form a mesh between the setae. Different feeding strategies have been described depending on water flow and particle concentration: active movement and passive. The short cirri form an additional net across the entrance of the mantle cavity and clean the particles from the long cirri [41].
Hexapoda			Because of the great diversity, only the most common and best-described SFMs in the aquatic larvae of Ephemeroptera, Trichoptera, and Diptera are described [42].
	17	Ephemeroptera	The most common SFM in mayflies is with the help of filtering setae and setulae on appendages, e.g., on forelegs or mouthparts. Depending on the species, SF can be supported by constructed burrows, silk-like material, induced flows, or secondary hairs on the filtering setae [42]. Collected particles are removed by bringing the setae close to the mouth for feeding.
	18	Trichoptera	Most species in Trichoptera spin silken nets to retain particles from the flow. The larvae of Hydropsychidae uses the nets to build shelters, which can include organic and mineral particles. Macronema larvae build cases (caddis), which are lined with silk. Particles can adhere to the silk when flowing through the caddis. Depending on the species, forelegs or mouthparts are used to remove the particles for ingestion [42].
	19	Diptera	In Diptera, there are five families that include SF species: Simuliidae, Culicidae, Dixidae, Chaoboridae, and Chironomidae. Black flies have modified mouthparts, i.e., cephalic fans, which are deployed passively in the water current to retain particles. Cleaning is done by mouthparts when the fans are retracted towards the oral cavity. Most Culicidae, Dixidae, and Chaoboridae use also fan-like brushes or hairs on modified mouthparts to retain particles [42]. Chironomids build small burrows, where a silk-net is spun across the opening. The larvae move within the burrow through the net. Particles together with the net are ingested and a new net is spun [42].
Echinodermata			SF can be observed in crinoids feeding with their tentacle crown and some sea cucumber, especially Dendrochirotida. In other groups, few species from Ophiuroidea or Clypeasteroida within the Echinoidea have also been described as SFs [43,44].
	20	Crinoidea	Crinoids spreads their arms into the water current. The arms branch out in pinnules, covered with tube feet catching particles. By flicking of the tube feet, the particles are transported into the pinnule's food groove and towards the mouth [45].
	21	Dendrochirotida	The sea cucumbers of Dendrochirotida have ten to thirty branched tentacles around the mouth, which are hold upwards to retain particles. Papillae on the tentacles are likely to secrete adhesive substances to increase particle retention. One by one tentacle is inserted into the mouth and particles are scraped off [46].
Hemichordata	22	Enteropneusta	The two main groups of hemichordates are both able to SF: Pterobranchia and Enteropneusta [47]. Because enteropneusts are better studied thus far, their SFM will be described exemplarily for both groups. In addition to deposit feeding, enteropneusts are able to SF. Buried in burrows, water is drawn into the branchial pharynx, where particles are trapped in the branchial pores. Particles are accumulated in mucus and transported by cilia towards the oesophagus [47].
Cephalo-chordata	23	Amphioxi-formes	When feeding, cephalochordates lie buried in the sand and the mouth facing upwards, exposed to the water. The mouth is surrounded by movable and sticky cirri to retain larger particles. A mucus net is produced by the endostyle and covers the pharyngeal basket where particles are retained. The mucus with the particles is transported towards the gut [48].
Tunicata			All tunicates are SFs. Ascidians (Ascidiacea) are sessile, while salps (Thaliacea) and larvaceans (Larvacea) are pelagic. They all use mucus nets to retain particles [49]. While the SFMs of ascidians and salps are very similar and a mucus net is built within the branchial basket [50], larvaceans built external filter housings [51].
	24	Ascidiacea	Ascidians pass a feeding current through the inhalant siphon, into the branchial basket, and out of the exhalant siphon. The branchial basket is lined with a mucus net, produced by the endostyle in which particles are retained. Cilia produce the feeding current and transport the mucus net from towards the oesophagus [52,53].
	25	Larvacea	Larvaceans built an external filter housing from secreted mucus. By movement of the tail, water is pumped through the filter. A coarse filter retains larger particles at the water inlet, while smaller particles are concentrated inside and propelled towards the mouth [54].
Petromy-zontida	26	Petromy-zontiformes	In contrast to the predatory adults, the lamprey larvae (ammocoetes) live as SFs, buried in the sediments. With rhythmic muscular contractions, the larvae pump water into their mouth. Cirri on the mouth opening prevent larger particles to enter,

Taxa	#	SF	Description
			smaller particles get stuck in bands of mucus behind the gill lamellae within the pharynx [55,56].
Chondrich-thyes			Within the Chondrichthyes, four elasmobranchs are SFs. In all four, the filtering structures are formed by branchial arches and gill rakers [57]. The SFMs of mobulid rays (Mobulidae) and whale sharks (*Rhincodon typus)* are similar and well understood. Little is known about basking sharks (*Cetorhinus maximus*) and megamouth sharks (*Megachasma pelagios*) and their SFMs have not been fully understood yet [58,59].
	27	Mobulidae	When feeding, mobulid rays swim with their mouth open to stream water into the buccal cavity, between the gill rakers, and out through the gill slits. The gill rakers are modified into parallel arrays of filter lobes. The lobes are oriented in shape of wings or spoilers towards the water flow in such a way, that the particles bounce off and are directed towards the oesophagus. This filtration method is called ricochet separation [60].
	28	*Rhincodon typus*	Either through forward swimming or by suction while being stationary, whale sharks stream water into the buccal cavity, through the filtering pads and out of the gill slits. Each filtering pad is composed of lobes with connective tissue forming a mesh with irregular holes to retain particles. The SFM is described as cross-flow filtration [61].
Actinopterygii			More than 70 species within the Actinopterygii are known to be SFs [62]. The pelagic living fish can be distinguished based on their filtration mechanisms in pump or suction feeding (e.g., *Hypophthalmychthys molitrix*) and ram feeding (e.g., *Clupea harengus*) [4,62].
	29	*Hypophthalmychthys molitrix*	While swimming, silver carps pump water into their mouth. Particles are retained by the mesh of filtering plates (fused gill rakers) and transported towards the oesophagus by shear forces along the epibranchial organ [63].
	30	*Clupea harengus*	Similar to other ram feeding fish, like anchovy, mackerels or sardines, herrings live and feed in shoals. While swimming, herrings open their mouth and extend their gill arch system with elongated gill rakers forming a mesh. The water stream into the mouth, between the gill rakers, over the gill filaments, and exits through the gill slits under the operculum. Particles are retained by the mesh of the gill rakers [4].
Amphibia	31	Anura	Tadpoles, the anuran larvae, are able to SF either facultative or obligate. A buccal pump sucks water into the branchial basket. Depending on the particle size, they are directed either towards the oesophagus or into the pharynx, where they are retained in the branchial food traps covered with mucus [4].
Aves			Well known SF birds are flamingos (Phoenicopteriformes) and SF ducks (Anatidae). Less studied are prions or shearwaters. All SF birds feed with their beak [64].
	32	Phoenicopteri-formes	Flamingos stand in shallow water with their head down, moving it side to side while feeding, the tongue acting as a piston to draw water inside. The margins of the bill are lined with lamellae, forming a sieve between the upper and lower bill, where particles are retained. The spiny tongue moves the particles towards the oesophagus [65].
	33	Anatidae	While feeding, the tongue acts like a piston to suck water into the bill. Inside the elongated bill, the margins of upper and lower bill are lined with lamellae. When closed, the lamellae oppose each other and act as a sieve to retain particles. The spiny tongue moves particles towards the oesophagus [66].
Cetacea			Within the whales, only the baleen whales (Mysticeti) are SFs. Similar to SF fish, baleen whales can be distinguished in ram feeding in balaenid whales (e.g., *Balaena mysticetus*) and suction feeding or lunge feeding in rorqual whales (e.g., *Balaenoptera physalus*). The separation medium is comprised by the baleen plates hanging from the upper jaw [4,67,68].
	34	*Balaena mysticetus*	Bowhead whales swim with their mouth opened to continuously force water along the paired racks of baleen, passing it through the baleen plates where particles are retained. Water exits the buccal cavity at the posterior end of the lips [69].
	35	*Balaenoptera physalus*	Fin whales swim towards their prey, e.g., fish shoals, open their mouth to expand the buccal cavity, and engulf the fish in a single pulse. Afterwards, the mouth is closed, and the water is expelled out of the mouth, through the baleen fringes, where particles are retained inside [70].

Table SI-3: Overview of selected biological and technical parameters as described in the text and used in Table SI-4 and Table SI-5. The bold parameters are used in Table 1.

Parameter			**Description**
Biological parameters	Ecology	Habitat	Marine, freshwater, terrestrial;
		Aquatic life	Pelagic, benthic
		Foraging type	Active or passive
		Motility	Motile or sessile
		Organism size	Size of organism
	Food type	**Particle size**	Sizes of seston, i.e., phytoplankton, zooplankton, bacterioplankton, detritus
Technical parameters		Separation mechanism	General description of SFM
	Separation medium	**Geometry**	Flat or funnel-shaped, enclosed or open
		Filter area/ effective area	Total area of a suspension feeder which is actually exposed to the suspension to retain particles
		Material of separation medium	Biological material the separation medium is made of
		Mesh design	Organisation of mesh forming structures; (i.e. flat surface, level of organisation, spongy, branching etc.)
		Mesh size/pore size	Size of apertures in the separation medium
	Fluid dynamics	**Flow past separation medium**	Non-FF versus FF (including dead-end and cross-flow filtration)
		Driving force	The force which is needed to cause a fluid to pass by or through a particle separating medium
		Water velocity	Fluid velocity in cm/s
		Flow regime	Fluid flow around the particle separating medium: creeping (Re < 1), laminar (Re 1-50), or turbulent (Re >50)
	Cleaning	**Working mode**	continuous or discontinuous
		Cleaning technique	Removal of particles from the particle separation medium

Table SI-4: References for ecological parameters including habitat, foraging type, motility, organism size, food size, and food to body ratio of each SFMs referred to in Figure 1.

	Taxa	**Habitat**	**Aquatic life**	**Ref**	**Foraging type**	**Ref**	**Motility**	**Ref**	**Organism size (adult)**	**Ref**	**Food size (min-max)**	**Ref**	**Food to body size (1: X)**	**Uptake of microplastics**
1	Porifera	freshwater /marine	benthic	[71]	active	[71]	sessile	[71]	Varies strongly, up to 1 m	[71]	0.1 µm up to 8 µm within flagellated chambers	[1,14]	na	[72]
2	Alcyonacea (Octocorallia)	marine	benthic	[71]	passive	[71]	sessile	[71]	up to 1.8 m high (colonies), polyps 1-5 mm height	[71,73]	3 µm - 700 µm	[74]	na	[75]
3	*Aurelia aurita* (Scyphozoa)	marine	pelagic	[71]	active (SF coupled to forward motion)	[22]	motile	[71]	up to 40 cm in diameter	[71]	50 µm, up to 5 mm	[1,76]	32	[77,78]
4	*Mnemiopsis leidyi*	marine	pelagic	[71]	active	[71]	motile	[71]	10 cm	[71]	50 µm - 3 mm	[79]	100	na
5	Entoprocta	marine (2 freshwater species)	benthic	[71]	active (movement of cilia)	[71]	sessile	[71]	0,1 mm - 7 mm (single zooids)	[71]	2 - 12 µm (90 µm when predatory)	[80]	na	na
6	Brachiopoda	marine	benthic	[71]	active (lophophore with cilia)	[71]	sessile	[71]	1 mm - 80 mm	[71]	2 - 200 µm	[81]	400	na
7	Phoronida	marine	benthic	[71]	active (lophophore with cilia)	[71]	sessile	[71]	6 mm - 200 mm	[71]	> 5 µm	[71]	1030	na
8	Bryozoa	freshwater / marine	benthic	[71]	active (lophophore with cilia)	[71]	sessile	[71]	2 - 25 cm (colony), 0.5 mm zooids	[71]	5 - 50 µm	[82,83]	na	na
9	Rotifera	mainly freshwater / few marine	pelagic, benthic	[7]	active (movement of wheel organ)	[71]	mainly motile	[71]	40 µm to 3 mm	[71]	1.3 µm, up to 20 µm	[1,29]	82	[84]
10	Sabellidae	marine	benthic	[71]	active (pinnules)	[71]	sessile	[71]	6 mm up to 30 cm high	[71]	1 µm - >8 µm	[10]	20000	[85]

	Taxa	Habitat	Aquatic life	Ref	Foraging type	Ref	Motility	Ref	Organism size (adult)	Ref	Food size (min-max)	Ref	Food to body size (1: X)	Uptake of microplastics
11	*Urechis caupo*	marine	benthic	[71]	active (pump mechanism)	[71]	stationary	[71]	15-18 cm	[71]	> 4 nm	[35]	na	na
12	*Mytilus edulis*	marine	benthic	[71]	active (movement of cilia)	[71]	sessile	[71]	around 9 cm	[71]	1 µm - 35 µm	[86]	450	[87,88]
13	*Dendropoma maximum*	marine	benthic	[89]	passive	[89]	sessile	[89]	around 8 cm	[89]	na	na	na	na
14	Daphnia	mainly freshwater / few marine	benthic, pelagic	[71]	active (movement of legs)	[71]	motile	[71]	0,26 - 6 mm	[71]	0.5 µm - 5 µm (at least)	[39,90]	600	[91]
15	*Euphausia superba*	marine	pelagic	[71]	active (pumping with filter basket)	[40]	motile	[71]	6 cm	[71]	2.5 µm - 35 µm	[1,40]	3000	[92]
16	Cirripedia	marine	benthic	[71]	active and passive	[71]	sessile	[71]	stalked up to 30 cm, non-stalked 10-60 mm	[71]	1 µm - 300 µm	[93]	na	[94]
17	Ephemeroptera	freshwater / some brackish water	benthic	[71]	passive (and active)	[95]	motile	[95]	up to 20 mm	[71]	<1 - 64 µm	[96,97]	667	[98]
18	Trichoptera	freshwater / some brackish water	benthic	[99]	passive	[99]	Motile (stationary)	[99]	3-40 mm	[99]	1 - 70 µm	[100]	na	[98]
19	Diptera	freshwater	pelagic, benthic	[101 ,102]	passive/ active	[102]	motile/sessile	[101 ,102]	1-3 mm	[101]	> 0.09	[103]	na	na
20	Crinoidea	marine	benthic	[71]	passive (active, movement of tube feet)	[71]	sessile, motile	[71]	10 cm - 60 cm	[71]	11 µm up to 1000 µm, up to 300 µm	[71,104]	1000	[105]
21	Dendrochirotida	marine	benthic	[71]	passive	[46]	mainly sessile	[71]	ca 10-30 cm	[71]	0.1 - 6.1 mm	[46]	67	[106]

	Taxa	Habitat	Aquatic life	Ref	Foraging type	Ref	Motility	Ref	Organism size (adult)	Ref	Food size (min-max)	Ref	Food to body size (1: X)	Uptake of microplastics
22	Enteropneusta	marine	benthic	[47]	active	[47]	stationary	[47]	9-45 cm, single species up to 2 m	[47]	0.2 - 28.4 µm	[47]	10000	na
23	*Amphioxiformes*	marine	benthic	[71]	active (wheel organ)	[71]	stationary	[71]	up to 60 mm	[71]	0.2 µm - 300 µm, 0.062 - 100 µm	[48,107]	300	na
24	*Ascidiacea*	marine	benthic	[71]	active (cilia, muscular pump) and passive	[71][108]	sessile	[71]	0,5 cm - 30 cm	[71]	>0.3 µm, <50 µm	[53]	6000	na
25	*Larvacea*	marine	pelagic	[71]	active (movement of tail)	[71]	motile	[71]	animal up to 5 mm and filter housing up to 5 cm, 1-10 cm	[54,71]	10 - 600 µm, 0.2-30 µm	[54,109]	17	[77]
26	*Petromyzontiformes*	freshwater /marine	benthic	[56]	active (pump mechanism)	[56]	stationary	[56]	4-20 cm	[4,110]	5 - 340 µm most common	[56]	588	na
27	*Mobulidae*	marine	pelagic	[111]	active (forward swimming)	[111]	motile	[111]	1,3 - 9 m breadth	[4]	51 - 500 (>500 µm)	[60]	4000	na
28	*Rhincodon typus*	marine	pelagic	[61]	active (pumping and forward motion)	[61]	motile	[61]	up to 18 m	[112]	0,34 - 10,74 mm	[61]	1000	[113,114]
29	*Hypophthalmychthys molitrix*	freshwater	pelagic	[115]	active (forward swimming)	[115]	motile	[115]	60-100 cm	[115]	4 - 85 µm	[115]	16000	na
30	*Clupea harengus*	marine	pelagic	[112]	active (forward swimming)	[4]	motile	[4]	5-34 cm	[4]	< 2.1 mm	[116]	200	[117]
31	*Anura*	freshwater	pelagic	[112]	active	[4]	motile	[4]	1-10 cm	[4]	< 10 µm, 0,2 µm -200 µm	[12,96][118]	100	[119]
32	*Phoenicopteriformes*	terrestrial	terrestrial	[64]	active	[64]	motile	[64]	80 - 145 cm	[4]	Greater flamingos 1 - 10 mm (*P. minor* 0,02 - 0,1 mm)	[4]	2000	na

	Taxa	Habitat	Aquatic life	Ref	Foraging type	Ref	Motility	Ref	Organism size (adult)	Ref	Food size (min-max)	Ref	Food to body size (1: X)	Uptake of microplastics
33	*Anatidae*	terrestrial	terrestrial	[64]	active	[64]	motile	[64]	35 - 80 cm	[4]	0,2 µm - 4,4 mm,	[4]	400	[120]
34	*Balaena mysticetus*	marine	pelagic	[4]	active (forward swimming)	[4]	motile	[4]	14 - 18 m	[4]	0,3 - 3 mm	[4]	15000	[121]
35	*Balaenoptera physalus*	marine	pelagic	[4]	active (forward swimming)	[4]	motile	[4]	18 - 24 m	[4]	3- 15 cm	[4]	2000	[121]

Table SI-5: Literature guide for the data presented in Figure 1 and Table 1. (x) indicates that no information was available, (-) indicates that this parameter is not applicable to the SFMs.

	#	SF	**Separation mechanism**	**Particle size**	**Material**	**Mesh/ pore size**	**Mesh design**	**Geometry**	**Filter area**	**Driving force**	**Water velocity**	**Flow regime**	**Working mode**	**Cleaning technique**
Porifera	1	Porifera	[18]	[14]	[18]	[14] [122]	[18]	[18] [19]	[18]	[122] [19]	[123] [122]	[19]	[18]	[18]
Cnidaria	2	Alcyonacea	[20][21]	[74]	[20]	[21]	[124] [21]	[125] [21]	[73,124]	[124] [21]	[124] [21]	[124] [21]	[20]	[20]
	3	*Aurelia aurita*	[22]	[76]	[22]	-	-	[22]	x	[22]	[22]	[22]	[22]	[22]
Ctenophora	4	*Mnemiopsis leidyi*	[23] [126]	[79]	[79]	-	-	-	x	[126]	[79]	[126]	[24]	[24]
Entoprocta	5	Entoprocta	[25][127]	[80]	[25,80]	-	-	[25]	x	[25]	x	x	x	[25]
Brachiopoda	6	Brachiopoda	[10] [26]	[81]	[128] [26]	[26]	[26]	[26]	[129]	[129]	[129]	[129]	[128]	[128]
Phoronida	7	Phoronida	[27]	[27]	[130]	[27]	[27]	[130] [131]	[27]	[27]	[27]	x	[27]	[27]
Bryozoa	8	Bryozoa	[82] [132] [133]	[83]	[134]	[82]	[82]	[82] [133]	[135] [133]	[82] [133]	[82] [133]	[83] [135]	[82]	[82]
Rotifera	9	Rotifera	[29]	[29]	[29]	-	-	-	-	[29]	[136]	[136]	[29]	[29]
Annelida	10	Sabellidae	[36]	[10]	[137]	-	-	[36]	x	[138]	[138]	[138]	[137]	[138][137]
	11	*Urechis caupo*	[35] [139]	[139]	[35] [139]	[139]	[139]	[139]	x	[35]	[140]	x	[139]	[35]
Mollusca	12	*Mytilus edulis*	[37] [141][142]	[86]	[37]	[141] [142]	[37]	[143]	[144]	[37]	[145]	[145] [141]	[37]	[37] [141]
	13	*Dendropoma maximum*	[89]	x	[146]	x	x	x	[89]	[89]	x	x	[146] [89]	[146] [89]
Arthropoda (Crustacea)	14	Daphnia	[39]	[90]	[147]	[148] [39]	[147]	[147]	[148][147]	[39]	[148]	[39]	[41]	[39]
	15	*Euphausia superba*	[40]	[40]	[40]	[40]	[40]	[40]	[40]	[40]	[40]	[40]	x	x
	16	Cirripedia	[41]	[93]	[41]	x	[41]	[41]	[149]	[41]	[41]	[149]	[41]	[41]
Arthropoda (Hexapoda)	17	Ephemeroptera	[42][99]	[96][97]	[96]	[96] [97]	[95] [96]	[95]	x	[96]	[96]	[150]	[95]	[95]
	18	Trichoptera	[42][151]	[100]	[152]	[151]	[151]	[151]	[151]	[153]	[153]	x	[151]	[42]
	19	Diptera	[42] [101][103]	[103]	[101]	[42]	[101]	[101]	[154]	[154]	[154] [103]	[101][155] [150]	[156]	[156] [101]
Echinodermata	20	Crinoidea	[104] [45]	[104]	[45]	[45]	[45]	[45]	x	[45]	[104] [157]	[45]	[157]	[157] [45]
	21	Dendrochirotida	[46]	[46]	[46]	x	[46]	[46]	x	x	x	x	[46]	[46]
Hemichordata	22	Enteropneusta	[47]	[47]	[47]	[47]	[47]	[47]	x	[158]	[47]	[158] [47]	[47]	[47]
Cephalochordata	23	Amphioxiformes	[48]	[48] [107]	[48]	[159]	[48]	[48]	[159]	[159]	[159]	x	[48]	[48] [159]

	#	SF	Separation mechanism	Particle size	Material	Mesh/ pore size	Mesh design	Geometry	Filter area	Driving force	Water velocity	Flow regime	Working mode	Cleaning technique
Tunicata	24	Ascidiacea	[52] [49]	[53]	[160][161]	[52] [161]	[52] [160] [161]	[52] [49]	[52]	[52]	[49]	[52][162]	[52] [49]	[52] [49]
	25	Larvacea	[54] [51]	[54]	[54]	[54] [51]	[54]	[54]	x	[54] [51]	[54] [51] [163]	[163]	[54]	[54] [51]
Petromyzontida	26	Petromyzontiformes	[4] [55]	[55]	[55]	x	x	x	x	[4] [56]	x	x	[55]	[55]
Chondrichthyes	27	Mobulidae	[60]	[60]	[57]	[111]	[57] [111]	[111]	[111]	[111] [60]	[60] [111]	[60] [111]	[60]	[60] [111]
	28	*Rhincodon typus*	[61]	[61]	[61]	[61]	[61] [57]	[61]	[61]	[61]	[61]	[61]	[61]	[61]
Actinopterygii	29	*Hypophthalmychthys molitrix*	[63]	[63] [164]	[63]	[63]	[63]	[63]	[63]	[4]	[63]	[63]	[63]	[63] [165]
	30	*Clupea harengus*	[166] [4]	[116]	[117] [166]	[117] [166]	[117] [166]	[117] [166]	[117] [166]	[4]	[167] [168]	[167]	[169]	[169]
Amphibia	31	Anura	[4]	[4]	[4]	[170]	[170]	[4]	[4]	[4]	x	x	[4]	[170]
Aves	32	*Phoenicopteriformes*	[65]	[4]	[171]	[171]	[171] [65]	[171] [65]	x	[4]	x	x	[65]	[65]
	33	Anatidae	[66]	[4]	[66]	[66]	[66]	[66]	[66]	[4]	x	[66]	[172]	[172]
Cetacea	34	*Balaena mysticetus*	[69] [68]	[4]	[173]	[174] [175]	[173]	[173]	[67]	[4] [176]	[176] [69] [67] [174]	[176] [67]	[176] [69]	[174]
	35	*Balaenoptera physalus*	[70] [68]	[4]	[177]	[70]	[68]	[68]	[70] [67]	[4]	[70] [67]	[70] [67]	[70]	[178]

Table SI-6: Previous publications with definitions and classifications based on included SFs.

Ref	Definition of SF	Classification of SF	Included SFs
[179]	Suspension feeders – animals which feed by selecting from the surrounding water the suspended micro-organisms and detritus.	None	Bottom fauna
[180] p. 25	No definition of suspension feeders. SF organisms are assigned to "true particle feeders" (German "reine Partikelfresser", translation by Yonge 1928).	1) Filterers 2) Mucus entanglers 3) Those with tasting appendages a) Mobile b) Sessile	Metazoans
[181] p. 25	No definition of suspension feeders. SF organisms are assigned to "mechanisms for dealing with small particles".	1) Pseudopodial 2) Ciliary 3) Tentacular 4) Mucoid 5) Muscular 6) Setous	Protozoans + invertebrates
[1]	"Mechanisms for extracting on a mass scale small particles suspended in the surrounding water has been developed by numerous aquatic organisms: the suspension feeders." (p. viii) Suspension feeders are typically non-selective feeders, which clear the surrounding water of particles at rates that are independent of the concentration of the particles below certain levels and of their value as food, and which feed continuously when undisturbed. (p. 134) Filter feeders are defined by "feeding by passing the surrounding water though structures that retain particles mainly according to size and shape". (p. xxi)	Filter feeders as a subgroup of SF	Invertebrates
[2] p. 1	"These suspension feeders have evolved a variety of devices with which to separate particles from the sea."	1) Impingement feeding 2) Ciliary feeding 3) Filter feeding 4) Collision feeding	Protozoans + invertebrates
[182] p. 89	"The terms 'suspension feeding' or 'filter feeding' have been coined to designate feeding in aquatic animals that have evolved special structures to process the surrounding water and to retain small suspended particles, including food particles such as phytoplankton cells."	None	Ciliates, flagellates, invertebrates
[4] p. 37	"Suspension-feeding aquatic animals capture planktonic prey as water flows past the feeding apparatus."	1) Continuous ram feeders 2) Intermittent ram feeders 3) Continuous suction feeders 4) Intermittent suction feeders	Vertebrates
[5]	Suspension feeders feed by capturing seston. Suspension feeding includes feeding, assimilation, growth, and elimination. Filtration refers to only the first two.	1) Active SF 2) Passive SF 3) Facultative active SF 4) Combined passive-active SF 5) Deposit SF	Marine, benthic macrofauna
[7]	"Suspension feeding is the capture and ingestion of food particles that are suspended in water" Filter feeders are active SF that "pump water through a structure that function as a filter, removing particles from suspension".	1) Active 2) Passive	Marine protozoans, invertebrates and vertebrates
[14]	Suspension feeders have specialized in grazing on phytoplankton or predation on, e.g., small zooplankton organisms by evolving different mechanisms for particle retention to solve the same basic problem of extracting a sufficient amount of food from a dilute environment.	1) Collar sieving 2) Cirri trapping 3) Ciliary sieving 4) Ciliary downstream collecting 5) Mucus-net filter-feeding 6) Setal filter-feeding 7) Non-filtering ciliary-feeding	Invertebrates, except insect larvae

		8) Ciliary spike suspension-feeding 9) Tube-feet suspension-feeding 10) Cnidae prey-capture mechanisms 11) Colloblast prey-capture	

Table SI-7: Particles sizes found in seston including plankton and detritus compared to size ranges of particles found in waste water and microplastics.

Size range of plankton	**Seston (marine)** [5,183,184]			**Size range**	**Waste water particles** [185,186]	**Microplastics** [187]
	Plankton		**Detritus** [188]			
			Truly dissolved material	< 1 nm	Dissolved ions, Na+, Cl-	Nanoplastics
			Colloidal organic matter (dissolved organic matter, DOM)	1 - 10 nm	Fine colloids	
20 – 200 nm	Femto-plankton	Marine viruses		10 - 100 nm	Colloids	
200 nm – 2 µm	Pico-plankton	Small protists, bacteria, Chrysophyta		100 nm - 1 µm	Small virus, large colloids	
2 µm – 20 µm	Nano-plankton	Nanoflagellates, small diatoms	Suspended particulate organic material (POM)	1 mm - 10 µm	Small bacteria, large virus, fine pigments	Microplastics
20 µm – 200 µm	Micro-plankton	Small copepods, foraminifera, ciliates, most phytoplankton		10 - 100 µm	Large bacteria, protozoans, clay particles	
200 µm – 20 mm	Meso-plankton	Amphipods, appendicularians, copepods, cladocerans		100 µm - 1 mm	Fine sand, hard dirt, starch, amoeba	
20 – 200 mm	Macro-plankton	Comb jellies, larval fish, solitary salps, euphausiids, cephalopods	Marine snow	1 - 10 mm	Coarse sand, tomato pops, worm eggs	Mesoplastics
> 200 mm	Mega-plankton	Jelly fish, colonial salps, cephalopods, amphipods		> 10 mm	Matches, toilet paper, worms	Macroplastics

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