Supporting Information

Quality criteria for microplastic effect studies in the context of risk assessment: A critical review.

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Methods continued - Detailed motivation for each criterion used in the quality evaluation.

Particle characterization

Criterion 1. Particle size. Species-specific physiological and behavioral traits can strongly influence the relative size of particles ingested by an organism, including MP.[1–4] Size selectivity depends on the morphology and feeding strategy of a species, which determines the upper size limit for the food they can ingest, as well as for the ingestible size of MP.[5–7] For instance, in a study assessing the ingestion of MP by seven Cladocera species, the maximum size of MP ingested increased proportionally with the body size [5]. The upper size limit will differ between species at varying trophic levels, but can also show significant variation within species depending on their developmental stage.[1,8] Based on species traits, size preferences have been demonstrated for a few organisms, being some MP sizes ingested in higher quantities than others.[2,7,9] Particle shape and polymer identity also affect the probability of MP to be encountered and ingested, thereby affecting the bioavailability of MP.[1] Furthermore, the residence time of MP in the body of the organisms has also been related with the size of the particles.[10] The relative relationship between the ingestion and retention of MP can result in decreased nutritional value and/or physical obstruction in the digestive tract, which have been proposed as two of the mechanisms underlying observed adverse effects for organisms exposed to MP.[2,3,8,11,12] As the ingestion and effects of MP can be size-dependent, the size distribution of the MP selected in an effect study can directly influence the occurrence and severity of the effects observed and therefore requires analytical characterization. Consequently, studies that report the full particle size distribution of the tested MP are assigned a criterion value of 2. The distribution, however, should be provided with sufficient resolution, ideally with 10 bins or more. If only one size is reported instead of a range, a study receives 2 points when the size reported is supported by analytical characterization and reported with a measurement error. MP sizes should ideally be characterized analytically using dynamic light scattering or laser diffraction methods or alternatively estimated using high resolution microscopy of the MP with a scale in combination with imaging analysis software. When the particle size/sizes are reported but not supported by analytical characterization, based on information provided in material safety data sheets or size separation using sieves, a study is assigned a criterion value of 1. Finally, studies that did not report the size of the MP used in their experiments are assigned a criterion value of 0.

Criterion 2. Particle shape. For several species, selective ingestion, gut retention, and effects of MP have been found to depend on their shape.[8,10,13] For instance, fibers were more lethal than spheres for the amphipod *Hyalella azteca*.[8] Authors report that fibers resulted in longer gut retention times, speculating that fibers may have aggregated in the gut.[8] Additionally, Piarulli et al. (2020) showed that MP analyzed in six different benthic invertebrate species collected from salt marshes, were mostly fibers (98.5%).[14] MP fragments are also reported to be associated with longer gut retention times in the

cladoceran *Daphnia magna* in comparison to spherical MP.[13] It has been suggested that the rounded shape of spherical MP facilitates their transport through the digestive system of organisms, resulting in less severe effects than for other shapes of MP.[8] Given several observations reporting on the relative influence of the shape of MP on effect endpoints, the evaluation criterion related to characterizing MP shape is seen as an important factor when interpreting ecotoxicological effects data. The shapes of MP have been defined in many ways, such as e.g., fragment, fiber, film, foam, pellet, sphere, line, bead, flake, sheet and granule.[15–17] Different shape categories can be found even within these categories; for instance, MP fragments can be further characterized as rounded circular or edgy rectangular shapes.[2] Further complicating shape characterization is the observation that the dimensions of MP vary along continuous scales and therefore do not lend themselves well to discrete categories of characterization.[6] Consequently, we consider the term "irregular MP" as an ambiguous definition of the shape, as it includes the potential to reflect several shape categories. Moreover, for a complete characterization of the shape, it is necessary to include at least one high-resolution photo illustrating each of the shapes included in the MP tested. Therefore, studies that provide an image obtained from a high-resolution microscope of the MP tested are assigned a criterion value of 2. Studies that limit the reporting of the shape of MP to the definitions of Rochman et al. (2019)[16] or their synonyms (sphere vs. bead), based on the information obtained from material safety data sheets but without a visual confirmation by the authors are assigned a criterion value of 1. Finally, studies that do not report the shape of the MP used or reported shapes that did not fall within the definitions described by Rochman et al. (2019),[16] are assigned a criterion value of 0.

Criterion 3. Polymer type. The fate, bioavailability, uptake and thus potential effects of MP can be also influenced by the composition of the polymer representing the MP, which determines the density of the particles in aqueous systems.[18,19] In a sterile system without potential biofouling of the particles and in the absence of agitation, positively buoyant MP will float on the water surface, while negatively buoyant MP will remain in the water column until they sink to the bottom of the system.[18] The fate of the MP in the water column thus influences their bioavailability and therefore the polymer type, as a proxy for density, needs to be characterized and reported. Additionally, knowing the polymer type will allow comparisons with field data on the occurrence, abundance and physical properties of the same polymer type, and possibly linking it with certain products and product emissions. Currently, elaborate techniques for polymer identification are available and widely applied in MP research, such as ATR-FTIR, micro-FTIR, Raman spectroscopy, pyrolysis GC-MS or similar methods.[20] For studies that analytically characterize the polymer type using one of these methods, a criterion score of 2 is assigned. When the polymer type is reported following the information given in the material safety data sheet and not confirmed by the authors, the study is assigned a criterion value of 1. Finally, studies that did not report the polymer type of the MP used are assigned a criterion value of 0.

Criterion 4. Source of MP. Reporting the source of where the MP were obtained is essential in order to better interpret the data the MP relate to, and to strengthen data reproducibility in future studies. Some studies, for instance, use in-house manufactured MP, following ad-hoc procedures which may not lend themselves well to reproducibility. In these instances it is imperative that detailed descriptions of the protocol used in producing the MP is provided (e.g., Korez et al., 2019).[21] Results of effect studies on MP published to date show a wide variety of responses for different organisms.[22] Even for the same species, different results can be obtained, which could be attributed to differences in the source(s) of MP.[2,23] Therefore, when MP are purchased from a commonly available supplier and where specifics of the provider is provided in the main text or in the supporting information, a study is assigned a criterion value of 2, as this scenario lends itself best to reproducibility. For those studies where MP are prepared in-house using commercially available plastic products, we also assign a criterion value of 2 when the name of that plastic product is provided as well as a detailed protocol for the preparation or extraction of the MP. For instance, Jemec Kokalj, Kunej and Skalar (2018),[24] extracted MP from a facial cleanser and made MP from a plastic bag. Polymers were characterized using FTIR, particle size distributions were measured by laser diffraction, and images of the MP were taken with a field emission scanning electron microscope. However, they do not provide the name of the facial cleanser nor the precedence of the plastic bag. Consequently, when the information given on a MP source is incomplete and thus not fully reproducible, a criterion value of 1 is assigned. Finally, studies that do not provide any information on the source of the MP are assigned a criterion value of 0.

Criterion 5. Data reporting. It is widely acknowledged that inconsistency in how concentrations are reported make it difficult to compare between effects studies.[22,25,26] Concentrations of MP can be presented as a particle number concentration, like the number of MP particles per L or per Kg of sediment, food or weight of the organism; or mass concentration, like grams of MP per L or per Kg of sediment, food or weight of the organism.[27] Some studies quantify the number of MP in a specific volume or weight using a hemocytometer, a flow cytometer or a coulter counter.[28–31] Other studies estimate the number of MP manually using a stereomicroscope combined with image analysis software, applicable for MP.[29,31,32] Moreover, some studies convert mass concentrations to number concentrations or vice versa based on assumptions that correlate the size of a particle to its volume, for which MP characteristics such as size distribution, shape and density are required.[2,33,34] A few other studies make reference to the conversion provided by the supplier of the MP.[3,35,36] Thus, the reporting and conversion of concentrations between particle number and mass concentration units can be done using a variety of methods, and should be clearly described in the study in order to facilitate comparisons across studies. Since the units of concentration represent a fundamental parameter to assess risk, which compares environmental concentrations to effect threshold concentrations, consistency in units is therefore of paramount importance.[27,37] Studies that report concentrations in particle number as well as in mass concentrations are thus assigned a criterion value of 2, as they provide the greatest opportunity to

compare between studies and for use in assessing environmental risk. Studies that limit the reporting of concentrations to only either particle number or mass concentrations, are assigned a criterion value of 1. Finally, studies where concentrations of MP are not reported receive a criterion value of 0.

Experimental design

Criterion 6. Chemical purity. Studies that aimed to investigate the interactive effects of MP and chemicals are not included in this study but are reviewed elsewhere.[22,38,39] Persistent organic pollutants (POPs), such as polychlorinated biphenyls (PCBs) and organochlorine pesticides are ubiquitous in the environment and will partition into any organic carbon, including MP.[37] Experiments measuring the partitioning behavior between MP and organic chemicals are relevant for determining sorption/desorption coefficients and/or sorption kinetics. However, from the perspective of assessing risk it is more relevant to evaluate the toxicity of plastic-associated chemicals in the absence of MP.[37] Assessing the adverse effects of the chemical stressor in the absence of the MP individually first, can provide an effective strategy for developing more complex test systems aimed at assessing multiple chemical and non-chemical stressors, and help address the immediate challenges of assessing the environmental risks of MP themselves.[37] This reasoning also applies for the diversity of chemical additives and plasticizers commonly associated with plastic.[40] Moreover, disentangling the effect assessment associated with chemical stressors from the non-chemical particle stressor can strengthen overall understanding of the mechanisms that influence MP toxicity. For instance, studies by Martínez-Gómez et al., (2017) and Pikuda et al., (2019) have shown that the toxicity from leachates derived from additives are more harmful than the inert polymer material, highlighting the importance of washing MP before the start of an experiment, if insight regarding the effects associated with the particles themselves is the main objective.[41,42] Otherwise, the chemical stressor overwhelms the effects that might be associated with the particles, preventing the ability to distinguish between the two. Additionally, the artificiality of an exposing test organisms to MP containing chemical additives within a closed system represents a worst-case scenario that is not representative of an environmentally relevant exposure. In the environment, organic chemicals, including POPs, chemical additives and plasticizers are widely dispersed as a consequence of their use in manufacturing and consumer products, and partition into all environmental media, resulting in various exposure pathways to exist. Consequently, assessing chemical exposure requires an understanding of the multimedia behavior of organic chemicals, whereby exposure via MP likely represents a negligible pathway as compared to other sources.[38,43] Therefore, in order to disentangle the effects associated with the particle stressor from confounding chemical effects, the toxicity of background chemicals should be minimized. This includes minimizing exposure to chemical additives and plasticizer that might be present in MP, but also chemicals associated with food particle surfactants (e.g., Tween) and markers (fluorescence). Minimizing chemical exposures in MP effects studies, however, represents a major challenge. For instance, a recent study by Cole et al. (2019) extensively measured chemicals in MP, and reports that a wide variety of unknown chemicals are used

in MP, making it nearly impossible to confirm conclusively that all relevant chemicals have been assessed.[44] Therefore, it is preferred to repeatedly wash the particles with an organic solvent(s) in an effort to minimize effects associated with a chemical-associated contaminant. It is notable, however, that this could have the undesired effect of altering the properties of the particles themselves, consequently care is required with respect to which organic solvents are used as well as the conditions of cleaning. Alternatively, several studies have demonstrated that it is possible to minimize the influence of the chemical stressor by providing evidence that the mass of chemical in the test system is at an exposure that remains below a chemical toxicity (e.g., Bellingeri et al., 2019; van Weert et al., 2019; Redondo-Hasselerharm et al., 2020).[45–47] In summary, studies that report the inclusion of methods to thoroughly clean MP by washing with an organic solvent are assigned a criterion value of 2, since the observations of adverse effects could be more confidently allocated to a particle-associated effect. If a certificate from the manufacturer was used or measurements were taken to subsequently use a control for the chemicals or the toxicity of chemicals was calculated based on L_{50} or EC_{50} from literature, the study is assigned a criterion value of 1. Finally, studies that did not address the potential influence of a chemical stressor on observed adverse effects when testing MP are assigned a criterion value of 0.

Criterion 7. Laboratory preparation. The importance of preventing contamination when testing MP is emphasized in several recent papers and critical reviews.[15,48–52] Catarino et al. (2018), for instance, quantified atmospheric fall-out within households, which, when rescaled to the surface area of a representative experimental test system of e.g. 20 x 25 cm^2, would imply a flux of 8333 particles per test system per day.[53] The amount of natural fall-out of MP likely differs between locations within a laboratory and among laboratories. Catarino et al. (2018), emphasized the need to account for atmospheric deposition during experiments, even in instances where relatively high concentrations are tested.[53] We argue, therefore, that the uncertainty related to contamination with MP during MP effects studies, also requires care in mitigating the potential for deposition and with respect to characterizing and quantifying the nature of the contaminants. This is because the nature of the MP-contaminants may be significantly different than those used in the test system, in that they may contain chemical additives that can strongly influence observed effects, negating test results. This is particularly relevant to the control test-system, meant to have zero MP concentration, or very low dosed systems, for which greater sensitivity would be anticipated due to the influence of MP-contaminants. Some studies thoroughly report measures taken to prevent MP-contaminates, such as wearing cotton lab coats, rinsing of equipment, covering the test systems or avoiding the use of plastic materials during the experiment.[54–56] Consequently, a criterion value of 2 is assigned for those studies adopting measures aimed at avoiding contamination from air, water and all materials used during the experiment. Studies adopting limited measures are assigned a criterion value of 1. Finally, studies that do not report the use of any measure to prevent contamination are assigned a criterion value of 0.

Criterion 8. Verification of background contamination. Whereas the previous criterion focuses on the measures taken to mitigate background MP-contaminants, the present criterion evaluates the extent to which studies verify that such measures are successful or alternatively that the adoption of taking no action to reduce background contamination is needed because the potential for MP-contaminants is demonstrated to be minimal. In this case, verification implies the use of methods that characterize and analytically measure MP concentrations in exposure systems. A study by Welden and Cowie, 2016, for instance, observed a fiber in the foregut of one of their control animals, underlining the importance of including method verification in MP effects test studies [57]. A few studies, on the other hand, have limited verification of background contamination to the reporting of visual observations.[54,55,58] Visual inspection, however, is generally considered inaccurate, as there is a high probability of missing small and transparent MP.[15,51] Moreover, reliance on the use of visual observations is susceptible to false positives.[20] Based on these considerations, a criterion value of 2 is assigned to studies measuring background contamination with analytical detection methods, such as by FTIR or Raman. For studies that limit the verification of background MP-contaminants to a visual inspection, a criterion value of 1 is assigned. Finally, for studies that do not report on background contamination of MP, a criterion value of 0 is assigned.

Criterion 9. Verification of exposure. In order to obtain accurate dose-effect relationships, exposure concentrations in the test systems must be quantified. Test concentrations are typically prepared by adding particles to the test medium, occasionally followed by dilution and homogenization steps. There are several reasons why the actual exposure concentration can deviate from the nominal concentration estimated from the initial preparation. First, human error can occur in the initial calculations or laboratory manipulations of glass ware and equipment can lead to deviations in the concentration. Secondly, the test system itself can influence exposure, whereby particles can stick to container walls and/or become unevenly distributed across test systems when homogenization is insufficient. Actual concentrations can also be higher than nominal concentrations due to background MP-contaminants, as discussed in the previous criterion.[53,59] These factors can propagate and substantially influence initial estimates of test concentrations. Furthermore, the dynamic behavior of the particles themselves can cause significant changes in exposure during the test. While less important for sediment-test systems, the behavior of particles in aqueous test systems can result in settling, floating or aggregation of the particles, changing the actual exposure conditions over time.[60] Fundamentally, the exposure of the stressor in an ecotoxicity test system should be constant over time and reproducible for each test. Demonstrating consistency in the exposure concentrations for the duration of the test is thus important to develop accurate dose-effect relationships, and the quantification of the exposure concentration should therefore be verified. A criterion value of 2 is assigned to studies that verify the exposure concentration of MP and ensure that at least 80% of the nominal concentration is maintained throughout the test.[61,62] Studies that measure the exposure concentration, but without verifying that at least 80% of

the nominal concentration is maintained throughout the test are assigned a criterion value of 1. Studies that only report the nominal concentration or limit the verification of the concentration to the stock solution are assigned a criterion value of 0.

Criterion 10. Homogeneity of exposure. The previous criterion evaluates the extent to which the exposure concentration is verified. However, unlike the fate of dissolved chemicals in ecotoxicological effect testing, solid particles are prone to inhomogeneity of exposure as they tend to settle or float depending on a variety of factors, such as the difference in their density compared to that of the medium they are dispersed in.[63–70] Therefore, especially for aqueous test systems, MP that have a higher density than water may settle when the dispersion is not well mixed, whereas buoyant particles may tend to reside at the surface of the test system only. Presence of air pockets or biofilm layers may change over time and influence exposure as a result of settling or causing differences in particle-particle interactions and settling velocities as a function of time, thus questioning the assumption of exposure homogeneity. These inhomogeneities can strongly influence the bioavailability and thus the exposure of the particles, resulting in a lack of control and reproducibility of test results. Methods for addressing heterogeneity in test systems assessing particle stressors include the use of ultrasonic agitation, and other physical mixing techniques (circular, wrist action shaking, plankton wheels) prior or during exposure, or by simply reporting the absence of such problems based on visual observations.[33,44,71–74]

Natural sediments are comprised of a mixture of particles with densities spanning a wide range, as compared to that of the solid polymeric particles that have been tested. MP mixed in sediment are 'held' in the sediment matrix and progressively encapsulated when biofilms form and test particles form hetero-aggregates and – agglomerates with the natural particles in the sediment matrix. This implies that exposure in effects test systems of MP mixed in sediment are homogeneously distributed. Many studies have recognized the need for homogeneity and have described in detail how MP were mixed in the exposure medium and sometimes also how homogeneity of exposure was verified.[47,75] For aqueous exposures, a criterion value of 2 is assigned to studies that verify that MP were homogeneously distributed through the use of microscopy photos and/or apply analytical tools to demonstrate that the MP were well mixed or dispersed in the solution. In instances where the method used to generate a homogeneous exposure is described but not verified, a criterion value of 1 is assigned. Effect testing of MP in sediment test systems, for which the verification of homogeneity is deemed to be not crucial, results in a criterion score of 2 for all studies that describe the method by which the MP are homogeneously mixed with the sediment, in detail. Studies that do not address the issue of homogeneity, or that observed an inhomogeneous exposure, are assigned a criterion value of 0.

Criterion 11. Exposure assessment of organisms. To be able to understand and interpret effect data, it is important to be able to causally link an observed effect to actual exposure data. The question 'what is

an organism exposed to?' however can have different answers for different organisms, particles and/or test conditions. The metric used to quantify the effect should be ecologically relevant and should be the same as the one used to quantify exposure.[37] Microplastics can have multiple of such environmentally relevant metrics (ERMs). They can be characterized on the basis of known species- and particle-specific effect mechanisms. Hence, it is the actual effect mechanism which defines how microplastic particles and test organisms interact and how actual exposure should be assessed. Exposure then can be seen as accumulation at the receptor site, i.e. where the interaction takes place, and which is considered as the target for the microplastic effect under consideration. We illustrate the principle with three examples. For instance, one of the more well understood effect mechanisms, is the deterioration of food quality due to the dilution of nutritious food particles caused by an elevated exposure to low-caloric, non-digestible MP that are co-ingested with food (Redondo-Hasselerharm et al., 2018; Wright et al., 2013).[2,12] Therefore, for a study that would ascribe observed effects to this mechanism, demonstrating ingestion would be a crucial criterion. Instead, studies that ascribe suborganismal effects to damage at the cell level[73,76–78] should ideally demonstrate systemic uptake and/or penetration of MPs and should demonstrate that these cells are reached. As a final example, studies that explain growth inhibition in algal cultures from a decrease in photosynthesis, should verify the presence of MPs at or in between algal cells in the culture.[79,80] A detailed overview and analysis of such reported effect mechanisms is provided in section 3.3 of his review. In the majority of instances, effects related to the ingestion of MP are reported as the most relevant exposure pathway, implying that the quality criteria to detect and quantify MP ingested by biota are of critical importance. Exposure due to translocation and cell penetration also requires detection and quantification of MP in biota tissue and is thus also important in defining the quality criteria. These criteria have been reported in a previous study,[51] for which criteria related to tissue digestion, particle detection and polymer identification are all applicable. For adverse effects influenced by external exposure of MP, i.e. from MP just being present in water or sediment, as in the example for algae, criteria for the analysis and quantification of MP in water are most relevant. It is widely understood that visual sorting of MP is insufficient to detect the small and often light-colored MP against a background of e.g., animal tissue. Therefore, following the QA/QC criteria suggested by Hermsen et al. (2018), a criterion value of 2 is assigned to studies that report the detection of MP quantitatively using e.g., FTIR or Raman imaging, to support statements of MP ingestion and/or penetration into cells of biological tissues that have been appropriately digested and filtered.[51] Studies demonstrating exposure of organisms to MP based on qualitative or visual observation, or citing results from a separate experiment, or in the absence of a digestion step, are assigned a criterion value of 1. Studies that do not report data on exposure, are assigned a criterion value of 0.

Criterion 12. Replication. In every effect assessment, an adequate experimental design requires a sufficient number of replicates in order to ensure statistically reliable results.[81,82] Studies should therefore clearly explain the degree of replication of each treatment.[81] Some studies, however, fail to

report on the use of replicates in their experimental design[24,57] while other studies report the use of replicates, but which are not actual replicates but better characterized as pseudo-replicates.[70,83,84] For instance, Jovanović et al. (2018) considered as replicates the 15 fish exposed to MP in the same tank.[85] As each replicate should be an independent experimental unit, with the experimental unit here being the tank, the exposure of all fish via the same tank should thus be better defined as multiple measurements taken one experimental unit.[86] In contrast to soluble chemicals, which can be homogenously distributed in the test system, the severity of the effects detected in MP studies can be attributed to the relative extent of bioavailability of the particles and the probability of encountering them in the test system. Therefore, in the case of MP, it is especially important to have several replicates to compensate for the uncertainties associated with the potential for inhomogeneous exposure associated with the test system. Studies were assigned a value of 2 when they included results from a minimum of three replicates. A criterion value of 1 is assigned to studies using only two replicates. Finally, studies that do not include any replicates or do not report the number of replicates used are assigned a criterion value of 0.

Applicable to risk assessment

Criterion 13. Endpoints. Effect studies with MP use a wide variety of endpoints, sometimes even within studies. We argue that when data from such studies are to be used in ecological risk assessment, the ecological relevance of the selected endpoint represents an important criterion to consider. From a risk assessment perspective, endpoints such as survival, growth and reproduction are considered ecologically relevant, because these endpoints directly relate to a population-level effect. These endpoints are preferred over e.g. suborganismal or behavioral endpoints, which are generally less relevant in assessing population-level responses, unless there is a clear demonstrated causal relationship between these responses and a higher level effect e.g. population effect.[25,87] For instance, de Sá et al., (2015) speculated that reduced food intake caused by the ingestion of MPs adversely affects both the individual and population-level fitness of a species.[88] The endpoints studied, however, are attributed to the predatory performance and efficiency of the species, which does not necessarily translate to an ecologically relevant population level effect. Whereas it has been suggested that suborganismal endpoints such as biomarkers can be representative of early warning signals and are thus more sensitive indicators than the traditional endpoints used in risk assessment[55,89], they can also be perceived as being susceptible to type I and II error, due to under-replication and pseudo-replication in ecotoxicological bioassays, which could lead to false alarms or undetected effects.[89,90] Moreover, there is no evidence that suborganismal endpoints are more sensitive than endpoints taken at higher organismal level responses, particularly for MP effects studies. Additionally it is possible that effects seen at the suborganismal level merely resemble reaction to decreased nutritional intake.[91] Furthermore, endpoints at these suborganismal levels are not likely to be useful predictors since they have complicated time- or dose-dependent responses, which makes it difficult to extrapolate correlations to higher levels of biological organization.[89] Still, in carefully controlled studies e.g. biomarkers can be useful for elucidating mechanisms of toxic action.[89]

In summary, a criterion value of 2 is assigned to studies where endpoints at either community or individual level of biological organization (e.g. survival, growth, development or reproduction) are used. If suborganismal endpoints are used, for which a causal relationship with effects on higher levels of biological organization is demonstrated, a criterion value of 1 is assigned to the study. Finally, studies that use endpoints that cannot be unambiguously linked to a threat at the individual or population level are assigned a criterion value of 0.

Criterion 14. Presence of natural (food) particles. It is important to note that the natural environment is not free of particles and that organisms have adapted various species-specific traits in relation to strategies for interacting with particles. While MP are ubiquitous in the aquatic environment, the amount of natural particles is typically greater than the concentrations of MP that have been reported in the environment.[38,92] Therefore, when designing an experiment meant to simulate natural conditions it is important to consider the response of organisms to both naturally occurring particles as well as a MP-stressor exposure.[25,91] Exposure to naturally occurring particulates, for instance, can represent an important food source to an organism or may otherwise form part of their natural habitat, such as sediment or suspended solids.[2,47] The inclusion of food and other particulates is needed because ecotoxicological effects of MP on organisms has been demonstrated to be influenced by the presence of naturally occurring particulates.[1,70,93,94] Observations that the co-exposure of both naturally occurring particulates and MP can mitigate toxicity implies the relative importance of a species ability to selectively feed and therefore reduce the risks associated with MP under environmentally relevant conditions.[91] We argue that without taking natural (food) particles into account, the observed adverse effects represent a system-dependent artefact that does not lend itself to risk assessment purposes. An exception, however, is made for algal studies, as their food source are nutrients and light, and therefore the addition of other naturally occurring particles is less likely to influence adverse effects.[95]

It is further noted that there are several studies that adopt standard test protocol guidelines for acute toxicity testing, which are applicable to soluble chemicals.[24,34,96,97] In such experiments the test guidance is not to feed the organisms, which is logical when testing soluble chemicals as the food particles may influence the bioavailability of the test chemical and the presence of food does not represent a limiting factor due to the short duration of the acute study. However, this guidance is not applicable to experiments aimed at assessing the acute response of MP, because the adverse effects can also potentially be influenced by the presence of food particles.[91] Therefore, when natural particles (at least food) are added to avoid an exposure that might be perceived as analogous to 'force feeding' the organisms with MP, a criterion value of 2 is assigned to the study. Studies that add food, but in which the food is not optimally available to the organisms are assigned a criterion value of 1. Finally, studies that do not include any naturally occurring or food particles are assigned a criterion value of 0.

Criterion 15. Reporting of effect thresholds. To date, the majority of effect studies report adverse effects for MP at a single or limited number of test concentrations.[11,88,98–100] These observations are beneficial in demonstrating the potential adverse effects that MP can have on biota. It remains unclear, however, the threshold concentration above which the adverse effect initiates. For the purposes of risk assessment, where the ratio of exposure concentrations to that of effect threshold concentrations are derived, accurate estimates of effect threshold concentrations, such as derived from dose-response relationships in the form of $L(E)C_x$, (or the generally less preferred NOEC or LOEC), [101–103] are required. Given the paucity of dose-response threshold effects data for MP, the need for effect threshold concentrations to help inform the risk assessment process has been widely recognized.[22,27,104] Therefore, given the relative importance of this criterion regarding applicability in risk assessment, effect studies aiming at reporting effect thresholds are assigned the greatest value. To be effective it is notable that effect threshold concentrations must be accompanied with estimates of error or uncertainty, in order to evaluate that differences in exposure concentrations are statistically meaningful. Based on this reasoning, we assign a criterion value of 2 to studies that report threshold effects data using $L(E)C_x$ derived from dose-response relationship modelling, with error data (95% confidence interval, standard error or standard deviation). If other metrics like NOEC or LOEC are used, or when no error data are provided, the data are still considered useful and a criterion value of 1 is assigned. Studies that do not explicitly provide data on threshold concentrations for the reported effects are assigned a criterion value of 0.

Criterion 16. Quality of the dose-response relationship - Effect threshold concentrations, such as EC_{50} or LC_{50}, are typically obtained by fitting a logit or probit model to dose-response data,[105] in which EC_{50} or LC_{50} is a model parameter. This implies that the statistical significance of the resulting EC_{50} or LC_{50} value depends on the quality of the fit to the data, and on the number of parameters fitted, compared to the number of data points in the dose-response relationship. In standard ecotoxicity test systems it is generally suggested to assess effects using a minimum of six different exposure dose concentrations, including the control, to obtain an accurate EC_{50} or LC_{50} value.[105] Ideally, the exposure concentrations used are representative of the full range of effects, i.e. from low effect to near-maximum effect, such that an EC_{50} or LC_{50} value can be derived without extrapolation. Intuitively, replication of test results at each exposure concentration will also contribute to more accurate EC_{50} or LC_{50} values. Since replication is already covered by criterion 12, only the number of exposure concentrations used in an effect study is evaluated under this criterion. Studies that use the recommended minimum of six exposure dose concentrations or more, including a treatment control (zero microplastic concentration), are assigned a criterion value of 2, and a criterion value of 1 if five different concentrations are used. For studies reporting dose-response relationships using less than five concentrations, a criterion value of 0 is assigned.

Criterion 17. Concentration range tested. Recent studies have drawn attention to the need to better define ecologically relevant concentration ranges for effect testing of MP.[26,106] As previously discussed, studies reporting adverse effects for MP often use unrealistically high exposure concentrations, which has resulted in suggestions for future studies to assess effects using lower, more environmentally relevant, concentrations.[37,106] However, if studies limit assessing effects to low concentrations, it is possible that derivation of effect threshold concentrations may not be possible. Consequently, we argue that studies must follow standard principles adopted in assessing the risks of chemicals, such as through the use of quantitative dose-effect relationships to obtain an assessment of effect threshold endpoints typical of ecotoxicology (i.e., EC_{50} or LC_{50}) with sufficient quality. To meet this requirement, effect testing can include both high and low concentrations, as long as the results are used to quantitatively derive the appropriate threshold values. For example, if an effect observed in an ecotoxicity test system occurs only at concentrations that exceed environmentally relevant exposure concentrations by several orders of magnitude, the end result would be supportive of demonstrating low risk. Nevertheless, there can also be strong arguments that support the use of environmentally realistic, low concentrations in ecotoxicity effects tests. This is because the reported effects occurring at high concentrations may be linked to an effect associated with a decrease in food quality, resulting from either the ingestion of inert non-digestible particles or due to an overwhelming number of particles in the test system that results in a decreased potential for the test organisms to find food particles. This type of effects occurs with any type of particle of low nutritional value and may be perceived as an artefact of the test system design, not an effect that is intrinsic to the MP themselves[25,33] and is therefore better understood as a non-specific particle effect. This exposure scenario typically results in the test organisms suffering from starvation prior to any other modes of action that the MP may cause – effects that might occur at lower concentrations following a chronic exposure.[47,107] In other words, at environmentally relevant concentrations, it is unlikely that food dilution represents a mechanism of ecological significance, but that more subtle effect mechanisms (related to behavior, avoidance, reproduction, particle toxicity) are likely of greater relevance to assess and for which long term chronic effects testing would be beneficial. For this reason, some studies intentionally assess the effects associated with lower test concentrations.[2,32] In summary, environmentally relevant concentrations should be given priority for effects testing of MP, which forms the basis of a legitimate criterion for the ecological relevance associated with chronic ecotoxicity test system design. Note that exposure duration is evaluated below, in a separate criterion, and only the ecological relevance of the concentration is evaluated under this criterion. Thus, studies that use two or more environmentally realistic concentrations in the exposure concentration doses tested, supported by credible literature data, are assigned a criterion value of 2. If the test system uses only a single environmentally relevant concentration, supported by credible literature data, a criterion value of 1 is assigned. Studies that acknowledge that concentrations are far above environmentally relevant concentrations, or that do not evaluate their exposure concentrations with environmental monitoring data, are assigned a criterion value of 0.

Criterion 18. Aging and biofouling. Under environmentally relevant conditions, MP undergo abiotic and biotic processes that alter their shape, size, structure and eventually their bioavailability.[108] Vroom et al. (2017) demonstrate that the aging of MP promotes their ingestion by marine zooplankton.[109] As the surface of MP functions as a substrate for biofilm to grow, ingestion of biofouled MP potentially represents an additional energy source for test organisms.[110] This implies that ecotoxicity tests that assess pristine particles may potentially underestimate the ingestion rates that may occur in the environment, whereby the potential to ingest aged and biofouled particles may be higher. Since MP undergo both aging and biofouling in the environment, it would thus be beneficial to consider how such processes influence ecotoxicity results and would further strengthen aims directed at ecological relevance. Consequently, studies that include aging of MP to make them more environmentally realistic and also characterized the MP for aging and biofouling, for instance by scanning electron microscope (SEM), are assigned a criterion value of 2. Studies that have only aged the MP but do not characterize them (e.g., Zettler et al. (2013))[111] are assigned a criterion value of 1. Finally, studies that limit testing to only the use of pristine MP and/or conditions that prevent the formation of a biofilm are assigned a criterion value of 0.

Criterion 19. Diversity of MP tested. To date, most studies assessing the effects of MP limit observations to a relatively small sub-set of all possible characteristics. For instance, studies testing MP based on a single or limited range of particle sizes, shapes and polymeric type may provide valuable information on how specific particle characteristics influence uptake and effects, but under ecologically relevant conditions, organisms will encounter a wide variety of characteristics, of which size, shape and density often are considered the most important properties influence the transport, fate and bioavailability of MP.[6,104,112] Species-specific biological and behavioral traits can also play an important factor in determining which properties of MP found in the environment will most likely result in an exposure for the individuals of a species.[2,104] The ecotoxicological effects related to the properties of the relevant fraction of MP for a species, may also be influenced by the presence of either other MP or of naturally occurring particles. Simulating species-specific responses to exposures of environmentally relevant heterogeneous mixtures of both MP and naturally occurring particles represents a significant challenge in MP effects testing. Recently, Kooi and Koelmans (2019) reviewed the ranges and distributions of the characteristics of environmentally relevant MP and observed relative similarity across datasets taken from different locations, with respect to their physicochemical characteristics.[6] Given the recent awareness associated with this criterion, we suggest that future studies adopt the use of distributions in physicochemical properties of MP as a standard approach to enable better environmental realism in MP effects testing. Consequently, studies that use MP with a range of sizes, shapes and densities in one mixture exposure, and which attempts to simulate the diversity of environmental MP, are assigned a criterion value of 2. If the diversity related to only one or two of the physicochemical characteristics

and/or a limited distribution, a criterion value of 1 is assigned. Studies that limited effect testing to a single type of MP were assigned a criterion value of 0.

Criterion 20. Exposure time. Standard test protocol guidelines for the ecotoxicity testing of chemicals recommend the application of defined exposure times for each of the endpoints assessed. While these guidelines are also routinely adopted in the effects testing of MP, some studies highlight the need for longer exposure times, due to the detection of time-dependent effects.[34,47,84,107,113–115] For instance, the effects of MP on the freshwater coral *Lophelia pertusa* differed between exposure times of 7, 20 and 47 days. While the coral growth rate decreased over time, effects on capture prey and polyp activity disappeared after 47 days, revealing that both positive and adverse effects of MP can differ with time.[84] Furthermore, observations for the marine mussel *Mytilus edulis*, report the formation of granulocytomas and the destabilization of the lysosomal membrane increased significantly with longer exposure times when exposed to MP.[114] Moreover, adverse effects of MP on the growth of the cladoceran *Daphnia magna* were only found after 25-31 days of exposure.[113] For *D. magna*, another study demonstrated that their immobilization increased over time when exposed to MP.[34] Generational effects following exposure to MP have also been reported, as in the case of the copepod *Tigriopus japonicus*.[115] Therefore, the importance of exposure duration, which can influence the detection of adverse effects that might differ between chemicals and MP is emphasized within this evaluation criterion. Exposure duration is of particular importance for endpoints that seem to be time-dependent, such as growth, reproduction and long term community effects.[47,116] Additionally, increasing the exposure time can be perceived as adding greater environmental relevance to the effect study, explaining the logic for why this criterion is in the ecological relevance category. Thus, for studies that include a minimum exposure time of 7 days for bacteria or phytoplankton, 21 days for zooplankton, 28 days for benthic invertebrates, macrophytes or fish larvae and 3 months for adult fish, the study is assigned a criterion value of 2. For studies that use an exposure time between 1 and 7 days for bacteria or phytoplankton, between 4 and 21 days for zooplankton, between 7 and 28 days for benthic invertebrates, macrophytes or fish larvae and between 1 and 3 months for adult fish, a criterion value of 1 is assigned. Finally, studies that use substantially shorter exposure times, specifically <1d for bacteria and phytoplankton, 4 days for zooplankton, 7 days for benthic invertebrates, macrophytes or fish larvae and 1 month for adult fish, are assigned a criterion value of 0, except in instances where multigenerational studies are performed, where a criterion value of 1 is assigned

Table S1. Study characteristics.

Author	*Year*	*System*	*Plant/Algae/ Invertebrate /Fish*	*Class studied*	*Species*	*Polymer type*	*Shape*	*Size (µm)*	*Exposure duration (h)*	*Endpoints studied*	*Endpoints affected*	*Effect threshold*
Aljaibachi et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PS	Sphere	2	504	Survival, Growth & Reproduction	Survival, Growth	
Au et al.	2015	Fresh	invertebrate	Malacostraca	*Hyalella azteca*	PE	Sphere	10 - 27	240	Survival	Survival	LC_{50}
Au et al.	2015	Fresh	invertebrate	Malacostraca	*Hyalella azteca*	PE	Sphere	10 - 27	672	Growth, Reproduction	Growth, Reproduction	
Au et al.	2015	Fresh	invertebrate	Malacostraca	*Hyalella azteca*	PP	Fiber	75-20 (x 20)	240	Survival	Survival	LC_{50}
Au et al.	2015	Fresh	invertebrate	Malacostraca	*Hyalella azteca*	PP	Fiber	75-20 (x 20)	240	Growth, Egestion time	Growth, Egestion time	
Blarer & Burkhardt-Holm	2016	Fresh	invertebrate	Malacostraca	*Gammarus fossarum*	PS	Sphere	1,6	672	Feeding rate, Assimilation efficiency, Wet weight change	Assimilation efficiency	
Blarer & Burkhardt-Holm	2016	Fresh	invertebrate	Malacostraca	*Gammarus fossarum*	PA	Fiber	500 x 20	672	Feeding rate, Assimilation efficiency, Wet weight change	Assimilation efficiency	
Bosker et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PS	Sphere	1 - 5	504	Population abundance, biomass	Population abundance, biomass	
Bour et al.	2018	Marine	invertebrate	Bivalve	*Ennucula tenuis*	PE	Fragment	4 - 6	672	Survival, Condition Index, Burrowing behavior		
Bour et al.	2018	Marine	invertebrate	Bivalve	*Ennucula tenuis*	PE	Fragment	20 - 25	672	Survival, Condition Index, Burrowing behavior	Total energy	
Bour et al.	2018	Marine	invertebrate	Bivalve	*Ennucula tenuis*	PE	Fragment	125 - 500	672	Survival, Condition Index, Burrowing behavior, Total energy, Protein content	Total energy	
Bour et al.	2018	Marine	invertebrate	Bivalve	*Abra nitida*	PE	Fragment	4 - 6	672	Survival, Condition Index, Burrowing behavior		
Bour et al.	2018	Marine	invertebrate	Bivalve	*Abra nitida*	PE	Fragment	20 - 25	672	Survival, Condition Index, Burrowing behavior		
Bour et al.	2018	Marine	invertebrate	Bivalve	*Abra nitida*	PE	Fragment	125 - 500	672	Survival, Condition Index, Burrowing behavior, Total energy, Protein content	Protein content	
Browne et al.	2008	Marine	invertebrate	Bivalve	*Mytilus edulis*	PS	Sphere	3	3	Feeding behavior, Phagocytic activity, ROS production		
Browne et al.	2008	Marine	invertebrate	Bivalve	*Mytilus edulis*	PS	Sphere	9,6	3	Feeding behavior, Phagocytic activity, ROS production		
Bruck & Ford	2018	Marine	invertebrate	Malacostraca	*Echinogammarus marinus*	PS	Sphere	8	840	Food consumption, Growth & Moulting		
Caniff & Hoang	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Sphere	63 - 75	504	Survival, Reproduction rate		
Capolupo	2018	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PS	Sphere	3	48 - 916	Feeding efficiency, Morphological development, Gene transcription	Gene transcription	
Chae et al.	2019	Marine	algae	Chlorophyceae	*Dunaliella salina*	PE	Sphere	180 - 212	144	Cell growth, Photosynthetic activity, Cell morphology	Cell growth, Photosynthetic activity	
Chapron et al.	2018	Marine	invertebrate	Anthozoa	*Lophelia pertusa*	LDPE	Sphere	500	168	Capture rates	Capture rates	
Chapron et al.	2018	Marine	invertebrate	Anthozoa	*Lophelia pertusa*	LDPE	Sphere	500	480	Polyp activity	Polyp activity	

Chapron et al.	2018	Marine	invertebrate	Anthozoa	*Lophelia pertusa*	LDPE	Sphere	500	1656	Skeleton growth rate	Skeleton growth rate	
Choi et al.	2018	Marine	fish	Actinopterygii	*Cyprinodon variegatus*	PE	Sphere	150 - 180	96	Survival, Malformation, Swimming behavior, Oxydative stress, Gene transcription, Enzyme activity	Oxidative stress, Gene expression, Enzymatic activity	
Choi et al.	2018	Marine	fish	Actinopterygii	*Cyprinodon variegatus*	PE	Irregular	6 - 350	96	Survival, Malformation, Swimming behavior, Oxydative stress, Gene transcription, Enzyme activity	Swimming behavior, Oxydative stress, Gene expression	
Chritchell & Hoogenboom	2018	Marine	fish	Actinopterygii	*Acanthochromis polyacanthus*	PET	Irregular	1000 - 2000	1008	Growth, Body condition & Behavior		
Cole & Galloway	2015	Marine	invertebrate	Bivalve	*Crassostrea gigas*	PS	Sphere	1	192	Feeding rate, growth	Feeding rate	
Cole & Galloway	2015	Marine	invertebrate	Bivalve	*Crassostrea gigas*	PS	Sphere	10	192	Feeding rate, growth		
Cole et al.	2013	Marine	invertebrate	Hexanauplia	*Centropages typicus*	PS	Sphere	7,3	24	Feeding rate	Feeding rate	
Cole et al.	2013	Marine	invertebrate	Hexanauplia	*Centropages typicus*	PS	Sphere	20,6	24	Feeding rate		
Cole et al.	2015	Marine	invertebrate	Hexanauplia	*Calanus helgol&icus*	PS	Sphere	20	216	Survival, Reproductive output, Egg production rates, Respiration rate	Reproductive output	
Cole et al.	2019	Marine	invertebrate	Hexanauplia	*Calanus finmarchicus*	Nylon	Fiber	10 x 30	144	Feeding, Prosome length, Moulting, Lipid accumulation	Feeding selectivity, Moulting	
Cole et al.	2019	Marine	invertebrate	Hexanauplia	*Calanus finmarchicus*	Nylon	Granule	10 - 50	144	Feeding, Prosome length, Moulting, Lipid accumulation	Moulting	
Cong et al.	2019	Marine	fish	Actinopterygii	*Oryzias melastigma*	PS	Sphere	10 - 11	336	Survival, Growth, Reproduction	Survival, Growth, Reproduction	
de Sá et al.	2015	Estuarine	fish	Actinopterygii	*Pomatoschistus microps*	PE	Sphere	420 - 500	0,05	Predatory performance & efficiency	Predatory performance & efficiency	
Detree & Gallardo-Escarrate	2017	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PE	Sphere	1 - 50	24	Gene expression	Gene expression	
Espinosa et al.	2017	Marine	fish	Actinopterygii	*Sparus aurata*	PVC	N/A	40 - 150	720	Growth, immune status, liver damage	Immune status, liver damage	
Franzellitti et al.	2019	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PS	Sphere	3	48	Multixenobiotic resistance	Multixenobiotic resistance	
Franzellitti et al.	2019	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PS	Sphere	3	96	Multixenobiotic resistance	Multixenobiotic resistance	
Franzellitti et al.	2019	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PS	Sphere	45	96	Multixenobiotic resistance	Multixenobiotic resistance	
Gambardella et al.	2019	Fresh	bacteria	Gammaproteo bacteria	*Vibrio fischeri*	PE	Irregular	4.25	0,5	Bioluminescence		NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteo bacteria	*Vibrio fischeri*	PE	Irregular	9.03	0,5	Bioluminescence		NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteo bacteria	*Vibrio fischeri*	PE	Irregular	14.07	0,5	Bioluminescence		NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteo bacteria	*Vibrio fischeri*	PE	Irregular	24.46	0,5	Bioluminescence		NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteo bacteria	*Vibrio fischeri*	PE	Irregular	125 - 500	0,5	Bioluminescence		NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteo bacteria	*Vibrio fischeri*	PE	Irregular	10.14	0,5	Bioluminescence		NOEC

Gambardella et al.	2019	Fresh	bacteria	Gammaproteobacteria	*Vibrio fischeri*	PE	Irregular	14.73	0,5	Bioluminescence	NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteobacteria	*Vibrio fischeri*	PE	Irregular	62.14	0,5	Bioluminescence	NOEC
Gambardella et al.	2019	Fresh	bacteria	Gammaproteobacteria	*Vibrio fischeri*	PE	Irregular	90.60	0,5	Bioluminescence	NOEC
Gambardella et al.	2019	Fresh	algae	Bacillariophyceae	*Phaeodactylum tricornutum*	PE	Irregular	4.25	72	Growth	NOEC
Gambardella et al.	2019	Fresh	algae	Bacillariophyceae	*Phaeodactylum tricornutum*	PE	Irregular	9.03	72	Growth	NOEC
Gambardella et al.	2019	Fresh	algae	Bacillariophyceae	*Phaeodactylum tricornutum*	PE	Irregular	14.07	72	Growth	NOEC
Gambardella et al.	2019	Fresh	algae	Bacillariophyceae	*Phaeodactylum tricornutum*	PE	Irregular	24.46	72	Growth	NOEC
Gambardella et al.	2019	Fresh	algae	Bacillariophyceae	*Phaeodactylum tricornutum*	PE	Irregular	125 - 500	72	Growth	NOEC
Gardon et al.	2018	Marine	invertebrate	Bivalve	*Pinctada margaritifera*	PS	Sphere	6, 10	720	Feeding activity, Oxygen consumption, Assimilation efficiency, Scope for growth	Assimilation efficiency, Scope for growth
Gardon et al.	2018	Marine	invertebrate	Bivalve	*Pinctada margaritifera*	PS	Sphere	6, 10	1440	Growth, Reproductive effort, Regression of gametogenesis	Regression of gametogenesis
Gerdes et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PET	Fragment	5	96	Immobilization	LC_{50}
Goncalves et al	2019	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PS	Sphere	2, 6, 10	48	Oxidative stress	
Goncalves et al	2019	Marine	invertebrate	Bivalve	*Mytilus galloprovincialis*	PS	Sphere	5, 10	504	Hystopathology	
Gorokhova et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	12	Swimming, Filtering behavior	Swimming, Filtering behavior
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PS	Sphere	30	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PP	Fragment	34	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PP	Fiber	34	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PE	Sphere	35	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PE	Sphere	59	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PS	Sphere	75	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PE	Sphere	83	3	Survival	No statistical comparison made with control

Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PP	Fragment	93	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PP	Fiber	93	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PE	Sphere	116	3	Survival	No statistical comparison made with control
Gray & Weinstein	2017	Marine	invertebrate	Malacostraca	*Palaemonetes pugio*	PE	Sphere	165	3	Survival	No statistical comparison made with control
Green	2016	Marine	invertebrate	Bivalve	*Ostrea edulis*	HDPE	N/A	0.48 - 316	1440	Respiration, Filtration rate, Shell growth	
Green	2016	Marine	invertebrate	Bivalve	*Ostrea edulis*	PLA	N/A	0.6 - 363	1440	Respiration, Filtration rate, Shell growth	
Green	2016	Marine	invertebrate	Gastropoda	*Littorina sp.*	HDPE	N/A	0.48 - 316	1440	Abundance, Biomass	Abundance
Green	2016	Marine	invertebrate	Gastropoda	*Littorina sp.*	PLA	N/A	0.6 - 363	1440	Abundance, Biomass	Abundance
Green	2016	Marine	invertebrate	Malacostraca	*Idotea balthica*	HDPE	N/A	0.48 - 316	1440	Abundance, Biomass	Abundance
Green	2016	Marine	invertebrate	Malacostraca	*Idotea balthica*	PLA	N/A	0.6 - 363	1440	Abundance, Biomass	Abundance
Green	2016	Marine	invertebrate	Bivalve	*Scrobicularia plana*	HDPE	N/A	0.48 - 316	1440	Abundance, Biomass	Biomass
Green	2016	Marine	invertebrate	Bivalve	*Scrobicularia plana*	PLA	N/A	0.6 - 363	1440	Abundance, Biomass	Biomass
Green et al.	2016	Marine	invertebrate	Polychaeta	*Arenicola marina*	PLA	N/A	1.4 - 707	744	Growth, metabolic rate, cast production	Metabolic rate
Green et al.	2016	Marine	invertebrate	Polychaeta	*Arenicola marina*	HDPE	N/A	2.5 - 316	744	Growth, metabolic rate, cast production	Metabolic rate
Green et al.	2016	Marine	invertebrate	Polychaeta	*Arenicola marina*	PVC	N/A	8.7 - 478	744	Growth, metabolic rate, cast production	Metabolic rate, cast production
Green et al.	2016	Marine	algae	N/A	*N/A*	PLA	N/A	1.4 - 707	744	Biomass	Biomass
Green et al.	2016	Marine	algae	N/A	*N/A*	HDPE	N/A	2.5 - 316	744	Biomass	Biomass
Green et al.	2016	Marine	algae	N/A	*N/A*	PVC	N/A	8.7 - 478	744	Biomass	Biomass
Green et al.	2016	Marine	bacteria	N/A	*N/A*	PLA	N/A	1.4 - 707	744	Biomass, chlorophyll-a content	Chlorophyll-a content
Green et al.	2016	Marine	bacteria	N/A	*N/A*	HDPE	N/A	2.5 - 316	744	Biomass, chlorophyll-a content	Chlorophyll-a content
Green et al.	2016	Marine	bacteria	N/A	*N/A*	PVC	N/A	8.7 - 478	744	Biomass, chlorophyll-a content	Chlorophyll-a content
Green et al.	2017	Marine	invertebrate	Bivalve	*Ostrea edulis*	HDPE	N/A	0.48 - 316	1200	Filtration rate	Filtration rate
Green et al.	2017	Marine	invertebrate	Bivalve	*Mytilus edulis*	HDPE	N/A	0.48 - 316	1200	Filtration rate	Filtration rate
Green et al.	2017	Marine	invertebrate	Bivalve	*Ostrea edulis*	PLA	N/A	0.6 - 363	1200	Filtration rate	Filtration rate
Green et al.	2017	Marine	invertebrate	Bivalve	*Mytilus edulis*	PLA	N/A	0.6 - 363	1200	Filtration rate	Filtration rate
Green et al.	2017	Marine	algae	N/A	*N/A*	HDPE	N/A	0.48 - 316	1200	Biomass	

Green et al.	2017	Marine	algae	N/A	*N/A*	PLA	N/A	0.6 - 363	1200	Biomass	
Green et al.	2017	Marine	bacteria	N/A	*N/A*	HDPE	N/A	0.48 - 316	1200	Biomass	Biomass
Green et al.	2017	Marine	bacteria	N/A	*N/A*	PLA	N/A	0.6 - 363	1200	Biomass	Biomass
Green et al.	2017	Marine	invertebrate	Polychaeta	*Eteone picta*	HDPE	N/A	0.48 - 316	1200	Abundance, Biomass	Abundance
Green et al.	2017	Marine	invertebrate	Polychaeta	*Eteone picta*	PLA	N/A	0.6 - 363	1200	Abundance, Biomass	Abundance
Green et al.	2017	Marine	invertebrate	Anopla	*Lineus longissimus*	HDPE	N/A	0.48 - 316	1200	Abundance, Biomass	Abundance
Green et al.	2017	Marine	invertebrate	Anopla	*Lineus longissimus*	PLA	N/A	0.6 - 363	1200	Abundance, Biomass	Abundance
Green et al.	2019	Marine	invertebrate	Bivalve	*Mytilus edulis*	PLA	Fragment	0.6-363	1248	Tenacity, Number of byssal threads, Haemolymph proteome	Tenacity, Number of byssal threads, Haemolymph proteome
Green et al.	2019	Marine	invertebrate	Bivalve	*Mytilus edulis*	HDPE	Fragment	0.48-316	1248	Tenacity, Number of byssal threads, Haemolymph proteome	Tenacity, Number of byssal threads, Haemolymph proteome
Hämer et al.	2014	Marine	invertebrate	Malacostraca	*Idotea emarginata*	PS	Sphere	10	1008	Survival, Growth, Intermolt duration, Ingestion rate	
Hämer et al.	2014	Marine	invertebrate	Malacostraca	*Idotea emarginata*	PS	Fragment	1 - 100	1008	Survival, growth, intermolt duration, ingestion rate	
Hämer et al.	2014	Marine	invertebrate	Malacostraca	*Idotea emarginata*	PA	Fiber	20 - 2500	1008	Survival, growth, intermolt duration, ingestion rate	
Hankins et al.	2018	Marine	invertebrate	Anthozoa	*Montastraea cavernosa*	PE	Sphere	90 - 106	48	Calcification	
Hankins et al.	2018	Marine	invertebrate	Anthozoa	*Orbicella faveolata*	PE	Sphere	425 - 500	48	Calcification	
Hankins et al.	2018	Marine	invertebrate	Anthozoa	*Montastraea cavernosa*	PE	Sphere	850 - 1000	48	Calcification	
Hankins et al.	2018	Marine	invertebrate	Anthozoa	*Orbicella faveolata*	PE	Sphere	90 - 106	48	Calcification	
Hankins et al.	2018	Marine	invertebrate	Anthozoa	*Montastraea cavernosa*	PE	Sphere	425 - 500	48	Calcification	
Hankins et al.	2018	Marine	invertebrate	Anthozoa	*Orbicella faveolata*	PE	Sphere	850 - 1000	48	Calcification	
Imhof & Laforsch	2016	Fresh	invertebrate	Gastropoda	*Potampoyrgus antipodarum*	PA, PET, PC, PS, PVC	Irregular	4.64 - 602	1344	Growth, reproduction	
Imhof et al.	2017	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PA, PC, PET, PVC	Irregular	27.5 - 72.5	48	Survival, Growth, Reproduction, Gene expression	Growth
Imhof et al.	2017	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	ABS, PVC, POM, SAN	Irregular	22.3 - 48.5	48	Survival, Growth, Reproduction, Gene expression	Growth
Jabeen et al.	2018	Fresh	fish	Actinopterygii	*Carassius auratus*	EVA	Fiber	700 - 5000	1008	Survival, Condition factor, Length, Weight, Hyspathology	Condition factor, Weight, Hyspathology
Jabeen et al.	2018	Fresh	fish	Actinopterygii	*Carassius auratus*	PS	Fragment	2500 - 3000	1008	Survival, Condition factor, Length, Weight, Hyspathology	Condition factor, Weight, Hyspathology

Jabeen et al.	2018	Fresh	fish	Actinopterygii	*Carassius auratus*	Polyethylene acrylate	Pellet	4900 - 5000	1008	Survival, Condition factor, Length, Weight, Hyspathology	Weight, Hystopathology	
Jacob et al.	2019	Marine	fish	Actinopterygii	*Acanthurus triostegus*	PS	Sphere	91.26	192	Survival, Foraging activity, Predation		
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	48	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	96	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	48	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	96	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	48	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	96	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	48	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	96	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	48	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	96	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	48	Survival	Survival	LC_{50}
Jaikumar et al.	2018	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	irregular	1 - 10	96	Survival	Survival	LC_{50}
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Day of first brood		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	504	Day of first brood		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	168	Day of first brood		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	504	Day of first brood		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	504	Day of first brood	Day of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	168	Day of first brood	Day of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Size of first brood	Size of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	504	Size of first brood	Size of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	168	Size of first brood	Size of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	504	Size of first brood	Size of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	504	Size of first brood		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	168	Size of first brood	Size of first brood	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Total # of broods		NOEC

Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	504	Total # of broods	Total # of broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	168	Total # of broods	Total # of broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	504	Total # of broods		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	504	Total # of broods		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	168	Total # of broods		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Size of first 3 broods	Size of first 3 broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	504	Size of first 3 broods	Size of first 3 broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	168	Size of first 3 broods	Size of first 3 broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	504	Size of first 3 broods	Size of first 3 broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	504	Size of first 3 broods	Size of first 3 broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	168	Size of first 3 broods	Size of first 3 broods	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Cumulative # of neonates	Cumulative # of neonates	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	504	Cumulative # of neonates	Cumulative # of neonates	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	168	Cumulative # of neonates	Cumulative # of neonates	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	504	Cumulative # of neonates	Cumulative # of neonates	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	504	Cumulative # of neonates	Cumulative # of neonates	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	168	Cumulative # of neonates	Cumulative # of neonates	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Terminal length	Terminal length	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	N/A	Sphere	1 - 5	504	Terminal length		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	N/A	Sphere	1 - 5	168	Terminal length	Terminal length	LOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	1 - 10	504	Terminal length		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Daphnia pulex*	PE	Irregular	1 - 10	504	Terminal length		NOEC
Jaikumar et al.	2019	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Irregular	1 - 10	168	Terminal length		NOEC
Jovanović et al.	2018	Marine	fish	Actinopterygii	*Sparus aurata*	PVCHMW	Irregular	75,6	1080	Growth, Hyspathology, Levels of glucose, AST, ALT, LDH, & GGT in serum		
Jovanović et al.	2018	Marine	fish	Actinopterygii	*Sparus aurata*	PA	Irregular	111,7	1080	Growth, Hyspathology, Levels of glucose, AST, ALT, LDH, & GGT in serum		
Jovanović et al.	2018	Marine	fish	Actinopterygii	*Sparus aurata*	UHMWPE	Irregular	23,4	1080	Growth, Hyspathology, Levels of glucose, AST, ALT, LDH, & GGT in serum		

Jovanović et al.	2018	Marine	fish	Actinopterygii	*Sparus aurata*	PS	Irregular	51	1080	Growth, Hyspathology, Levels of glucose, AST, ALT, LDH, & GGT in serum	
Jovanović et al.	2018	Marine	fish	Actinopterygii	*Sparus aurata*	MDPE	Irregular	54,5	1080	Growth, Hyspathology, Levels of glucose, AST, ALT, LDH, & GGT in serum	
Jovanović et al.	2018	Marine	fish	Actinopterygii	*Sparus aurata*	PWCLMW	Irregular	87,6	1080	Growth, Hyspathology, Levels of glucose, AST, ALT, LDH, & GGT in serum	
Jemec et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PET	Fiber	60-1400 x 30-530 µm	48	Survival, Growth	Survival
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Fragment	183.1	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Fragment	102.9	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Fragment	63.05	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Fragment	264	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Fragment	247.9	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Fragment	136.8	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PET	Fiber	22.8	48	Survival, Growth, Immobility	
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PE	Fragment	183.1	48	Growth	Growth
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PE	Fragment	102.9	48	Growth	Growth
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PE	Fragment	63.05	48	Growth	Growth
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PE	Fragment	264	48	Growth	Growth
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PE	Fragment	247.9	48	Growth	Growth
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PE	Fragment	136.8	48	Growth	Growth
Jemec et al.	2018	Fresh	invertebrate	Branchiopoda	*Artemia franciscana*	PET	Fiber	22.8	48	Growth	Growth
Jeong et al.	2016	Marine	invertebrate	Monogononta	*Brachionus koreanus*	PS	Sphere	6	288	Survival, Growth, Reproduction	
Jeong et al.	2016	Marine	invertebrate	Monogononta	*Brachionus koreanus*	PS	Sphere	6	24	ROS production, enzyme activity	ROS production, enzyme activity
Jeong et al.	2017	Marine	invertebrate	Hexanauplia	*Paracyclopina nana*	PS	Sphere	6	24	Growth rate, Fecundity, Development	Development
Jin et al.	2018	fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	50	336	Microbiota dysbiosis, Inflammation	Microbiota dysbiosis
Kalcikova et al.	2017	Fresh	plant	Liliopsida	*Lemna minor*	PE	Irregular/sharp surface	30 - 600	168	Specific leaf growth rate, Photosynthetic pigments content, Root growth, Root cell viability	Root growth
Kalcikova et al.	2017	Fresh	plant	Liliopsida	*Lemna minor*	PE	Irregular/smooth surface	40 - 400	168	Specific leaf growth rate, Photosynthetic pigments content, Root growth	Root growth

Kaposi et al.	2014	Marine	invertebrate	Echinoidea	*Tripneustes gratilla larvae*	PE	Sphere	10 - 45	120	Survival, Growth	Growth	
Karami et al.	2017	Fresh	fish	Actinopterygii	*Danio rerio*	LDPE	Fragments	4.64 - 17.6	240	Condition factor, Growth, Gene expression		
Karami et al.	2017	Fresh	fish	Actinopterygii	*Danio rerio*	LDPE	Fragments	4.64 - 17.6	480	Condition factor, Growth, Gene expression	Gene expression	
Korez et al.	2019	Marine	invertebrate	Malacostraca	*Idotea emarginata*	PMMA	Fragment	10 - 100	192	Feeding rate, Enzymatic activity	Feeding rate, Enzymatic activity	
Kratina et al.	2019	Fresh	invertebrate	Malacostraca	*Gammarus pulex*	PMMA	Sphere	40.2	24	Feeding rate, Metabolic rate	Metabolic rate	
Lee et al.	2013	Estuarine	invertebrate	Hexanauplia	*Tigriopus japonicus F0 generation*	PS	Sphere	6	336	Survival, developmental time & fecundity	Fecundity	EC_{50}
Lee et al.	2013	Estuarine	invertebrate	Hexanauplia	*Tigriopus japonicus F1 generation*	PS	Sphere	6	336	Survival, developmental time & fecundity	Fecundity	EC_{50}
Lei et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PA	Irregular	20 - 180	240	Survival, Hyspathology	Hyspathology	
Lei et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PE	Irregular	20 - 120	240	Survival, Hyspathology	Hyspathology	
Lei et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PP	Irregular	40 - 180	240	Survival, Hyspathology	Survival, Hyspathology	
Lei et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PVC	Irregular	50 - 170	240	Survival, Hyspathology	Hyspathology	
Lei et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	5	240	Survival, Hyspathology		
Lei et al.	2018	Fresh	invertebrate	Chromadorea	*Caenorhabditis elegans*	PA	Irregular	20 - 180	48	Survival, Body length, Reproduction, Calcium levels, Gene expression	Survival, Body length, Reproduction, Calcium levels, Gene expression	
Lei et al.	2018	Fresh	invertebrate	Chromadorea	*Caenorhabditis elegans*	PE	Irregular	20 - 120	48	Survival, Body length, Reproduction, Calcium levels, Gene expression	Survival, Body length, Reproduction, Calcium levels, Gene expression	
Lei et al.	2018	Fresh	invertebrate	Chromadorea	*Caenorhabditis elegans*	PP	Irregular	40 - 180	48	Survival, Body length, Reproduction, Calcium levels, Gene expression	Survival, Body length, Reproduction, Calcium levels, Gene expression	
Lei et al.	2018	Fresh	invertebrate	Chromadorea	*Caenorhabditis elegans*	PVC	Irregular	50 - 170	48	Survival, Body length, Reproduction, Calcium levels, Gene expression	Survival, Body length, Reproduction, Calcium levels, Gene expression	
Lei et al.	2018	Fresh	invertebrate	Chromadorea	*Caenorhabditis elegans*	PS	Sphere	5	48	Survival, Body length, Reproduction, Calcium levels, Gene expression	Survival, Body length, Reproduction, Gene expression	
LeMoine et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PE	Sphere	10 - 45	336	Survival, Growth, Hatching, Oxygen consumption, Gene expression	Gene expression	
Leung & Chan	2018	Marine	invertebrate	Polychaeta	*Perinereis aibuhitensis*	PS	Sphere	8 - 12	672	Survival, Reduction of posterior segment regeneration	Mortality, Reduction of posterior segment regeneration	
Leung & Chan	2018	Marine	invertebrate	Polychaeta	*Perinereis aibuhitensis*	PS	Sphere	32 - 38	672	Survival, Reduction of posterior segment regeneration	Mortality, Reduction of posterior segment regeneration	
Lo & Chan	2018	Marine	invertebrate	Gastropoda	*Crepidula onyx*	PS	Sphere	2 - 5	336	Survival, Growth, Feeding, Larval settlement	Feeding, Larval settlement	
Lu et al.	2016	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	5	504	Oxidative stress, inflammation & lipid accumulation	Oxidative stress, inflammation & lipid accumulation	

Lu et al.	2018	Fresh	fish	Actinopterygii	*Oncorhynchus mykiss*	PS	Sphere	1	2	Gene expression		
Lu et al.	2018	Fresh	fish	Actinopterygii	*Oncorhynchus mykiss*	PS	Sphere	20	2	Gene expression		
Lu et al.	2018	Fresh	fish	Actinopterygii	*Oncorhynchus mykiss*	PS	Sphere	40	2	Gene expression	Gene expression	
Lu et al.	2018	Fresh	fish	Actinopterygii	*Oncorhynchus mykiss*	PS	Sphere	90	2	Gene expression	Gene expression	
Lu et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	1	2	Gene expression	Gene expression	
Lu et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	20	2	Gene expression		
Lu et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	40	2	Gene expression		
Lu et al.	2018	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	90	2	Gene expression	Gene expression	
Magni et al.	2018	Fresh	invertebrate	Bivalve	*Dreissena polymorpha*	PS	Sphere	1, 10	144	Cellular stress, Oxidative damage, Neuro-genotoxicity	Cellular stress	
Magni et al.	2019	Fresh	invertebrate	Bivalve	*Dreissena polymorpha*	PS	Sphere	1, 10	144	Protein modulation	Protein modulation	
Manlinich et al.	2018	Fresh	fish	Actinopterygii	*Pimephales promelas*	PE	Sphere	180 - 212	720	Growth		
Mao et al.	2018	Fresh	algae	Trebouxiophyceae	*Chlorella pyrenoidosa*	PS	Sphere	1	720	Growth, Photosynthesis, Morphology	Growth, Photosynthesis, Morphology	
Mateos-Cárdenas	2019	Fresh	plant	Liliopsida	*Lemna minor*	PE	Sphere	10 - 45	240	Growth, Photosynthesis		
Mateos-Cárdenas	2019	Fresh	plant	Liliopsida	*Lemna minor*	PE	Sphere	10 - 45	720	Growth		
Mateos-Cárdenas	2019	Fresh	invertebrate	Malacostraca	*Gammarus duebeni*	PE	Sphere	10 - 45	48	Survival, Mobility		
Mazurais et al.	2015	Marine	fish	Actinopterygii	*Dicentrarchus labrax*	PE	Sphere	10 - 45	1032	Survival, Growth, Gene expression	Survival	
Murphy & Quinn	2018	Fresh	invertebrate	Hydrozoa	*Hydra attenuata*	PE	Irregular	< 400	1	Feeding rate	Feeding rate	IC_{50}
Murphy & Quinn	2018	Fresh	invertebrate	Hydrozoa	*Hydra attenuata*	PE	Irregular	< 400	1	Morphological score, Hydranth numbers	Morphological score, Hydranth numbers	
Ogonowski et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Number of produced offspring (NID)	NID	EC_{50}
Ogonowski et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	2,6	504	Number of produced offspring (NID)	NID	EC_{50}
Ogonowski et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	N/A	Sphere	1 - 5	504	Survival, Growth, Number of broods (BID)		
Ogonowski et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Irregular	2,6	504	Survival, Growth, Number of broods (BID)	Survival, BID	
Peixoto et al.	2019	Marine	invertebrate	Branchiopoda	*Artemia franciscana*	N/A	Sphere	1 - 5	1056	Survival, Growth, Feeding, Reproduction	Reproduction	
Qiao et al.	2019	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	5	504	Inflammation, oxidative stress, Metabolism, Gut microbiome	Inflammation, oxidative stress, Metabolism, Gut microbiome	
Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Malacostraca	*Gammarus pulex*	PS	Irregular	20 - 500	672	Growth	Growth	EC_{50}

Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Malacostraca	*Gammarus pulex*	PS	Irregular	20 - 500	672	Survival, Feeding activity		
Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Malacostraca	*Hyalella azteca*	PS	Irregular	20 - 500	672	Survival, Growth, Feeding activity		
Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Clitellata	*Lumbriculus variegatus*	PS	Irregular	20 - 500	672	Reproduction		
Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Clitellata	*Tubifex sp.*	PS	Irregular	20 - 500	672	Survival, Growth		
Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Bivalve	*Sphaerium corneum*	PS	Irregular	20 - 500	672	Survival, Growth		
Redondo-Hasselerharm et al.	2018	Fresh	invertebrate	Malacostraca	*Asellus aquaticus*	PS	Irregular	20 - 500	672	Survival, Growth		
Redondo-Hasselerharm et al.	2020	Fresh	invertebrate	Clitellata	*Tubificidae*	PS	Fragment	20 - 516	10800	Population abundance	Population abundance	
Rehse et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Sphere	1 - 4	96	Immobilization	Immobilization	EC_{50}
Rehse et al.	2016	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PE	Sphere	90 - 106	96	Immobilization	Immobilization	
Reichert et al.	2018	Marine	invertebrate	Anthozoa	*Acropora humilis*	PE	Irregular	37 - 163	672	Tissue necrosis, Bleaching	Bleaching	
Reichert et al.	2018	Marine	invertebrate	Anthozoa	*Acropora millepora*	PE	Irregular	37 - 163	672	Tissue necrosis, Bleaching	Bleaching	
Reichert et al.	2018	Marine	invertebrate	Anthozoa	*Pocillopora verrucosa*	PE	Irregular	37 - 163	672	Tissue necrosis, Bleaching	Tissue necrosis	
Reichert et al.	2018	Marine	invertebrate	Anthozoa	*Pocillopora damicornis*	PE	Irregular	37 - 163	672	Tissue necrosis, Bleaching	Tissue necrosis	
Reichert et al.	2018	Marine	invertebrate	Anthozoa	*Porites lutea*	PE	Irregular	37 - 163	672	Tissue necrosis, Bleaching		
Reichert et al.	2018	Marine	invertebrate	Anthozoa	*Porites cylindrica*	PE	Irregular	37 - 163	672	Tissue necrosis, Bleaching	Bleaching	
Revel et al.	2018	Estuarine	invertebrate	Polychaeta	*Hediste diversicolor*	PE, PP	N/A	0.4 - 400	240	Cell viability, Phagocytosis activity, Phenoloxydase, Acid phosphatase	Cell viability	
Revel et al.	2019	Marine	invertebrate	Bivalve	*Mytilus spp.*	PE, PP	N/A	0.4 - 950	240	Condition index, clearance rate, Oxydative stress, Enzyme activity, Genotoxicity	Oxydative stress, Genotoxicity	
Revel et al.	2020	Marine	invertebrate	Bivalve	*Crassostrea gigas*	PE, PP	Fragment	0.4 - 500	240	Clearance rate, Tissue alteration, Oxidative stress, Enzyme activity, Genotoxicity		
Ribeiro et al.	2017	Marine	invertebrate	Bivalve	*Scrobicularia plana*	PS	Sphere	20	336	Condition index, Oxidative stress, Genotoxicity	Oxidative stress, Genotoxicity	
Rist et al.	2017	Fresh	invertebrate	Branchiopoda	*Daphnia magna*	PS	Sphere	2	504	Survival, Growth, time to first offspring, number of broods, number of neonates, total number of molts		
Romano et al.	2018	Fresh	fish	Actinopterygii	*Barbodes gonionotus*	PVC	Fragment	40 - 310	96	Trypsin activity, Chymotrypsin activity, Hyspathology	Trypsin activity, Chymotrypsin activity	

Seoane et al	2019	Marine	algae	Bacillariophyceae	*Chaetoceros neogracile*	PS	Sphere	2	72	Growth, Photosynthetic efficiency, Oxidative stress, Membrane potential, Enzyme activity, Lipid content	Enzyme activity, Lipid content	
Silva et al.	2019	Fresh	invertebrate	Insecta	*Chrinomus riparius*	PE	Irregular	32 - 63	240	Growth	Growth	LOEC
Silva et al.	2019	Fresh	invertebrate	Insecta	*Chrinomus riparius*	PE	Irregular	63 - 250	240	Growth	Growth	LOEC
Silva et al.	2019	Fresh	invertebrate	Insecta	*Chrinomus riparius*	PE	Irregular	125 - 500	240	Growth	Growth	LOEC
Silva et al.	2019	Fresh	invertebrate	Insecta	*Chrinomus riparius*	PE	Irregular	32 - 63	672	Emergence	Emergence	EmT_{50}
Silva et al.	2019	Fresh	invertebrate	Insecta	*Chrinomus riparius*	PE	Irregular	63 - 250	672	Emergence	Emergence	EmT_{50}
Silva et al.	2019	Fresh	invertebrate	Insecta	*Chrinomus riparius*	PE	Irregular	125 - 500	672	Emergence	Emergence	EmT_{50}
Sjollema et al.	2016	Marine	algae	Chlorophyceae	*Dunaliella tertiolecta*	PS	Sphere	6	72	Growth, Photosynthesis		
Straub et al.	2017	Fresh	invertebrate	Malacostraca	*Gammarus fossarum*	PMMA	Irregular	32-63	672	Feeding rate, WW change, Assimilation efficiency	WW change, Assimilation efficiency	
Straub et al.	2017	Fresh	invertebrate	Malacostraca	*Gammarus fossarum*	PHB	Irregular	32-63	672	Feeding rate, WW change, Assimilation efficiency	WW change	
Sun et al.	2018	Marine	bacteria	Gammaproteobacteria	*Halomonas alkaliphila*	PS	Sphere	1.6	2	Cell viability, Oxidative stress, Cell membrane composition, Conversion efficiencies for inorganic N	Cell viability, Oxidative stress, Cell membrane composition, Conversion efficiencies for inorganic N	
Sussarellu et al.	2016	Marine	invertebrate	Bivalve	*Crassostrea gigas*	PS	Sphere	2, 6	1440	Feeding, Fecundity, Offspring development	Feeding, Fecundity, Offspring development	
Tang et al.	2018	Marine	invertebrate	Anthozoa	*Pocillopora damicornis*	PS	Smooth	1	24	Symbiotic density, Chlorophyll content, Enzyme activity	Chlorophyll content, Enzyme activity	
Van Cauwenberghe et al.	2015	Marine	invertebrate	Bivalve	*Mytilus edulis*	PS	Sphere	10, 30 , 90	336	Energy budget		
Van Cauwenberghe et al.	2015	Marine	invertebrate	Polychaeta	*Arenicola marina*	PS	Sphere	10, 30 , 90	336	Energy budget		
Von Moos et al.	2012	Marine	invertebrate	Bivalve	*Mytilus edulis*	HDPE	Sphere	0 - 80	96	Condition index, Granulocytoma formation, Lysosomal membrane stability, Lipofuscin accumulation, Neutral lipid content	Granulocytoma formation, Lysosomal membrane stability	
Vroom et al.	2017	Marine	invertebrate	Hexanauplia	*Calanus finmarchicus*	PS	Sphere	15	264	Survival		
Wan et al.	2019	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	5	168	Gut microbiome, Metabolism, Oxidative stress, Gene transcription	Gut microbiome, Metabolism, Oxidative stress, Gene transcription	
Wan et al.	2019	Fresh	fish	Actinopterygii	*Danio rerio*	PS	Sphere	50	168	Gut microbiome, Metabolism, Oxidative stress, Gene transcription	Gut microbiome, Metabolism, Oxidative stress, Gene transcription	
Wang et al.	2019	Estuarine	invertebrate	Branchiopoda	*Artemia parthenogenetica*	PS	Sphere	10 - 11	24	Survival		NOEC

Wang et al.	2019	Estuarine	invertebrate	Branchiopoda	*Artemia parthenogenetica*	PS	Sphere	10 - 11	336	Growth, Instar development time		NOEC
Wang et al.	2019	Estuarine	invertebrate	Branchiopoda	*Artemia parthenogenetica*	PS	Sphere	10 - 11	24	Epithelial cell morphology	Epithelial cell morphology	
Watts et al.	2016	Marine	invertebrate	Hexanauplia	*Carcinus maenas*	PS	Sphere	8	1	Oxygen consumption	Oxygen consumption	
Watts et al.	2016	Marine	invertebrate	Hexanauplia	*Carcinus maenas*	PS	Sphere	8	24	Oxygen consumption, Plasma Na+ & Ca2+ ion concentrations	Plasma Na+ & Ca2+ ion concentrations	
Weber et al.	2018	Fresh	invertebrate	Malacostraca	*Gammarus pulex*	PET	Fragment	10 - 150	1152	Survival, molting, metabolism, feeding activity		
Welden & Cowie	2016	Marine	invertebrate	Malacostraca	*Nephrops norvegicus*	PP	Fiber	3000 - 5000	5760	Growth, Feeding rate, Metabolic depression	Growth	
Wen et al.	2018	Fresh	fish	Actinopterygii	*Symphysodon aequifasciatus*	PE	Sphere	70 - 88	720	Survival, Growth, Predatory performance, Enzyme activity	Predatory performance, Enzyme activity	
Wright et al.	2013	Marine	invertebrate	Polychaeta	*Arenicola marina*	UPVC	Irregular	130	672	Feeding activity, Phagocytic activity, Energy reserves	Feeding activity, Phagocytic activity, Energy reserves	
Wright et al.	2013	Marine	invertebrate	Polychaeta	*Arenicola marina*	UPVC	Irregular	130	48	Gut residence time	Gut residence time	
Wu et al.	2019	Fresh	algae	Trebouxiophyceae	*Chlorella pyrenoidosa*	PP	N/A	157	264	Chlorophyll a content, Photosynthetic efficiency	Chlorophyll a content, Photosynthetic efficiency	
Wu et al.	2019	Fresh	bacteria	Cyanophyceae	*Microcystis flos-aqua*	PP	N/A	157	168	Chlorophyll a content, Photosynthetic efficiency	Chlorophyll a content, Photosynthetic efficiency	
Wu et al.	2019	Fresh	algae	Trebouxiophyceae	*Chlorella pyrenoidosa*	PVC	N/A	172	264	Chlorophyll a content, Photosynthetic efficiency	Chlorophyll a content, Photosynthetic efficiency	
Wu et al.	2019	Fresh	bacteria	Cyanophyceae	*Microcystis flos-aqua*	PVC	N/A	172	168	Chlorophyll a content, Photosynthetic efficiency	Chlorophyll a content, Photosynthetic efficiency	
Xu et al.	2017	Marine	invertebrate	Bivalve	*Atactodea striata*	PS	Granule	63 - 250	240	Clearance rate, Absorption efficiency, Respiration rate	Clearance rate	
Yin et al.	2018	Marine	fish	Actinopterygii	*Sebastes schlegelii*	PS	Sphere	15	336	Feeding activity, Growth, Swimming speed, Hyspathology	Feeding activity, Growth, Swimming speed, Hyspathology	
Yin et al.	2019	Marine	fish	Actinopterygii	*Sebastes schlegelii*	PS	Sphere	15	336	Survival, Growth, Condition factor, Behavior, Oxygen consumption, Ammonia excretion, Nutritional composition	Behavior, Oxygen consumption, Ammonia excretion, Nutritional composition	
Yu et al.	2018	Estuarine	invertebrate	Malacostraca	*Eriocheir sinensis*	PS	Sphere	5	504	Survival, Growth, Oxydative stress, Inflammation	Growth, Oxydative stress, Inflammation	
Zhang et al.	2017	Marine	algae	Mediophyceae	*Skeletonema costatum*	PVC	Sphere	1	96	Growth, Photosynthesis	Growth, Photosynthesis	
Zhang et al.	2019	Fresh	invertebrate	Hexanauplia	*Tigriopus japonicus F0, F1 generations*	PS	Sphere	5,84	48	Survival, sex ratio, developmental time of nauplius phase, Developmental time to maturation, Number of clutches, Number of nauplii/clutch, Fecundity, Proteomic analysis	Survival, number of nauplii/clutch, Fecundity, Proteomic analysis	
Zhang et al.	2019	Fresh	invertebrate	Hexanauplia	*Tigriopus japonicus F2 generation*	PS	Sphere	5,84	48	Survival, sex ratio, developmental time of nauplius phase, Developmental time to maturation, Number of clutches,		

										Number of nauplii/clutch, Fecundity, Proteomic analysis		
Zhao et al.	2019	Marine	algae	Dinophyceae	*Karenia mikimotoi*	PVC	Sphere	1	96	Growth, Chlorophyll content, Photosynthetic efficiency	Growth, Chlorophyll content, Photosynthetic efficiency	
Ziajahromi et al.	2018	Fresh	invertebrate	Insecta	*Chironomus tepperi*	PE	Sphere	1 - 4	120	Survival, Growth, Emergence	Survival, Growth, Emergence	
Ziajahromi et al.	2018	Fresh	invertebrate	Insecta	*Chironomus tepperi*	PE	Sphere	10 - 27	120	Survival, Growth, Emergence	Survival, Growth, Emergence	
Ziajahromi et al.	2018	Fresh	invertebrate	Insecta	*Chironomus tepperi*	PE	Sphere	43 - 54	240	Survival, Growth, Emergence	Survival, Growth, Emergence	
Ziajahromi et al.	2018	Fresh	invertebrate	Insecta	*Chironomus tepperi*	PE	Sphere	100 - 126	240	Survival, Growth, Emergence	Emergence	
Ziajahromi et al.	2017	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Sphere	1 - 4	48	Survival	Survival	LC_{50}
Ziajahromi et al.	2017	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	Polyester	Fiber	0 - 1000	48	Survival	Survival	LC_{50}
Ziajahromi et al.	2017	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Sphere	1 - 4	192	Survival	Survival	
Ziajahromi et al.	2017	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	Polyester	Fiber	0 - 1000	192	Survival	Survival	
Ziajahromi et al.	2017	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	PE	Sphere	1 - 4	192	Growth, Reproduction	Reproduction	EC_{50}
Ziajahromi et al.	2017	Fresh	invertebrate	Branchiopoda	*Ceriodaphnia dubia*	Polyester	Fiber	0 - 1000	192	Growth, Reproduction	Reproduction	EC_{50}

Table S2. Explanation of the quantitative scoring system proposed to evaluate the studies testing the effects of MP on aquatic biota using the (QA/QC) criteria**.** The purpose of the quantitative scoring system criteria is to assess the quality of the papers and to give guidance for appropriate methods for MP particle studies in the future. The first subset of criteria (criteria 1 – 12) relates to the general technical quality of effect tests. The second set of criteria (criteria 13-20) relates to relevance of the papers to be used in risk assessment. For each criterion a score of either 2 (adequate), 1 (adequate with restrictions) or 0 (inadequate) points were assigned, which are explained below.

CRITERIA RELATING TO THE TECHNICAL QUALITY OF EFFECT TESTS (1 – 12)				
Criterion	**Explanation**	**Score 2**	**Score 1**	**Score 0**
Particle characterization				
1. Particle size	Size is a crucial factor explaining effects of MP and thus should be reported.	- If a range of sizes is used; a full (i.e. ≥ 10 bins) size distribution is measured and reported. - If a single size is used, that size is measured with an indication of measurement error and reported.	If particle size/sizes are reported but not measured.	No information on size reported.
2. Particle shape	Shape is a crucial factor explaining effects of MP and thus should be measured and reported.	Shapes are measured with high resolution picture and reported.	Particle shapes are reported but not measured.	No information on particle shape is reported.
3. Polymer type	Polymer type can be a factor explaining effects of MP and thus should be reported.	Polymer identity confirmed with e.g. FTIR, Raman spectroscopy or similar methods.	Polymer type provided with certificate or as provided by manufacturer.	No information on polymer identity is reported.

4. Source of MP	Specification on where MP stock or solution is bought and/or how it is self-made maximizes reproducibility and thus should be reported.	The origin and/or production of MP in own laboratory is reported in detail.	The information given on MP source is incomplete and hence not fully reproducible.	No information on MP source reported.
5. Data reporting	Unambiguous units are required to ensure reproducibility of the experiment and to make it possible to compare data across experiments.	MP concentrations are reported as mass as well as number concentration.	MP concentrations are reported as mass or as number concentration.	MP concentrations are not reported.
Experimental design				
6. Chemical purity	In order to test particle toxicity, the toxicity of other chemicals in solution or mixture should be ruled out. This includes additives present in MP, chemicals associated with food particles and surfactants (e.g. Tween).	Chemical effects other than from the polymer or solution/mixtures are ruled out. MP are cleaned with organic solvent.	- Chemicals are analyzed or studies relied on manufacturer certificate. - Controls are used or calculations are made with values from literature (i.e., LC_{50} or EC_{50}) to rule out toxicity of chemical impurities.	Not mentioned.
7. Laboratory preparation	MP contamination arising from the laboratory (air, water and materials) should be minimized. All materials used (equipment, tools, work surfaces and clothing) should be free of MP.	- All materials used are thoroughly washed with high quality water (e.g. Milli-Q water). - Measures are taken to prevent MP contamination from air. - Cotton lab coats were used to avoid microfiber contamination.	Only part of the measures under 2 are taken to avoid MP contamination.	Not mentioned.

8. Verification of background contamination	Assessment of MP contamination of the exposure systems in the laboratory.	Level of contamination evaluated and quantified, e.g. with FTIR, Raman or similar method.	Contamination visually inspected.	No verification of contamination.
9. Verification of exposure	Not only the nominal concentration should be mentioned. The exposure concentration should be measured.	Measurement of exposure concentration and evidence that at least 80% of the nominal concentration throughout the test is maintained.	Measurement of exposure concentration, however no evidence that at least 80% of the nominal concentration throughout the test is maintained.	No verification of exposure concentration.
10. Homogeneity of exposure	Verification of homogeneity throughout the entire exposure system is crucial for the MP characterization and the assessment of bioavailability.	Water as medium: Picture or measurement of MP in water that demonstrated well mixed or dispersion in solution. Sediment as medium: Description of method used to obtain homogenous exposure.	Water as medium: Description of the method used to obtain homogeneous exposure. Sediment as medium:	Not mentioned or exposure is not homogenous.
11. Exposure assessment	Exposure of the organism to MP should be verified by measurement.	Exposure of the organism to MP is measured quantitatively with e.g. FTIR or Raman. In case MP are ingested additionally an digestion step is included (see Hermsen et al., 2018).[51]	Exposure of the organism to MP is demonstrated qualitatively, visually, in a separate experiment or without digestion step.	No measurement of exposure of MP to organism.
12. Replication	For statistical rigor in detecting effect thresholds (e.g., EC_{50} or EC_{10}), sufficient replicates should be tested.	3 or more replicates.	2 replicates.	No replicates.

CRITERIA APPLICABLE TO ECOLOGICAL RISK ASSESSMENT (13-20)				
Criterion	**Explanation**	**Score 2**	**Score 1**	**Score 0**
Applicable to Risk assessment				
13. Endpoints	Endpoints should be considered that inform ecologically relevant population level risk assessment and clearly reported.	Endpoints taken at the community (e.g. bacteria and algae) or individual level (e.g. survival, mortality, growth, development, reproduction).	Suborganismal responses as long as a causal relationship with the endpoints mentioned under '2' has been demonstrated.	Endpoints cannot be unambiguously linked to a threat on the population or individual level.
14. Presence of natural (food) particles	The exposure conditions should be environmentally relevant.	Natural particles (at least food) are added to avoid force feeding of MP. Criterion not applicable to algae or bacteria and hence these studies receive 2 points.	Food is not optimally available.	No food or natural particles are added to avoid force feeding of MP.
15. Reporting of effect thresholds	To enable PEC/PNEC types of comparisons, the effect threshold should be assessed with error of uncertainty using dose- response relationships.	Effect thresholds are reported as L(E)Cx with error or uncertainty intervals.	Effect thresholds are reported as LOEC or NOEC, or as L(E)Cx value without error or confidence interval.	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC or not possible to derive effect threshold.
16. Quality of dose-response relationship	For statistical rigor in detecting effect thresholds (e.g., EC_{50}, EC_{10}), sufficient doses should be tested, including a treatment control, covering the full shape of the effect curve and emphasizing the slope for parameter estimation.	Multiple doses, at least 6, including a treatment control.	Multiple doses, at least 5, including a treatment control.	Less than 5 doses.

Ecological relevance				
17. Concentration range tested	Concentrations should be motivated (with a reference in the appropriate unit) from measured environmental concentrations (MEC).	More than 1 environmentally relevant concentration was used within the range tested.	At least 1 environmentally relevant concentration was used within the range tested.	- No relevant concentrations were used. - No comparison with MEC.
18. Aging and biofouling	Aging, weathering and biofouling is what occurs in the environment and could affect the uptake of MP; therefore, it is crucial to consider this for an ecological relevant experiment.	MP particles have undergone process to make them environmentally realistic by accounting for biofouling. In addition, pictures of altered particles are provided.	MP particles have undergone process to make them environmentally realistic, accounting for aging, weathering and/or biofouling, however they have not been characterized.	Pristine MP used and/or conditions were as such that it was not possible to form a biofilm during the exposure time.
19. Diversity of MP tested	In the environment, MP have a wide variety of shapes and sizes. This needs to be taken into account for environmentally relevant effect assessment.	A wide range of sizes (order of magnitude), shapes and densities are used, thereby approaching the diversity of environmental MP.	Diversity relates to only 1 or 2 of the characteristics (e.g. only a wide size range) and/or spans a part of the characteristics range only.	Only a single type of particles is tested (i.e. single size, shape and density).
20. Exposure time	It is crucial to use appropriate exposure times to allow for the detection of adverse effects.	Bacteria and phytoplankton ≥ 1 week Zooplankton ≥ 21 d Benthic invertebrates ≥ 28 d Fish ≥ 3 months Macrophytes ≥ 28 d	Bacteria, phytoplankton: 1 – 7 d Zooplankton: 4 – 21 d Benthic invertebrates: 7 - 28 d Fish: 1 - 3 months Macrophytes: 7 - 28 d	Bacteria, phytoplankton < 1 d Zooplankton < 4 d Benthic invertebrates < 7 d Fish < 1 month Macrophytes: < 7 d

Table S3. Scores and mechanisms per author. For each criterion a score of either 2 (adequate), 1 (adequate with restrictions) or 0 (inadequate) points is assigned to the study under consideration. Maximum possible score is 40 points. Texts on the demonstrated mechanism often are literal quotes from the respective articles. These quotes are identified by quotation marks ("x").

Paper: Aljaibachi and Callaghan (2018)[93]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (2 µm) but not measured	1
2	Particle shape	Shape mentioned (bead) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Sigma-Aldrich)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Authors state that there was no evidence for aggregation, however, was not demonstrated	1
11	Exposure assessment of organisms	Ingestion quantified in separate experiment	1
12	Replication	5 replicates used	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth and reproduction	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Detection of effect thresholds (LT_{10}, LT_{50} and LT_{90}) with standard error	2
16	Quality of dose-response relationship	6 concentrations including control	2
17	Concentration range tested	No comparison made with MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	21 days	2
		Total	**21**
Mechanisms explaining effects			
*	Effect	Where ample food is present, MPs have little effect on adults.	

Paper: Au et al. (2015)[8]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values (10 - 27 µm for spheres & 75-20 x 20 µm for fibers) given and confirmed with microscope. No PSD or average with error given	1
2	Particle shape	Shapes given (sphere and fiber), but no pictures shown	1
3	Polymer type	Polymer type given and checked for PP fibers, not for PE spheres	2
4	Source MP	Source given for spheres (Cospheric); fibers are self-made	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Spheres were not cleaned, fibers cleaned with water	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Spheres in ethanol quantified twice using a hemocytometer prior to experiment, fibers counted individually	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion visually quantified in the same experiment	1
12	Replication	At least 3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, reproduction and egestion time	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	LC_{50} for survival. For the rest, effect thresholds are reported without the use of L(E)Cx or NOEC value	2
16	Quality of dose-response relationship	6 concentrations including control for survival, 4 for other endpoints	2
17	Concentration range tested	They do not include environmentally realistic concentrations for spheres (5000 MP/ml is the lowest conc.)	0
18	Aging and biofouling	Fibers were aged (no pictures), while spheres were pristine MP	1
19	Diversity of MP tested	2 polymer types separately tested, 2 shapes separately tested, a small range of sizes	0
20	Exposure time	Up to 42 days	2
		Total	**22**
Mechanisms explaining effects			
*	Effects	Reduced growth and reproduction	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"MP ingestion *may cause* a **mechanical hazard**, resulting in **blocking the food passage (1)** or *may cause* the organism to **feel satiated**, indirectly resulting in a **reduction in food intake (2)**. Increased toxicity due to PP MP fiber exposures *may be* attributable to the difference in shape." " It is possible that some of the differences seen between the acute exposures to PE and PP MP *could be* due to the **oxygen-containing functional groups (3)** present on the surface of PP MP fibers due to the various aging processes the marine rope endured."	

Paper: Blarer and Burkhardt-Holm (2016)[11]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (1.6 µm for spheres & 500 x 20 µm for fibers) but not confirmed	1
2	Particle shape	Shapes given (bead and fiber), no pictures shown	1
3	Polymer type	Polymer types given (PS for spheres, PA for fibers) but not confirmed	1
4	Source MP	Particles are made at Nuertingen-Geislingen University. Information given is incomplete and not fully reproducible.	1
5	Data reporting	Data reported in particles/cm for fibers, particles/ml for spheres	1
6	Chemical purity	It is stated that both MP were produced without additives	1
7	Lab preparation	Only mentioned for digestion of samples (after exposure experiment)	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Quantified at the start of the experiment	1
10	Homogeneity of exposure	Fibers were not homogeneously distributed; however, spheres were measured throughout water column. Concentrations were stable through time (SI).	2
11	Exposure assessment of organisms	Ingestion visually quantified for fibers and qualitatively assessed for spheres	1
12	Replication	15 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding rate, assimilation efficiency, wet weight change	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	They do not include environmentally relevant concentrations	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	28 days	2
		Total	**19**
Mechanisms explaining effects			
*	Effect	"Microplastics affect assimilation efficiency in the freshwater amphipod *Gammarus fossarum*"	
*	Demonstrated mechanism	"The presence of PA fibers in the digestive tract inhibited food assimilation."	
*	Speculated mechanism	"The long PA fibers *may* **physically damage** the **digestive tract (1)** and thereby **impair assimilation efficiency (2)**." The sharp-edged fibers, however, *could* have caused more pronounced mechanical injuries of the delicate gut epithelium than the round and smooth-surfaced beads, but different **surface properties (3)** *could* have contributed as well."	

P**aper: Bour et al. (2018)**[75]

Technical subset	***Criterion***	***Explanation***	***Score***
1	Particle size	Min/max size values given (4-6 µm; 20-25 µm and 125-500 µm) and confirmed with microscope only for the biggest size class	2
2	Particle shape	Shape mentioned (Irregular fragment) but not shown	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Micro Powders)	2
5	Data reporting	Data reported in mg/kg and particles/kg of sediment	2
6	Chemical purity	Analysis of three pollutants in MP. Not all chemical effects can be ruled out.	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	MP visually quantified in sediment only at the end of the experiment	1
10	Homogeneity of exposure	Homogenization mentioned and checked at the end of the experiment	2
11	Exposure assessment of organisms	Ingestion visually quantified in the same experiment	1
12	Replication	4 replicates	2
		Subtotal	**15**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Condition index, burrowing behavior and surborganismal responses	2
14	Presence of natural (food) particles	Use of sediment for benthic invertebrate, so natural particles present	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	Environmentally relevant concentrations used only for bigger particles	1
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, a variety of sizes separately tested	0
20	Exposure time	28 days	2
		Total	**23**
Mechanisms explaining effects			
*	Effects	Decreased energy reserve in *E. tenuis*. Decrease protein content in *A. nitida*	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"When passing through the digestive tracts, MP *could* **physically damage gut tissues (1)**, resulting in **decreased nutrient uptake (2)**. Physical damage *can* lead to inflammatory responses. We *postulate* that long-term exposure of benthic bivalves would lead to **depletion of energy reserves (2)** and potentially result in effects at the organism level."	

Paper: Bosker et al. (2019)[107]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max and average sizes given (1- 5, 4.1 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data provided in particles/ml	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Concentration verified with a hemocytometer prior to exposure	1
10	Homogeneity of exposure	Vortexing prior to exposure, daily resuspension manually (pipette), plus aeration	1
11	Exposure of assessment of organisms	Not assessed	0
12	Replication	4 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Population size and population biomass	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	High concentrations of MP, no comparison with MEC	0
18	Aging and biofouling	Exposure time of experiment is long enough for biofilm to develop	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	21 days	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	Reduction in total biomass population	
*	Demonstrated mechanism	-	
*	Speculated mechanism	" First, the accumulation of MP in the gut *might* reduce the **uptake efficiency** of the food or **reduce assimilation of food (2)**. After uptake MP can from **aggregates in the gut** of organisms, and as a result can cause a **blockage in the gut (1)** which could reduce food uptake." " changes in the **energy translocation** to cope with **elimination of the MP (9)**."	

Paper: Browne et al. (2008)[9]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (3 and 9.6 µm) but not confirmed	1
2	Particle shape	Shape mentioned (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Molecular probes)	2
5	Data reporting	Number of particles/treatment (no concentration per ml or L given)	0
6	Chemical purity	No leaching observed of fluorescent chemical label. Not all chemical effects can be ruled out	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verified by Coulter Counter analysis at the start of the experiment	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion visually quantified in the same experiment	1
12	Replication	At least 3 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding activity and suborganismal responses	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Environmentally relevant concentration not included	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, 2 sizes separately tested	0
20	Exposure time	48 days	2
		Total	**17**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Bruck and Ford (2018)[117]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (8 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Thermo Scientific)	2
5	Data reporting	Only in MP/g of food. No info on how many grams of food were added.	0
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	3 replicates	2
		Subtotal	**8**
Applicable for risk assessment			
13	Endpoints	Feeding, growth and moulting	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	35 days	2
		Total	**15**
Mechanisms explaining effects			
*	Effects	No effects found.	

Paper: Canniff and Hoang (2018)[110]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (63-75 µm) but distribution not shown	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PS) and confirmed with FTIR	2
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in mg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	4 replicates	2
		Subtotal	**11**
Applicable for risk assessment			
13	Endpoints	Survival and reproduction	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	No comparison MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	21 days	2
		Total	**18**
Mechanisms explaining effects			
*	Effects	No effects found.	

Paper: Capolupo et al. (2018)[118]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (3 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in MP/mL and µg/L	2
6	Chemical purity	Stated that there are no surfactants added or present in MP suspension	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Lack of aggregation verified with epifluorescence microscopy at the start of the experiment	2
11	Exposure assessment of organisms	MP visually quantified	1
12	Replication	4 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding efficiency, Morphological/development and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	7 concentrations including control	2
17	Concentration range tested	MP concentrations far exceed those detected in marine environment	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	48-h Embryo-larval development	0
		Total	**19**
Mechanisms explaining effects			
*	Effects	No effects found on consumption or development. However, MP induced physical and transcriptional impairments in mussel larvae, indicating sub-lethal impacts.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Transcriptional data obtained in this study outline the *potential* impacts of MP on **shell biogenesis, immune and lysosomal systems (8). "**	

Paper: Chae, Kim and An (2019)[119]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Particle size distribution measured with microscope and CellSens software. Min/max size values (180-212 µm) and average size with standard deviation provided (203.84 ± 13.76 µm)	2
2	Particle shape	Shape given (sphere) and confirmed with microscopic images	2
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	In mg/L and particles/L	2
6	Chemical purity	Chemicals from MP were analyzed qualitatively using liquid chromatography	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Verification of exposure at beginning of experiment	1
10	Homogeneity of exposure	MP floated on the surface of the solution and the algae were exposed to MP at the surface of the medium only	0
11	Exposure of assessment	Not addressed	0
12	Replication	3 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Cell growth, photosynthetic activity and cell morphology	2
14	Presence of natural (food) particles	NA	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly.	0
16	Quality of dose-response relationship	8 concentrations including control	2
17	Concentration range tested	Authors state that concentration range tested includes environmentally relevant concentrations, however no reference is provided	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	6 days	1
		Total	**20**
Mechanisms explaining effects			
*	Effects	Cell growth and photosynthetic activity enhanced. Cell morphology was not affected.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"This phenomenon *might* be explained by trace concentrations of **additive chemicals (4)** endocrine disruptors, phthalates, stabilizers) that possibly **leached from MP** promoting the growth and photosynthetic activity of *D. salina.*"	

Paper: Chapron et al. (2018)[84]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (500 µm) but not measured	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (LDPE) but not confirmed	1
4	Source MP	Source given (Santa Cruz Biotechnology)	2
5	Data reporting	Data reported in beads/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not addressed	0
12	Replication	No replicates	0
		Subtotal	**6**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, feeding and behavior	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison MEC	0
18	Aging and biofouling	MP were incubated for 2 months in filtered seawater	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	69 days	2
		Total	**13**
Mechanisms explaining effects			
*	Effects	No effect on behavior or feeding. Reduced growth/calcification	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"MP did not impact polyp behavior or prey capture rates; however, calcification was still reduced compared to control and in situ conditions. The exact causes are *still unclear,* but they *might* involve possible **physical damages (5)** or **energy storage alteration (2)**." " Thus, the fitness of the organism *could* be affected by an **increased energy cost** caused by the **egestion of plastics.**"	

Paper: Choi et al. (2018)[120]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	PSD measured but only max/min values given without error (150-180 µm for spheres, 6-350 µm for irregular MP)	1
2	Particle shape	Shapes given (sphere, irregular) and shown	2
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in mg/L and particles/L	2
6	Chemical purity	Control used for surfactant Tween-80	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Tween-80 solution added to obtain dispersibility, not verified	1
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	3 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, malformations, swimming behavior, and suborganismal endpoints	2
14	Presence of natural (food) particles	No addition of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	Only unrealistic concentrations used	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	2 polymers separately tested, various shapes and wide size ranges for irregular MP (more than 1 order of magnitude)	1
20	Exposure time	4 days	0
		Total	**16**
Mechanisms explaining effects			
*	Effects	Decreased swimming behavior, ROS generated, ROS-related molecular changes	
*	Demonstrated mechanism	"The mechanisms underlying the responses to MP are still unclear."	
*	Speculated mechanism	"The **generation** of **intracellular ROS**, followed by the **differential regulation** of **gene**s related to ROS, *suggest* that **ROS-related toxic effects (10)** occur in organisms exposed to MP."	

Paper: Cole and Galloway (2015)[30]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size values given (1 and 10 μm) but not confirmed for effect experiment (only for uptake experiment)	2
2	Particle shape	Shape given (bead) but not confirmed for effect experiment (only for uptake experiment)	2
3	Polymer type	Polymer type given (PS) but not confirmed	2
4	Source MP	Source given (Spherotech)	2
5	Data reporting	Data reported in particles/l and ug/ml	2
6	Chemical purity	Preservatives removed by centrifuging, removing the supernatant, washing in Milli-Q and centrifuging again	2
7	Lab preparation	Bioassays were covered to limit airborne contamination	1
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Quantified at the start of the experiment using a coulter counter	1
10	Homogeneity of exposure	MP beads added to seawater and sonicated. Postexposure subsamples were viewed under microscope and aggregation observed	0
11	Exposure assessment of organisms	Ingestion visually quantified in separate experiment	1
12	Replication	At least 4 replicates	2
		Subtotal	**17**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding and growth	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	2 concentrations including control for growth; 5 concentration including control for feeding	1
17	Concentration range tested	They do not include environmentally realistic concentrations	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, 2 sizes separately tested	0
20	Exposure time	8 days	1
		Total	**23**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Cole et al. (2013)[4]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (7.3 and 20.6 µm) but not confirmed	1
2	Particle shape	Shape given (bead) but not confirmed	1
3	Polymer type	Polymer type given (PS) and confirmed with Coherent anti-Stokes Raman scattering (CARS)	2
4	Source MP	Source given (Spherotech)	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion quantified however in separate experiment. Found MP trapped between external appendages.	1
12	Replication	At least 5 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	They do not include environmentally realistic concentrations	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, 2 sizes separately tested	0
20	Exposure time	24 h	0
		Total	**15**
Mechanisms explaining effects			
*	Effects	Reduced feeding	
*	Demonstrated mechanism	Reduced algal ingestion rate	
*	Speculated mechanism	" During our studies, we also found MP were becoming trapped between the **external appendages** and carapace segments of live copepods. We found that very small MP (0.4−3.8 µm) became lodged between the filamental hairs and setae of the antennules, furca, and the swimming legs. As these appendages have key roles in copepod function and behavior, this *may* have repercussions for locomotion, ingestion, mating, and mechanoreception, that may limit their ability to detect prey, feed, reproduce, and evade predators."	

Paper: Cole et al. (2015)[98]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (20 µm) but not confirmed	1
2	Particle shape	Shape mentioned (sphere) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Sigma-Aldrich)	2
5	Data reporting	Data reported in particles/ml and % of food	1
6	Chemical purity	Toxicity ruled out using references	1
7	Lab preparation	Chambers covered with loosely fitting lids to prevent airborne contamination	1
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Quantified at the start of the experiment using a coulter counter	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	In the ingestion rate experiment MP are quantitatively assessed. In the long exposure MP uptake verified by visually checking fecal pellets.	1
12	Replication	At least 5 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Reproductive output, Egg production rates, Respiration rate	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	They say the concentration is not extreme as used in recent ecotoxicological papers, however, do not compare to MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	Up to 9 days	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	Significant reduction in egg volume on days 7 and 9 resulted from reduced ingested carbon biomass (owing to MP exposure) of the adult copepods.	
*	Demonstrated mechanism	" Here we demonstrate that ingestion of MP can significantly alter the feeding capacity of the pelagic copepod *Calanus helgolandicus*." " The budget helps identify that MP exposed copepods will have much higher **energetic deficiencies (2)** than controls, predominantly owing to the 40% **reduction** in **ingested carbon biomass**."	
*	Speculated mechanism	-	

Paper: Cole et al. (2019)[44]

Technical subset	*Criterion*	***Explanation***	***Score***
1	Particle size	Average size given (10-30 µm for granules, 30 µm for fibers) and pictures shown. No indication of measurement error.	1
2	Particle shape	Shape given and shown in pictures SI	2
3	Polymer type	Polymer type given (nylon) but not confirmed	1
4	Source MP	Source given (Goodfellow)	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	MP were rinsed with ethanol and water prior to their use. Additionally, chemicals were analyzed.	2
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Quantified using a Sedgewick rafter chamber prior to the experiment	1
10	Homogeneity of exposure	Use of a rotating plankton wheel, no verification of homogeneity	1
11	Exposure of assessment of organisms	Ingestion quantified in separate experiment	1
12	Replication	10 replicates	2
		Subtotal	**14**
Applicable for risk assessment	*Criterion*	***Explanation***	
13	Endpoints	Feeding, Prosome length, Moulting, Lipid accumulation	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Higher than relevant	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	6 days	1
		Total	**19**
Mechanisms explaining effects			
*	Effects	Shift in prey selectivity and premature moulting, reduction in ingestion rate for *T. rotula* and *S. trochoidea*	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"When consumed, fibers are more prone to causing **physical damage** owing to their **sharp edges** (1)." Limited **assimilation efficiency** (2), **additives** (4) " **Reduced feeding** (2) and stymied lipid accumulation *may* both have contributed to earlier moulting; however endocrine disruption *might* also have played a role."	

Paper: Cong et al. (2019)[121]

Technical subset	*Criterion*	***Explanation***	***Score***
1	Particle size	Min/max sizes given (10 - 11 µm) and measured with coulter counter, data not shown. No indication of measurement error	1
2	Particle shape	Shape given (sphere) but not checked	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Name of provider given, Thermo Fisher Scientific corporation, USA	2
5	Data reporting	Data reported in particles/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of concentration in sock solution	1
10	Homogeneity of exposure	Not assessed	0
11	Exposure of assessment of organisms	Ingestion quantitatively assessed in separate experiment	0
12	Replication	3 replicates	2
		Subtotal	**9**
Applicable for risk assessment	*Criterion*	***Explanation***	
13	Endpoints	Survival, Growth, Reproduction	2
14	Presence of natural (food) particles	Feeding included in one of the treatments	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Higher than natural levels	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	14 days	2
		Total	**15**
Mechanisms explaining effects			
*	Effects	Increased mortality and decreased growth and reproduction	
*	Demonstrated mechanism	-	
*	Speculated mechanism	-	

Paper: de Sá, Luís and Guilhermino, (2015)[88]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (420 - 500 µm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in particles/treatment (no concentration per ml or L given)	0
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	The relative percentage of MP ingested was calculated relatively to the total number of preys ingested	1
12	Replication	No replication	0
		Subtotal	**6**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Predatory performance and efficiency	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	They do not include environmentally realistic concentrations/no comparison to MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	3 minutes	0
		Total	**8**
Mechanisms explaining effects			
*	Effects	Reduction of the predatory performance and efficiency	
*	Demonstrated mechanism	-	
*	Speculated mechanism	-	

Paper: Critchell and Hoogenboom (2018)[94]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (1-2 mm) but not measured	1
2	Particle shape	Shapes given (fragment, sphere) but not shown	1
3	Polymer type	Polymer type given (PET) but not confirmed	1
4	Source MP	Source given (Visy Plastics)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	6 replicates	2
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, body condition and behavior	2
14	Presence of natural (food) particles	Addition of food in one experiment, in other experiment food is replaced by MP	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	Reported that highest concentration is higher than MEC, authors did not mention if other concentrations were environmentally relevant	0
18	Aging and biofouling	MP were soaked for at least 2 weeks, however not characterized	1
19	Diversity of MP tested	One polymer type, various shapes for fragments, small size range (less than one order of magnitude)	1
20	Exposure time	1 week acute exposure and 6 weeks chronic exposure	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	When food is replaced by MP it negatively affects growth and body condition due to limited food availability	
*	Demonstrated mechanism	-	
*	Speculated mechanism	-	

Paper: Détrée and Gallardo-Escárate (2017)[78]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (1 - 50 µm) but not measured	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Abifor)	2
5	Data reporting	Data reported in microbeads/L	1
6	Chemical purity	Report that MP is free of any additive	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Aeration systems added to optimize the distribution and suspension of MP	1
11	Exposure assessment of organisms	Not addressed	0
12	Replication	2 replicates	1
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Suborganismal, no causal link with endpoints taken higher	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	24 hours	0
		Total	**11**
Mechanisms explaining effects			
*	Effects	"Up-regulation of genes relative to carbon metabolism, oxidative stress, immune response and apoptosis in the mantle and digestive gland, down-regulation of genes involved in carbon metabolism in the hemolymph and gills."	
*	Demonstrated mechanism	"Key enzymes of metabolism *are* impacted." " Disruptive and tissue dependent effect of a short MP exposure on **major biological processes (8)** in *M. galloprovincialis*."	
*	Speculated mechanism	"Ingestion of MP *may* provoke adverse effects that require an **augmentation** of **energy production** to **maintain** the organism's **homeostasis**." "MP *may* **modulate** the mussel's **oxidative system (10)**." "The damage provoked by the ingestion of MP and the **inflammation** that follows, *may* require the production of stress, immune and antioxidant proteins to maintain the global homoeostasis of the organism and demand increased production and utilization of energy."	

Paper: Espinosa, Cuesta and Esteban (2017)[122]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (40 - 150 µm) and confirmed with microscope	2
2	Particle shape	Shape not given	0
3	Polymer type	Polymer type given (PVC) but not confirmed	1
4	Source MP	Source given (Centro Tecnologico del Calzado y del Plastico), but not commercial and not reproducible	1
5	Data reporting	Data reported in mg/kg of feed	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not assessed	0
12	Replication	No replicates	0
		Subtotal	**5**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	3 concentrations tested including control	0
17	Concentration range tested	Includes one environmentally relevant concentration	1
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	Up to 30 days	1
		Total	**12**
Mechanisms explaining effects			
*	Effects	"Our data suggest low damage to muscle, liver and kidney, but not to gut, as a result of PVC-MP intake." " Our results indicated that PVC-MP intake did not have a significant impact on the HK leucocyte cellular activities (phagocytosis, respiratory burst activity and peroxidase content) or on the humoral response (peroxidase activity and IgM levels) in the serum or skin mucus."	
*	Speculated mechanism	"These findings *could indicate* that **MP ingestion** caused **cellular stress (6)** in the **liver**."	
*	Demonstrated mechanism	-	

Paper: Franzellitti et al. (2019)[77]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes reported (3 and 45 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not measured	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in particles/mL	1
6	Chemical purity	Authors state that no surfactants were present or added, however did not assure this by cleaning	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Before spiking, lack of aggregation was verified by epifluorescence microscopy	2
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	At least 3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Only suborganismal endpoints used, cannot be unambiguously linked to a threat on the population level.	0
14	Presence of natural (food) particles	No addition of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one shape, 2 sizes separately tested	0
20	Exposure time	4 days	0
		Total	**12**
Mechanisms explaining effects			
*	Effects	"Reduction of MXR activity and down-regulation of ABCB and ABCC transcripts"	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Data reported in this study *suggest* that modulation of the MXR system may be a part of a generalized response triggered by **particle ingestion** and stimulation of **digestive** and immune functions both in larval and adult stages of mussels."	

Paper: Gambardella et al. (2019)[71]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	PSD measured by electronic counter. D10, D50 (2.92, 8.27, 13.79, 23.65, 9.04, 14.64, 59.22, 93.43 µm) and D90 provided with error	2
2	Particle shape	Shapes mentioned (irregular) but not measured	0
3	Polymer type	Polymer type (PE) given but not measured	1
4	Source MP	Source given (Micro Powders, Cospheric, Rotogal)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Actual exposure checked but only in separate experiment	1
10	Homogeneity of exposure	Shaker, rotating wheel, air point mentioned	1
11	Exposure of assessment of organisms	For non-ingesting organisms (algae), assessment of external exposure suffices	2
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Algal growth and bacterial bioluminescence	2
14	Presence of natural (food) particles	NA for algae and bacteria	2
15	Detection of effect thresholds	Effect thresholds provided (although higher than highest dose)	2
16	Quality of dose-response relationship	Number of concentrations not mentioned, but a wide range was used	0
17	Concentration range tested	Range of doses spanned environmentally relevant concentrations	2
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, various shapes, wide range of sizes used, however separately tested	0
20	Exposure time	30 minutes for bacteria, 72 h for algal growth	1
		Total	**21**
Mechanisms explaining effects			
*****	Effects	No effects found	

Paper: Gardon et al. (2018)[123]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (6 and 10 µm) but not measured	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PS) and confirmed with Raman	2
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in µg/L and in particles/L	2
6	Chemical purity	Tween-20 added to control tank	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Tween-20 added to avoid agglutination	1
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	4 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, Reproductive effort, Regression of gametogenesis, Feeding activity, Oxygen consumption, Assimilation efficiency, Scope for growth	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	2 months	2
		Total	**20**
Mechanisms explaining effects			
*	Effects	MP have negative impact on Assimilation Efficiency (AE) and mean energy balance (SFG). In exposed oyster's gametogenesis was strongly impacted	
*	Demonstrated mechanism	"This study *highlights* the impact of **ingesting** a diet containing polystyrene microbeads on the **assimilation efficiency (2)** of the pearl oyster which directly influences its **energy balance**. The dose-dependent **decrease** in **AE** and **SFG** supports these results and *demonstrates* an **immutable effect** of micro-PS on the oyster **physiology**."	
*	Speculated mechanism	"Thus, we cannot distinguish between the possible mechanisms explaining the toxicity of MP-PS, to which direct particle toxicity and effects of MP-PS associated **chemicals (4)** such as DVB, may contribute."	

Paper: Gerdes et al. (2019)[33]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	PSD given and confirmed with DLS (5 µm)	2
2	Particle shape	Shape not mentioned, but picture provided	2
3	Polymer type	Polymer type (PET) given and confirmed with FTIR	2
4	Source MP	Source given (Goodfellow) for original material. Pellets were milled to powder. Information is sufficient for the MP to be reproducible.	2
5	Data reporting	Data reported in mg/L and particles/L (Table S1)	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Use of a plankton wheel. No sedimentation observed. Continuous particle ingestion by the test animals was confirmed for both materials through observation of the exposed animals by bright-field microscopy	2
11	Exposure of assessment of organisms	Ingestion qualitatively by bright field microscopy	1
12	Replication	At least four replicates	2
		Subtotal	**15**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Immobilization	2
14	Presence of natural (food) particles	Authors state that our animals were starved during the exposure. Natural particles added	1
15	Detection of effect thresholds	LC_{50} with 95% confidence intervals	2
16	Quality of dose-response relationship	6 concentrations including control	2
17	Concentration range tested	Much higher than environmentally relevant	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one size	0
20	Exposure time	96 h	1
		Total	**23**
Mechanisms explaining effects			
*	Effects	MP PET is more toxic than kaolin	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"**Energy expenditure** *may* **increase (2)** in the presence of non-food particles since induced filtering activity is similar as for food particles."	

Paper: Gonçalves et al.[76]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (2, 5, 6 and 10 µm) but not confirmed	1
2	Particle shape	Shape mentioned (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) given but not confirmed	1
4	Source MP	Sources given (Alfa-Aesar, Sigma-aldrich, Magsphere)	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Checked in separate experiment with a coulter counter	1
10	Homogeneity of exposure	Dispersion verified with coulter counter in separate experiment	1
11	Exposure of assessment of organisms	Ingestion qualitatively assessed in separate experiment	1
12	Replication	At least 3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Suborganismal endpoints (oxidative stress response and histopathological effects)	0
14	Presence of natural (food) particles	Food added only for the 21 d histopathology exposure	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	Authors state that concentrations are high, yet realistic. Comparison with MEC made.	2
18	Aging and biofouling	Exposure time long enough to allow for biofouling	1
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	Oxidative stress for 48 hours, histopathology for 21 days	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	"Biochemical indicators for oxidative stress were generally irresponsive regardless of organ and time of exposure. Small foci of haemocytic infiltration in gastric epithelia were found, albeit not clearly related to MP ingestion. Globally, no evident histopathological damage was recorded in whole-body sections of exposed animals."	
*	Demonstrated mechanism	-	
*	Speculated mechanism	-	

Paper: Gorokhova et al. (2018)[124*]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (1 - 5 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Not reported	0
4	Source MP	Source given (Cospheric)	2
5	Data reporting	No concentration unit provided, only number of particles and volume water in aquaria mentioned separately	0
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Verification of the contamination at the start of the experiment	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not addressed	0
12	Replication	2 Replicates	1
		Subtotal	**6**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Swimming and filtering behavior	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	Only unrealistic concentrations used	0
18	Aging and biofouling	Particles coated with artificial biofilm; surface charge measured	2
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	12 hours	0
		Total	**12**
Mechanisms explaining effects			
*	Effects	Increased swimming activity	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"The observed differences *imply* that daphnids *would* **spend more time performing the non-feeding movements when swimming in suspension with MP (2),** and even more when the MP are carrying biofilm. The increased jumping activity of filtrators exposed to microparticles (both natural and anthropogenic) *may* translate into changes in energy balance and growth."	

* 'by exception this non-peer reviewed study was included'

Paper: Gray and Weinstein (2017)[10]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (30, 34, 34, 35, 59, 75, 83, 93, 93, 116, 165 µm) but not measured	1
2	Particle shape	Shapes given (spheres, fragments, fibers) but not shown	1
3	Polymer type	Polymer types given (PE, PS, PP) and confirmed in previous study for the polypropylene rope	2
4	Source MP	Sources given (Cospheric and Phosphorex, TWO H Chem and Clemson Univ.)	2
5	Data reporting	Data reported in particles/L	1
6	Chemical purity	Other toxic substances are ruled out	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Only nominal concentration mentioned	0
10	Homogeneity of exposure	Particles were first suspended in ethanol. Gentle aeration for fragments and fibers	1
11	Exposure assessment of organisms	Ingestion visually quantified in gut and respiratory chambers	1
12	Replication	No replicates	0
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival	2
14	Presence of natural (food) particles	Absence of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Authors state they used an environmentally relevant concentration	1
18	Aging and biofouling	Use of weathered marine rope, all other used MP are pristine	1
19	Diversity of MP tested	3 polymer types, 3 shapes, size ranges 30-165 µm used. However, they were separately tested	0
20	Exposure time	3 hours	0
		Total	**14**
Mechanisms explaining effects			
*	Effects	Increased mortality	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Retained fibers *may* become entangled within the **intestinal tract** over time, leading to a nonbiodegradable **gut blockage (1)**, resulting in death. It is also *possible* that toxicity related to fiber ingestion is the result of internal structures becoming **damaged** as the entangled fibers pass through the gut."	
*	Speculated mechanism	"In any event, **prolonged resident** times of spheres in the **gut** *can* result in d**ecreased food consumption** because of **false satiation (2)**, leading to reduced fitness."	

Paper: Green (2016)[100]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Mean and Min/max size values (0.6 - 363 µm for PLA, 0.48 - 316 µm for HDPE) and confirmed with a Mastersizer	2
2	Particle shape	Shape not mentioned	0
3	Polymer type	Polymer types given (PLA and HDPE) but not confirmed	1
4	Source MP	Not given	0
5	Data reporting	Data reported in ug/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Measured concentrations at the start of the experiment (SI)	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not mentioned	0
12	Replication	6 replicates	2
		Subtotal	**8**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Respiration, filtration, and growth rates of one species, diversity, abundance and biomass of the community	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	3 concentrations used, including control	0
17	Concentration range tested	All concentrations are environmentally realistic, although the higher one is rare	2
18	Aging and biofouling	Added to microalgae for 3 days, additionally the exposure time was long enough to allow biofouling of MP	1
19	Diversity of MP tested	2 polymer types separately tested, wide range of sizes (more than 1 order or magnitude)	1
20	Exposure time	60 days	2
		Total	**18**
Mechanisms explaining effects			
*	Effects	Reduction in abundances and biomasses of organisms	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"When MP are ingested, effects on organisms *can* arise due to **physical (blockages (1))** **chemical (4) (plasticizers or persistent organic pollutants**; Rochman *et al*., 2013) or **biological (microbial communities (7)** on the particles) factors. Reductions in abundances and biomasses of organisms found in the current study *may* have occurred directly due to ingestion of MP (causing mortality, reduced reproductive output or reduced feeding), or indirectly, due to MP altering the behavior or abundances of other organisms (thereby altering interactions between species)."	

Paper: Green et al. (2016)[125]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Mean and Min/max size values given (1.4-707 µm for PLA, 2.5-316 µm for HDPE, 8.7-478 µm for PVC) but not confirmed	1
2	Particle shape	Not mentioned	0
3	Polymer type	Polymer types given (PLA, HDPE and PVC) but not confirmed	1
4	Source MP	Not mentioned	0
5	Data reporting	% of wet sediment weight	1
6	Chemical purity	They did not attempt to separate physical and chemical effects of MP	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not assessed	0
12	Replication	5 replicates	2
		Subtotal	**5**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Biomass, feeding activity, bioturbation, metabolic rate	2
14	Presence of natural (food) particles	Natural sediment present	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	Includes at least two environmentally realistic concentrations	2
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	3 polymer types separately tested, wide range of sizes (more than 1 order or magnitude)	1
20	Exposure time	Chronic exposure (31 days)	2
		Total	**15**
Mechanisms explaining effects			
*	Effects	Lowered egestion, metabolic rates increased, biomass decreased, alteration in burrowing behavior	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"After one month of exposure to MP the biological activity of lugworms as measured by oxygen consumption was altered. This *could* be a **response to stress (6)** induced by the MP." " It is not uncommon for marine organisms that increase their respiration as a stress response to also reduce feeding and suffer from overall energy loss." "Alterations in the burrowing behavior may have occurred as an indirect consequence of MP due to changes to the microphytobenthos." "Stronger effects of PVC may be due to **chemical leaching (4)** of **residual vinyl chloride monomers.** which are toxic."	

Paper: Green et al. (2017)[126]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Mean and Min/max size values (0.6 - 363 µm for PLA, 0.48 - 316 µm for HDPE) but not confirmed	1
2	Particle shape	Shape not mentioned	0
3	Polymer type	Polymer types given (PLA and HDPE) but not confirmed	1
4	Source MP	Not given	0
5	Data reporting	Data reported in µg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of exposure along the experiment using a hemocytometer (Table S1)	2
10	Homogeneity of exposure	No aggregations of microalgae and MP were observed during the experiment.	1
11	Exposure assessment of organisms	Not assessed	0
12	Replication	5 replicates	2
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Filtration of two bivalves, community abundance and biomass	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	3 concentrations used, including control	0
17	Concentration range tested	All concentrations are environmentally realistic, although the higher one is rare	2
18	Aging and biofouling	Added to microalgae for 3 days, additionally the exposure time was long enough to allow biofouling of MP	1
19	Diversity of MP tested	2 polymer types separately tested, wide range of sizes (more than 1 order or magnitude)	1
20	Exposure time	50 days	2
		Total	**19**
Mechanisms explaining effects			
*	Effects	Reduced filtration by *M. edulis* and increased filtration by *O. edulis*	
*	Demonstrated mechanism	-	
*	Speculated mechanism	-	

Paper: Green et al. (2019)[127]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max (PLA 0.6 - 363 µm) (HDPE 0.48 - 316 µm) and average sizes given (PLA 65.6 µm) (HDPE 102.6 µm) but not confirmed	1
2	Particle shape	Shape (fragment) mentioned but not confirmed	1
3	Polymer type	Polymer type (PLA and HDPE) given but not confirmed	1
4	Source MP	Not mentioned	0
5	Data reporting	Data reported in particles/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Deliberate pulse exposure to mimic realism, however, not homogeneous	0
11	Exposure of assessment of organisms	Not assessed	0
12	Replication	5 replicates	2
		Subtotal	**6**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Tenacity, number of byssal threads and suborganismal endpoints	2
14	Presence of natural (food) particles	Food and sediment added	2
15	Detection of effect thresholds	2 concentrations including control	0
16	Quality of dose-response relationship	Effect thresholds are not reported explicitly	0
17	Concentration range tested	Higher than environmental concentrations	0
18	Aging and biofouling	Exposure time long enough to allow for biofouling	1
19	Diversity of MP tested	2 polymer types separately tested, various shapes, wide range of sizes	1
20	Exposure time	52 days	2
		Total	**14**
Mechanisms explaining effects			
*	Effects	Reduced number of byssal threads produced and attachment strength. Altered haemolymph proteome and changes in protein abundances	
*	Demonstrated mechanism	"Exposure of mussels to either PLA or HDPE MP *resulted* in changes in the **immunological profiles (8)** of their **haemolymph.**"	
*	Speculated mechanism	"These immunological changes *may* be due to **physical abrasion (1)** from the MP after being **ingested** by the mussels." " The reduction in the abundance of metabolic proteins *may*, therefore, be associated with **reduced feeding (2)** but further research is needed to establish this causal link."	

Paper: Hämer et al. (2014)[128]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given for PS spheres (10 µm) min/max size values given for PS fragments (1 - 100 µm) and PA fibers (20 − 2.500 µm), but not measured	1
2	Particle shape	Shapes given (sphere, fragment, fiber) but not confirmed	1
3	Polymer type	Polymer types given (PS and PA) but not confirmed	1
4	Source MP	Sources given (Thermo Scientific; Magic Pyramide) but fragments and fibers were self-cut. Not enough info is provided for reproducibility of fibers	2
5	Data reporting	Data reported as particles per mg of food for spheres and fragments and µg per mg of food for fibers	1
6	Chemical purity	Spheres were washed with demineralized water. Fragments and fibers were not	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of exposure at start of the experiment only for fragments.	1
10	Homogeneity of exposure	Spheres and fragments were homogenized in agarose, pictures of food preparations are shown in SI	2
11	Exposure assessment of organisms	Ingestion quantified, however in separate experiment	1
12	Replication	24 replicates (although not clearly explained)	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, intermolt duration, ingestion rate	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not assessed with L(E)Cx, LOEC or NOEC (only 2 concentration tested including control)	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison made to MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP. Mechanical grinding of plastic fragments	1
19	Diversity of MP tested	3 polymer types separately tested, wide range of sizes (more than 1 order of magnitude for fragments and fibers)	1
20	Exposure time	6-7 weeks	2
		Total	**20**
Mechanisms explaining effects			
*	Effects	No effects found.	

Paper: Hankins, Duffy and Drisco (2018)[129]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (90-106 µm, 425-500 µm, 850-1000 µm) but not measured	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data in mg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Use of 100% cotton clothing, no other measures taken	1
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Description of how microbeads are kept in suspension	1
11	Exposure assessment of organisms	Ingestion visually assessed	1
12	Replication	5 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Calcification	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison made with MEC	0
18	Aging and biofouling	MP are placed in culture for six weeks to grow biofilm, not characterized	1
19	Diversity of MP tested	One polymer type, one shape, small size ranges	0
20	Exposure time	48 hours	1
		Total	**18**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Imhof and Laforsch (2016)[130]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Mean and min/max size values given (4.64 - 602 µm) and confirmed with microscope	2
2	Particle shape	Shape given (irregular) and visible in figure S1	2
3	Polymer type	Polymer types given (PA, PET, PC, PS, PVC) but not confirmed	1
4	Source MP	Source and description of how it is made in the lab given for all polymers, except for one, for which enough information is given for reproducibility.	2
5	Data reporting	Data reported as % plastic in food	1
6	Chemical purity	Not ruled out	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Exposure was not homogeneous, as MP were added on top of the food	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed using pictures of faces from the same experiment	1
12	Replication	7 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, Reproduction	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	No environmentally realistic concentrations included/ no comparison made to MEC	0
18	Aging and biofouling	Plastic pellets were ground with grinder. Exposure time of 8 weeks allows for aging of MP.	2
19	Diversity of MP tested	Different polymer types with wide size ranges and a variety of shapes	2
20	Exposure time	8 weeks	2
		Total	**21**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Imhof et al. (2017)[131]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes measured and given with standard deviation (27.5 - 72.5; 22.3 - 48.5 µm)	2
2	Particle shape	Shape given (fragment) and shown	2
3	Polymer type	Polymer types given (PA, PC, PET, PVC and ABS terpolymer, PVC, POM homopolymer, and SAN) but not confirmed	1
4	Source MP	Sources given (Teijin Kasei America, BASF SE, Styrolution Group, DuPont, Granulat)	2
5	Data reporting	Data reported in particles/mL	1
6	Chemical purity	Effects of additives are not ruled out	0
7	Lab preparation	Experimental containers covered with glass plates	1
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	MP sank to the bottom of the experimental glasses	0
11	Exposure assessment of organisms	Ingestion visually quantified in preliminary experiment	1
12	Replication	At least 6 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, reproduction and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Authors state they used an environmentally realistic concentration and give ref	1
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	Two mixtures with 4 polymers, various shapes, small size ranges	1
20	Exposure time	Up to 22 days	2
		Total	**21**
Mechanisms explaining effects			
*	Effects	Ingestion of MP from plastic did not affect mortality, development or reproductive parameters of *Daphnia*. Small responses on morphological traits, alterations in gene expression	
*	Demonstrated mechanism	-	
*	Speculated mechanisms	"Downregulated gene GST *indicates* that MP *may* also **interact** with **pathways** related to **oxidative stress (10)**." "MP *might* act directly on **morphological traits** or **leaching additives (4)** might interact with the **signaling pathway** responsible for inducing phenotypic plastic responses in defensive traits."	

Paper: Jabeen et al. (2018)[132]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Reported (Fibers: 0.7 mm - 5 mm; fragments: 2.5 - 3 mm; pellets: 4.9-5 mm) but not confirmed	1
2	Particle shape	Shapes given but not confirmed pictures of shapes and reported	2
3	Polymer type	Polymer types given (EVA, PS, PA) and confirmed with Raman	2
4	Source MP	Collected from field (fibers) and purchased (fragments and pellets), but name of provider not given. Information given is incomplete and hence not fully reproducible.	1
5	Data reporting	Data reported in g (food + MP)/g ww fish) and particles/fish	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	State that commercial fish food is completely free from MP contamination, no further measures taken.	0
8	Verification of background contamination	Fish food was said to be free of MP, but overall background not verified	0
9	Verification of exposure	There might have been small variations on average, but fish were dosed with a concentration of 0.96%, 1.36%, 1.94% and 3.81% (g (food þ MP)/g ww fish), which was equal to 0, 55e76, 15, 15 and 15 MP fed to each fish for control, fibers, fragments and pellets groups respectively.	2
10	Homogeneity of exposure	MP were mixed with food and fish feed actively on food particles.	2
11	Exposure of assessment of organisms	Ingestion quantitatively assessed in the same experiment with stereomicroscope	1
12	Replication	3 replicates	2
		Subtotal	**15**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Mortality, condition factor, length, weight and suborganismal endpoints	2
14	Presence of natural (food) particles	Plastic-amended food, so natural particles present	2
15	Detection of effect thresholds	Not applicable (only 2 concentrations tested including control)	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Exposure time of experiment is long enough for biofilm to develop	1
19	Diversity of MP tested	For each shape category tested, there was a range of sizes reported	1
20	Exposure time	6 weeks	1
		Total	**22**
Mechanisms explaining adverse effects			
*	Effects	No mortality, but erosion of mucous cells and inflammation in upper jaw.	
*	Demonstrated mechanism	**Breakage** of **filaments** in gills and **impacts** on **intestinal linings (1)** due to fibers. Sharp edges of fragments cause **abnormalities in jaws tissue**, **erosion** of the **lower jaw mucous** cells in the upper jaw and **detachment** of **superficial layer** and breakage of the dermal and hypodermal layer **(5)**. **Damage** of **liver tissue** by fibers	

*	Speculated mechanism	Some effects in liver *speculated* to be caused by plastic **associated toxicants (4)**. Structural changes in intestine due to food containing fibers.

Paper: Jacob et al. (2019)[133]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size (91.26 µm) given but not measured	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PS) but not measured	1
4	Source MP	Source given (Polysciences Warrington)	2
5	Data reporting	Data reported in MP/mL and mg/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Aquaria equipped with an air stone to maintain MP in suspension	1
11	Exposure assessment of organisms	Ingestion visually inspected with microscope	1
12	Replication	6 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, foraging activity and predation	2
14	Presence of natural (food) particles	Addition of food only once in the 8-day experiment	1
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Unrealistic concentration used	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	3,5 and 8 days	0
		Total	**14**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Jaikumar et al. (2018)[134]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max values given (1 - 5 µm for spheres, 1 - 10 µm for irregular MP) confirmed with TEM, but Particle Size Distribution or average with standard deviation not given	1
2	Particle shape	Shapes given (irregular, sphere) and shown in TEM images	2
3	Polymer type	Polymer type given for irregular MP (PE) but not confirmed	1
4	Source MP	Source given (Cospheric) and preparation well described	2
5	Data reporting	Data reported particles/mL	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Use of Tween-80	1
11	Exposure assessment of organisms	Not addressed	0
12	Replication	4 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Mortality	2
14	Presence of natural (food) particles	No addition of food or natural particles	0
15	Detection of effect thresholds	Detection of effect thresholds (LC_{50}) without confidence intervals	1
16	Quality of dose-response relationship	6 concentrations including control	2
17	Concentration range tested	Only unrealistic concentrations used	0
18	Aging and biofouling	Manufactured secondary MP and photographed. No aging	1
19	Diversity of MP tested	One polymer type, two shapes separately tested, small size ranges	0
20	Exposure time	96 hours	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	Effects on survival	
*	Demonstrated mechanism	"Associated mechanisms warrant further investigations."	
*	Speculated mechanism	"Therefore, the observed effects *may* have been influenced by **plastic additives** or **unbound monomers** of particles. However, this is *unlikely* as no toxic effects of leachates from plastics have been detected for *D. magna,* even at much higher exposure concentrations than those used in the present study. The propensity of MP to form **aggregates** in the **gut** following ingestion has been previously described and *suggested* to cause **internal abrasions (1)** and **mechanical damage**."	

Paper: Jaikumar et al. (2019)[135]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max sizes given (1-5 µm) and confirmed with TEM (but shown in Jaikumar et al. 2018). No particle distribution or indication of measurement error	1
2	Particle shape	Shapes given (sphere, irregular) and confirmed with TEM (but shown in paper Jaikumar et al. 2018)	2
3	Polymer type	Polymer type not given for PMP and given for SMP (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data provided in particles/ml	1
6	Chemical purity	Cleaned only with milli water to remove Tween	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of concentration with hemocytometer at start of experiment	1
10	Homogeneity of exposure	Addition of tween 80	1
11	Exposure of assessment of organisms	Ingestion qualitatively assessed in separate experiment (but data not shown)	1
12	Replication	At least 12 replicates	2
		Subtotal	**12**
Applicable for risk assessment			
13	Endpoints	Day of first brood, Size of first brood, Total # of broods, Size of first 3 broods, Cumulative number of neonates, Terminal length	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	NOEC, LOEC reported, but not with error data	1
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	Higher than reported in the environment	0
18	Aging and biofouling	Exposure time long enough to allow for biofouling	1
19	Diversity of MP tested	Various shapes, small size range	1
20	Exposure time	Up to 21 days	2
		Total	**22**
Mechanisms explaining effects			
*	Effects	Decline of reproductive output	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"MP *can* also result in **reduced feeding rates (2)** in organisms including *D. magna* which can impair the **energy budget**. The body size (length of carapax) and the mesh size of the filtering apparatus are defining the size range of particles ingested allowing *D. magna* to ingest particles between 200 nm and 90 mm and *C. dubia* to ingest particles with sizes up to 25 mm."	

Paper: Jemec et al. (2016)[97]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Size distribution given length 62-1400 µm, width 31-528 µm + confirmed with OM and SEM	2
2	Particle shape	Fiber shape given and confirmed with OM and SEM	2
3	Polymer type	Polymer type given (PET) and confirmed using FTIR	2
4	Source MP	It is said that it was commercial PET, but it was not stated where it was purchased.	1
5	Data reporting	Data reported as mg/L and MP/L	2
6	Chemical purity	MP rinsed with water and ethanol to remove surface contamination, and leachates chemically analyzed. Controls with medium and with leachates.	2
7	Lab preparation	No information provided	0
8	Verification of background contamination	No information provided	0
9	Verification of exposure	No verification of the exposure	0
10	Homogeneity of exposure	Not homogeneous (clumps and aggregates formed Fig. S1)	0
11	Exposure of assessment of organisms	Ingestion qualitatively assessed with FTIR in the same experiment	1
12	Replication	2 replicates	1
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Growth	2
14	Presence of natural (food) particles	One series pre-fed with algae, but then no food was added during actual exposure	0
15	Detection of effect thresholds	Design fully correct to detect EC50, however the effect was not dose dependent	2
16	Quality of dose-response relationship	5 concentrations including the control	1
17	Concentration range tested	Higher than realistic, but they may resemble hot spots	1
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, but wide size range tested	1
20	Exposure time	2 days	0
		Total	**20**
Mechanisms explaining adverse effects			
*	Effects	No effects found if daphnids were fed	

Paper: Jemec Kokalj, Kunej and Skalar (2018)[24]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Mean diameter with standard error given 183.1 ± 92.46, 102.9 ± 29.1, 63.05 ± 24.75, 264 ± 128.3, 247.9 ± 123.6, 136.8 ± 50.89, 22.8 ± 6.11 µm and measured with DLS	2
2	Particle shape	Shapes given (fragment, fiber) and confirmed with SEM pictures	2
3	Polymer type	Polymer type given (PE, PET) and confirmed in previous study Jemec et al. (2016)	2
4	Source MP	Description of production in own lab, however source/manufacturer of commercial facial cleaner is not mentioned	1
5	Data reporting	Data reported in mg/L and number of particles/mg	2
6	Chemical purity	Washed with water to remove soap or NaCl, but not plastic-associated chemicals	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Static exposure, without mixing	0
11	Exposure of assessment of organisms	Ingestion qualitatively assessed with stereomicroscope	1
12	Replication	2 replicates ISO 6341:2012	1
		Subtotal	**11**
Applicable for risk assessment			
13	Endpoints	Survival, Growth and Immobility	2
14	Presence of natural (food) particles	Feeding only prior to exposure	0
15	Detection of effect thresholds	Not applicable (only 2 concentrations tested including control)	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Higher than environmentally realistic values. Therefore, the organisms are not likely to encounter such concentrations unless in the case of pollution hot spots. (no comparison with MEC hot spot)	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, wide range of sizes, however separately tested	0
20	Exposure time	*Daphnia magna*, 24 h; brine shrimp *Artemia franciscana*, 48 h	0
		Total	**13**
Mechanisms explaining adverse effects			
*****	Effects	No effects found	

Paper: Jeong et al. (2016)[136]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (6 µm) but not confirmed	1
2	Particle shape	Shape mentioned (bead) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in µg/ml	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed using a microscope in separate experiment	1
12	Replication	3 replicates	2
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, fecundity, life span, reproduction time and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Pristine microbeads used	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	Chronic exposure (12 days)	1
		Total	**15**
Mechanisms explaining effects			
*	Effects	Reduced growth rate, reduced fecundity, decreased lifespan, longer reproduction time, antioxidant-related enzymes and MAPK signaling were activated	
*	Demonstrated mechanism	"Taken together, our data *indicate* that exposure to MP significantly **increases the level of ROS (10)** in a size-dependent manner and that the activation of antioxidant-related enzymes including SOD, GST, GR, and GPx is directly related to a defense mechanism against **MP-induced oxidative stress (10)**."	
*	Speculated mechanism	"Most *likely* explanations for these findings are linked to **insufficient nutrition (2)** due to ingestion of MP instead of diet"	

Paper: Jeong et al. (2017)[36]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (6 µm) but not measured	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in µg/mL and particles/mL	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed in preliminary experiment	1
12	Replication	3 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth rate, fecundity, development	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	24h	0
		Total	**15**
Mechanisms explaining effects			
*	Effects	Increased GR, GST and SOD activity (MP 6µm)	
*	Demonstrated mechanism	"Activation of **GSH-related antioxidant enzyme**s *was* involved in MP-induced **oxidative stress (10)**, implying that these processes are likely to be an important defense mechanism against MP-induced oxidative stress in *P. nana*."	
*	Speculated mechanism	-	

Paper: Jin et al. (2018)[137]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (50 µm), confirmed with SEM, but standard deviation not given	1
2	Particle shape	Shape given (sphere) and shown in SEM images	2
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Microsphere-Nanospheres)	2
5	Data reporting	Data reported in µg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not addressed	0
12	Replication	2 replicates	1
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Abundance, richness and diversity of gut microbiota, cannot be linked to threat on the population level	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations, including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	14 days	0
		Total	**11**
Mechanisms explaining effects			
*	Effects	"Change in richness and diversity of microbiota in the gut"	
*	Demonstrated mechanism	"MP *influence* the volume of mucus and *induce* microbiota dysbiosis (**microbial imbalance (7)**) in the **gut** of adult zebrafish." "We have *observed* that different sizes of polystyrene MP can induce **microbiota dysbiosis** and **inflammation** in the adult zebrafish **gut (1)** after a 14-day exposure."	
*	Speculated mechanism	-	

Paper: Jovanović et al. (2018)[85]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes measured and given (75.6, 111.7, 23.4, 51, 54.5, 87.6 µm) with SD	2
2	Particle shape	Shapes not described in the text but shown in pictures	2
3	Polymer type	Polymer types given (PVCHMW, PA, UHMWPE, PS, MDPE, PWCLMW) but not confirmed	1
4	Source MP	Source given (Sigma-Aldrich) and preparation well described	2
5	Data reporting	Data reported in g/kg of fish weight	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Description of mixed fish feed	1
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	No replication	0
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth rate	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations, including control	0
17	Concentration range tested	They say its environmentally realistic, however no MEC provided	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	6 different polymer types separately tested, small size ranges separately tested	0
20	Exposure time	45 days	1
		Total	**16**
Mechanisms explaining effects			
*	Effects	No effect on stress, growth rate, pathology, or accumulation in gastrointestinal tract	

Paper: Kalčíková et al. (2017)[138]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max and average sizes given (30-600, 71.30±34.29 µm; 40-400, 96.00±69.99 µm) with standard deviation	2
2	Particle shape	Shape given (irregular) and shown in SEM images	2
3	Polymer type	Polymer type given (PE) and measured by IR analysis	2
4	Source MP	Description how MP stock is made, however the source of exfoliating products is not mentioned	1
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Microbead leachate was used as control	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	MP adsorption onto root surface qualitatively assessed	1
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth rate, chlorophyll a and b	2
14	Presence of natural (food) particles	NA	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations, including control	0
17	Concentration range tested	No comparison made with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, variety of shapes, wide size range (1 order of magnitude)	1
20	Exposure time	7 days	1
		Total	**18**
Mechanisms explaining effects			
*	Effects	Affected root growth, reduced viability of root cells	
*	Demonstrated mechanism	"Microbeads affected the root growth of *Lemna minor* through the adsorption onto the root surface and **mechanically damaging (5)** of the roots (fig. 6 for *evidence*)." Microbeads with sharp edges *affect* root cell viability. Microbeads with smooth surface do not.	
*	Speculated mechanism	-	

Paper: Kaposi et al. (2014)[99]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (10 - 45 µm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PE) but not checked	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in spheres/ml	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Daily checked using a microscope for the effect experiment	2
10	Homogeneity of exposure	Gentle aeration kept the microspheres in suspension	1
11	Exposure assessment of organisms	Ingestion and egestion visually quantified in the same experiment	1
12	Replication	5 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival and growth	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	5 concentrations, including control	1
17	Concentration range tested	No environmentally realistic concentration	0
18	Aging and biofouling	Pristine microsphere used. Aged in a separate experiment	0
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	5 days	1
		Total	**18**
Mechanisms explaining effects			
*	Effects	"Small non-dose dependent effect on larval growth"	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"The reduced body width of *T. gratilla* larvae exposed to 300 spheres/mL *may* be the result of **reduced feeding efficiencies (2)** associated with the ingestion of MP."	

Paper: Karami et al. (2017)[139]

Technical subset	Criterion	*Explanation*	*Score*
1	Particle size	Particle Size Distribution measured, D10 (4.64 µm), D50 (10.9 µm) and D90 (17.6 µm) values given but without error	1
2	Particle shape	Shape given (irregular) and shown in SEM images	2
3	Polymer type	Polymer type given (LDPE) but not confirmed	1
4	Source MP	Source given (Toxemerge Pty Ltd)	2
5	Data reporting	Data reported in µg/L and particles/L	2
6	Chemical purity	Solvent control used. MP analyzed for heavy metals, PCB's, phthalates and PAHs.	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Use of ethanol as solvent to minimize particle aggregation. Aeration of beakers.	1
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	5 Replicates	2
		Subtotal	**13**
Applicable for risk assessment			
13	Endpoints	Condition factor, length, weight	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations, including control	0
17	Concentration range tested	More than one realistic concentration tested	2
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, variety of shapes, small size range	1
20	Exposure time	10 and 20 days	0
		Total	**21**
Mechanisms explaining effects			
*	Effects	Exposure to LDPE fragments has *minimal impact* on biomarker responses	

Paper: Korez et al. (2019)[21]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max average sizes given (10-100 µm), confirmed with microscope but size distribution or error not reported	1
2	Particle shape	Shape given (fragments), however not shown	1
3	Polymer type	Polymer type given (PMMA) but not confirmed	1
4	Source MP	Source given (Magic Pyramid Bruecher & Partner KG, Frechen, Germany) and description on how granulate was made	2
5	Data reporting	Data reported in particles/mg of food and µg/mg food	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Verification of exposure at the beginning of experiments in stock solution.	1
10	Homogeneity of exposure	Homogeneous dispersion of MP in food visually checked	2
11	Exposure of assessment	Not mentioned	0
12	Replication	20 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding rate and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations, including control	0
17	Concentration range tested	Only unrealistic concentrations used	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, various shapes, wide range of sizes	1
20	Exposure time	8 days	1
		Total	**18**
Mechanisms explaining effects			
*	Effects	Isopods, *I. emarginata,* are not affected by MP when they receive sufficient natural food of high nutritional quality.	

Paper: Kratina et al. (2019)[140]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (40.2 µm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PMMA) but not confirmed	1
4	Source MP	Source given (Spherotech)	2
5	Data reporting	Data reported in MP/cm^2	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Use of glass material to minimize contamination. Lids were placed on all microcosms to prevent contamination.	1
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Verification of exposure at the beginning of exposure.	1
10	Homogeneity of exposure	Not throughout whole medium, but equal distribution at the bottom where food is placed.	0
11	Exposure of assessment	Not addressed	0
12	Replication	3-7 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding rate, metabolic rate	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	11 concentrations, including control	2
17	Concentration range tested	More than 1 environmentally relevant concentration was used within the range tested.	2
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	24 h	0
		Total	**18**
Mechanisms explaining effects			
*	Effects	Metabolic rate increased with MP concentration at lowest temperature but decreased at the higher temperatures. MP did not affect feeding rates	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"It is *likely* that the physical presence of **non-nutritious** MP in place of food, can lead to **longer gut passage times (2)** and **adverse biological impacts**. A **reduction** in **metabolism** due to a combination of warming and high concentration of MP *could* further **reduce** the amount of **energy assimilated** for individual and population growth rates." "Suppression of metabolic rates through exposure to MP has been described in other aquatic organisms, highlighting the *potential* for these tiny pollutants to impede **physiological performance (8)**."	

Paper: Lee et al. (2013)[3]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (6 µm) but not confirmed	1
2	Particle shape	Shape mentioned (bead) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in µg/ml and particles/ml	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Test solutions were sonicated for 30 min immediately prior to use in each experiment aggregates were still found in 50nm beads tested.	0
11	Exposure assessment of organisms	Ingestion quantitatively assessed in separate experiment	1
12	Replication	3 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, developmental time and fecundity	2
14	Presence of natural (food) particles	No feeding during acute test, feeding during chronic test	2
15	Detection of effect thresholds	Effect thresholds are reported as LC50 and EC50	2
16	Quality of dose-response relationship	Acute test 8 concentrations (including control), chronic test 5 concentrations (including control)	2
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Pristine microbeads used. No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	Acute (96 h) and Chronic (until adult females developed egg sacs, 14 days on average)	1
		Total	**19**
Mechanisms explaining effects			
*	Effects	"Decrease in fecundity"	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"This effect *can* be attributed to **insufficient nutrition (2)** or the **inhibition of digestion (1)** due to the large amount of MP ingested as prey." "PS beads *may* **physically inhibit (5)** the fertilization of copepods."	

Paper: Lei et al. (2018)[141]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	PSD measured with a Zetasizer (20-180 µm for PA, 20-120 µm for PE, 40-180 µm for PP, 50-170 µm for PVC µm, 5 µm for PS)	2
2	Particle shape	Shapes not described in the text but shown in pictures	2
3	Polymer type	Polymer types given (PA, PE, PP, PVC, PS) and confirmed with FTIR	2
4	Source MP	Sources given (Sigma-Alderich, Aladdin, Sinopharm Chemical)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not addressed	0
12	Replication	3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, development and reproduction	2
14	Presence of natural (food) particles	Addition food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	5 concentrations for *C. elegans*, 6 concentrations for *D. rerio*, including control	2
17	Concentration range tested	More than 1 environmentally realistic concentration	2
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	5 different polymer types separately tested, small size ranges separately tested	0
20	Exposure time	2 days for *C. elegans* (2 days considered sufficient for the nematode), 10 days for D. rerio	1
		Total	**20**
Mechanisms explaining effects			
*	Effects	"MP caused intestinal damage in *D. rerio* MP inhibited survival rates, body length and reproduction of *C. elegans*." "Reduced calcium levels but increased expression of the glutathione S-transferase 4 enzyme in the intestine"	
*	Demonstrated mechanism	"Reduced calcium levels but increased expression of the glutathione S-transferase 4 enzyme in the intestine, which *indicates* i**ntestinal damage (1)** and **oxidative stress (10)** are major effects of MP exposure." "These results *provide evidence* of **oxidative damage (10)** due to **ingestion** and **accumulation** of MP."	
*	Speculated mechanism	-	

Paper: LeMoine et al. (2018)[142]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (10-45 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not checked	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in mg/L and particles/ml	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Homogeneous concentration mentioned, not shown	1
11	Exposure of assessment of organisms	Ingestion qualitatively assessed in the same experiment with fluorescence microscopy	1
12	Replication	3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Growth, Hatching and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Not applicable (only 3 concentrations tested, including control)	0
16	Quality of dose-response relationship	3 concentrations, including control	0
17	Concentration range tested	Only high concentrations	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, a small range of sizes	0
20	Exposure time	14 days	1
		Total	**16**
Mechanisms explaining adverse effects			
*	Effects	"Could not detect any detrimental effects of these particles on larval development, growth or metabolism." "Transient changes in expression of thousands of genes within 48 h exposure, which largely disappeared by 14 days."	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"We *contend* that as they occur during a critical phase of development and **target essential processes (8)** (e.g., brain and neural differentiation, metabolism), MP exposure *may* therefore have direct and indirect repercussions on the animals' fitness at later life stages warranting further investigation."	

Paper: Leung and Chan (2018)[143]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (8-12 µm and 32-38 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Spherotech, Cospheric)	2
5	Data reporting	Data in beads/ml	1
6	Chemical purity	Beads were rinsed and soaked overnight in FSW prior to use	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Quantification of beads with Coulter counter prior to addition. Quantification of beads in sediment samples under a microscope at the end of the experiment. At least 80% of nominal concentration maintained.	2
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Not addressed	0
12	Replication	At least 6 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Mortality and segment regeneration	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations, including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small size ranges	0
20	Exposure time	4 weeks	2
		Total	**17**
Mechanisms explaining effects			
*	Effects	"Increased mortality and reduced the rate of posterior segment regeneration."	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Smaller-diameter beads appeared more detrimental, *possibility* due to their physical property, sorption of organic molecules and **bacteria (7)**, as well as selective feeding of the worms." "The **hydrophobic chemicals** attached and the **plasticizers leached (4)** *could* **disrupt cellular functions." "**Therefore, the number of beads ingested by the worms *might* be higher in the small beads treatments and in turn slowing the regeneration as removal of these **non-nutritional particles** from the **gut** *could* incur **energetic cost (2)** and/or r**educe intake of nutritious particles**."	

Paper: Lo and Chan (2018)[144]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Sizes measured but only min/max size values given without error (2-5 μm)	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Spherotech Inc)	2
5	Data reporting	Data reported in particles/mL	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	(SI) Nominal concentration verified, actual concentration for high concentrations measured after exposure. Environmentally relevant concentrations not verified due to detection limit	2
10	Homogeneity of exposure	(SI) Stirring efficiently created homogenous sample measured with Coulter Counter	2
11	Exposure assessment of organisms	Particle (Algae and MP) removal measured quantitatively, separate experiment	1
12	Replication	3 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, feeding, and percentage of males	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 and 4 concentrations, including control	0
17	Concentration range tested	One environmentally relevant concentration	1
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	14 and 65 days	2
		Total	**21**
Mechanisms explaining effects			
*	Effects	No effect at environmentally relevant concentrations. Reduced growth at higher concentrations.	
	Demonstrated mechanism	-	
*	Speculated mechanism	"At higher concentrations, these micro-PS fed larvae consumed a similar number of algae compared to those in control but grew relatively slower than those in the control *suggesting* that ingestion and/or **removal** of MP was/were **energetically costly (2)**." "Selection against, ingesting or egesting MP *could* incur e**nergetic cost**, which in turn affect growth." Due to **limited energy** larval settled earlier. Exposure to MP *could* also negatively affect organism **chemically (4)** through **styrene's monomer**.	

Paper: Lu et al. (2016)[145]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (5 µm) and confirmed with pictures	2
2	Particle shape	Shape given (sphere) and confirmed with pictures	2
3	Polymer type	Polymer type given (PS) and confirmed with FTIR	2
4	Source MP	Source given (Tianjin BaseLine ChromTech Research Centre)	2
5	Data reporting	Data reported in µg/L and particles/ml	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	tanks were continuously aerated to maintain the dispersion of the particles in water. No aggregation was observed in the tanks with aeration (Figure S3)	2
11	Exposure assessment of organisms	Ingestion quantitatively assessed in separate experiment	1
12	Replication	At least 3 replicates	2
		Subtotal	**15**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Suborganismal endpoints cannot be unambiguously linked to a threat on the population or individual level.	0
14	Presence of natural (food) particles	Feeding not mentioned (only during maintenance)	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	4 concentrations, including control	0
17	Concentration range tested	At least 1 environmentally realistic concentration	1
18	Aging and biofouling	Virgin PS particles. Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	3 weeks	0
		Total	**17**
Mechanisms explaining effects			
*	Effects	Inflammation, lipid accumulation, disturbed lipid and energy metabolism.	
*	Demonstrated mechanism	"MP caused inflammation and lipid accumulation in fish liver. MP also induced significantly increased activities of superoxide dismutase and catalase, *indicating* that **oxidative stress (10)** was induced after treatment with MP."	
*	Speculated mechanism	"Our report on this phenomenon is the first, and this *may* be attributed to **insufficient nutrition (2)** or the **inhibition of food digestion (1)** because more large-sized MP were ingested by the fish."	

Paper: Lu et al. (2018)[146]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Sizes measured but only average values given 1, 20, 40, 90 µm) without error	1
2	Particle shape	Shape given (sphere) and shown	2
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (MicroParticles)	2
5	Data reporting	Data reported in particles/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Description of pretreatment of beads with Tween 20 to prevent aggregation	1
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	2 replicates	1
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Gene expression cannot be unambiguously linked to a threat on the population level	0
14	Presence of natural (food) particles	No addition of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations, including control	0
17	Concentration range tested	Only unrealistic concentration tested	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	2 hours	0
		Total	**10**
Mechanisms explaining effects			
*	Effects	Upregulation of genes ifnγ, il1β, igm, s100a and downregulation of genes il1β, s100a, saa, il8gene.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"The reason is at present unknown, but it can be *speculated* that minute particles are taken up by gill epithelia and associated cells where after immune gene expression is initiated."	

Paper: Magni et al. (2018)[147]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (1 and 10 µm), but not confirmed	1
2	Particle shape	Shape given (bead) and shown	2
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Sigma-Aldrich)	2
5	Data reporting	Data reported in mg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Illustration MP without aggregation phenomena	2
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	3 replicates	2
		Subtotal	**13**
Applicable for risk assessment			
13	Endpoints	Cellular stress, oxidative damage and neuro- genotoxicity, cannot be linked to a threat on the population level	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations, including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, wide size range (1 order of magnitude)	1
20	Exposure time	6 days	0
		Total	**16**
Mechanisms explaining effects			
*	Effects	No effect on oxidative stress and genetic damage, with the exception of a modulation of catalase glutathione peroxidase activities. we can assert that PMs, contextually to our experimental design, do not have direct adverse effects on the nervous system of zebra mussel. Despite the accumulation of MP in the exposed mussels, our results highlight that MP did not induce great alteration of both oxidative balance and neuro- genotoxicity in zebra mussel, for the selected endpoints and exposure time.	

Paper: Magni et al. (2019)[72]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (1 and 10 µm) but not confirmed	1
2	Particle shape	Shape (sphere) mentioned and shown in pictures	2
3	Polymer type	Polymer type (PS) given but not confirmed	1
4	Source MP	Source given (Sigma Aldrich)	2
5	Data reporting	Data provided in particles/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of the exposure in the stock solutions	1
10	Homogeneity of exposure	No aggregation in the working suspensions, Slow stirring to prevent sedimentation	1
11	Exposure of assessment of organisms	Ingestion qualitatively assessed in same experiment	1
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Suborganismal endpoint and no link with population related endpoints provided	0
14	Presence of natural (food) particles	Food added	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations, including control	0
17	Concentration range tested	Higher than environmentally realistic	0
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	Only 2 sizes included	0
20	Exposure time	6 days	1
		Total	**15**
Mechanisms explaining effects			
*	Effects	"78 proteins were differentially modulated"	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Overrun of **homeostatic responses (8)** that are no longer able to fight the injuries made by MP." "This methodology suggested that M2 was able to create an imbalance in the oxidative status of gill cells which was reflected in the modulation of many proteins involved in some different cellular pathways."	

Paper: Malinich *et al.* (2018)

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (180-212 µm) but not measured	1
2	Particle shape	Shape given (bead) and shown	2
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in both mg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Each tank contained an aerator to provide air, circulate food and plastics, and prevent settling of plastics over time	1
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	6 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations, including control	0
17	Concentration range tested	Authors say the highest concentration used was high/unrealistic	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	15 and 30 days	2
		Total	**19**
Mechanisms explaining effects			
*	Effects	No effect on consumption or growth. Young juveniles are able to distinguish MP from food particles and are able to tolerate the presence of MP and do not have adverse effect on growth.	

Paper: Mao et al. (2018)[149]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given in the main text (1 µm), measured with a Zetasizer and particle size distribution provided in the SI	2
2	Particle shape	Shape given (bead) and shown in SEM pictures	2
3	Polymer type	Polymer type given (PS) but not measured	1
4	Source MP	Source given (Sigma-Aldrich)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Visually shown	1
12	Replication	3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, Photosynthesis, Morphology	2
14	Presence of natural (food) particles	NA for algae	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	Authors state that 2 environmentally realistic concentrations were used	2
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	30 days	2
		Total	**20**
Mechanisms explaining effects			
*	Effects	"Reduced photosynthetic activity of *Chlorella pyrenoidosa,* unclear pyrenoids, distorted thylakoids and damaged cell membrane were observed." However; "could reduce the adverse effects of MP jointly through cell wall thickening, algae homo-aggregation and algae-MP hetero-aggregation, hence triggering an increase of algal photosynthetic activity and its growth, and cell structures turned to normal."	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"The mechanisms for the toxicity *might* be attributed to the **physical damage (5)** and **oxidative stress (10)**."	

Paper: Mateos-Cárdenas et al. (2019)[150]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max sizes given (10-45 µm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in particles/ml and mg/L	2
6	Chemical purity	Control for Tween-20 run to account for surfactant toxicity, however not all chemical toxicity ruled out	0
7	Lab preparation	Test dishes were covered with soda-lime watch glass dishes with fused edges to avoid contamination	1
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	Number of particles in Lemna minor exposed to Gammarus were quantified (start of experiment)	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Adhesion of MP to L. *minor* visually quantified and ingestion qualitatively assessed for Gammarus	1
12	Replication	At least 7 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Photosynthetic efficiency and growth (Lemna) and mortality, moulting and fitness (Gammarus)	2
14	Presence of natural (food) particles	Addition of food Gammarus	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Concentration not environmentally realistic	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, a small range of sizes	0
20	Exposure time	Chronic exposure for *Lemna* (7 days and 30 days), Acute exposure for Gammarus (48 h)	2
		Total	**19**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Mazurais et al. (2015)[151]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (10 - 45 µm) but not confirmed	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PE) but not checked	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in microbeads/gram	1
6	Chemical purity	PE microbeads were not cleaned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	The concentration of MP in the three diets was confirmed with a microscope at the start of the experiment	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed in the same experiment	1
12	Replication	6 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Mortality and growth	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly with L(E)Cx, LOEC or NOEC	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	No comparison with MEC, authors assume that the quantities of MP ingested correspond to high environmentally relevant concentrations of MP.	0
18	Aging and biofouling	Pristine microbeads used, Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	43 days	2
		Total	**17**
Mechanisms explaining effects			
*	Effects	"The highest concentration slightly impacted mortality rates."	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"This slight impact is *likely* to be explained by the apparent high potential of microbeads egestion from the gut." "While the diameter of the anterior intestine is around 60-80 mm at 29 dph in European sea bass, it *is conceivable* that microbeads of 45 mm or less used in the present work, when ingested in very high quantities, *could* **block the lumen (1)** at earlier stages of development." "Base on material safety data sheet of PE microbeads. acidic conditions within the gut of fish larvae *may* produce **hazardous decomposition by-products (4)** such as oxides of sulfur."	

Paper: Murphy and Quinn (2018)[152]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Max size given (400 µm) but not confirmed	1
2	Particle shape	Shape given (irregular) but not shown	1
3	Polymer type	Polymer type given (PE) and confirmed with FTIR	2
4	Source MP	MP were extracted from a face wash. The information given is incomplete (product name not provided) and hence not fully reproducible.	1
5	Data reporting	Data reported in mg/L; I50 also reported in particles/ml	2
6	Chemical purity	MP were cleaned with ethanol 70% three times and then rinsed with water	2
7	Lab preparation	Not done	0
8	Verification of background contamination	Done for preliminary tests, not for actual tests	0
9	Verification of exposure	No verification of the exposure	0
10	Homogeneity of exposure	Description of the method used to obtain homogeneous exposure.	1
11	Exposure assessment of organisms	Ingestion visually quantified in the same experiment	1
12	Replication	At least 3 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding rates, morphological scores and hydranth number	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are reported; however, no confidence interval is provided.	1
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	No environmentally realistic concentration used	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, irregularly shaped, wide range of sizes (more than 1 order of magnitude)	1
20	Exposure time	1 hour	0
		Total	**20**
Mechanisms explaining effects			
*	Effects	Reduction in feeding rate and (non-lethal) changes to morphology	
*	Demonstrated mechanism	"Exposure to MP has the potential to reduce the health of *H. attenuata* by **impacting** its **ability to feed** and limiting the amount of prey consumed." "Normally it takes *H. attenuata* less than 8 h to expel any waste material from their gastric cavity, but in the current study this took considerably longer, between 24 and 48 h in some individuals to egest MP. These results *indicate* that when exposed to MP *H. attenuata* are **expending** considerably more time and **energy** clearing their **gastric cavity (2)** then under normal conditions."	
*	Speculated mechanism	"MP ingestion *may* cause **internal damage (1)** to the gastric cavity, a **false sense** of **satiation (2)** and **impairment of appendages (5)**."	

Paper: Ogonowski et al. (2016)[29]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max and average sizes given for spheres (1 - 5, 4.1±1.0 µm) and irregular particles (2.6 ±1.8 µm) and confirmed with a Spectrex laser particle counter	2
2	Particle shape	Shapes given (sphere and irregular) mentioned but not shown	1
3	Polymer type	Polymer type only given for one of the MP (PE), no confirmation of polymer type	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Chemical effects were not ruled out, Tween 80 added	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of the background contamination	0
9	Verification of exposure	Verification of the exposure at the start of the experiment using a hemocytometer	1
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	Ingestion quantitatively assessed in separate experiment	1
12	Replication	At least 5 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, reproductive output, body size, number of broods, time between broods, age at first reproduction,	2
14	Presence of natural (food) particles	Food and natural particles added	2
15	Detection of effect thresholds	Effect thresholds are given with EC50 for number of broods (SI, Table S3)	2
16	Quality of dose-response relationship	5 concentrations including control used for adults, 2 concentrations for neonates	1
17	Concentration range tested	No environmentally realistic concentrations included, no ref included	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, 2 shapes separately tested, small range of sizes	0
20	Exposure time	Acute (24 h) and chronic exposure (up to 21 days)	2
		Total	**21**
Mechanisms explaining effects			
*	Effects	"Exposure to SMP caused elevated mortality, increased inter-brood period and decreased reproduction"	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Given the observed aggregative properties of SMP, it is *possible* that the formation and passage of aggregates through the gut *might* have caused some **internal damage (1)** and, thereby, contributed to the **elevated mortality**." "This *suggests* that **growth effects** mainly depend on overall **food availability (2)**, which is in line with other studies demonstrating both positive and negative effects of natural particulates on the growth of filter feeders."	

Paper: Peixoto et al. (2019)[153]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max average size value given (1-5 μm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not confirmed	1
3	Polymer type	Not given	0
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of the exposure with hematocytometer along the experiment and evidence that at least 80% of the nominal concentration throughout the test is maintained	2
10	Homogeneity of exposure	Not mentioned	0
11	Exposure of assessment of organisms	Ingestion was qualitatively confirmed by fluorescence microscopy, and assessed by difference, using mass balance	1
12	Replication	3 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Growth, Feeding, Reproduction	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	One environmentally realistic concentration included	1
18	Aging and biofouling	Not addressed, not possible to grow as test medium are renewed every 2 days	0
19	Diversity of MP tested	Only a (small) range of sizes tested	0
20	Exposure time	44 days	2
		Total	**17**
Mechanisms explaining effects			
*	Effects	Reproductive success strongly affected	
*	Demonstrated mechanism	-	
*	Speculated mechanism	-	

Paper: Qiao et al. (2019)[73]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (5 µm) and confirmed with TEM. no indication of measurement error	1
2	Particle shape	Spherical shape given and confirmed with TEM	2
3	Polymer type	Polymer type (PS) given and confirmed with FTIR	2
4	Source MP	Name of provider given (Tianjin Base-Line ChromTech Research Centre)	2
5	Data reporting	Data reported in µg/L and particles/L	2
6	Chemical purity	No plasticizers detected in FTIR	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Dispersion by aeration	1
11	Exposure of assessment of organisms	Ingestion qualitatively assessed with polarized light microscope in the same experiment	1
12	Replication	Treatments not replicated	0
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Suborganismal endpoints (tissue histology, enzymatic biomarkers, gut microbiome and metabolomic responses)	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	One relevant concentration included	1
18	Aging and biofouling	Exposure time long enough to allow for biofouling	1
19	Diversity of MP tested	One polymer type, one size, one shape	0
20	Exposure time	21 days	0
		Total	**16**
Mechanisms explaining effects			
*	Effects	"Significant histological changes and enzymatic biomarkers alterations"	
*	Demonstrated mechanism	"MP *induced* **inflammation (1)** and **oxidative stress (10)** in zebrafish." "Gut inflammation, bowel wall thinning, villi damage and epithelial damage were *observed* in the MPs-treated gut tissues." *"indicating* **oxidative stress** was caused by MP exposure. This was *confirmed* by the increased glutathione in the gut tissues. Glutathione is an important intracellular antioxidant that prevents the uncontrolled formation of free radicals and reactive oxygen species (ROS) and inhibits their reactions with DNA, proteins and lipids."	

Paper: Redondo-Hasselerharm et al. (2018)[2]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values and average size given (20 - 500 µm) and particle size distribution measured and given	2
2	Particle shape	Shape given (fragment) and shown in pictures	2
3	Polymer type	Polymer type given (PS) and confirmed using FTIR	2
4	Source MP	Source given (Axalta Coating Systems)	2
5	Data reporting	Data reported in g/kg of sediment (dry weight) and particles/kg of sediment (dry weight)	2
6	Chemical purity	To remove additives present, if any, the MP were washed with methanol three times	2
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Well mixed in sediment	2
11	Exposure assessment of organisms	Ingestion quantified in the same experiment with FTIR	2
12	Replication	At least 3 replicates	2
		Subtotal	**18**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Growth, Feeding activity and Reproduction	2
14	Presence of natural (food) particles	Food and sediment added	2
15	Detection of effect thresholds	Effect thresholds reported with confidence intervals	2
16	Quality of dose-response relationship	At least 7 concentrations including control	2
17	Concentration range tested	One environmentally realistic concentration included	1
18	Aging and biofouling	Acclimatization of particles in natural sediment for 6 weeks	1
19	Diversity of MP tested	One polymer type, wide range of sizes and shapes	1
20	Exposure time	28 days	2
		Total	**31**
Mechanisms explaining effects			
*	Effects	"Significant reduction in growth"	
*	Demonstrated mechanism	"Our results *indicate* that **growth reduction** of *G. pulex* was a sublethal effect caused by a **lower ability** of these organisms to **assimilate food (2)** due to the ingestion of PS MP, as well as by the **gut blockage (1)** by these particles due to a longer excretion time needed to depurate their gut."	
*	Speculated mechanism	-	

Paper: Redondo-Hasselerharm et al. (2020)[47]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Particle size distribution measured (not shown) range 20 to 516 µm, average size 227.7 ± 6.01 µm	1
2	Particle shape	Shape given (irregular fragments), however not confirmed	1
3	Polymer type	Polymer type given (PS), however not confirmed	1
4	Source MP	Name provider given (Axalta Coating Systems GMBH)	2
5	Data reporting	% plastic in sediment dry weight	1
6	Chemical purity	MP thoroughly washed with methanol to remove organic chemicals associated with the MP	2
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Measurements of actual concentration at start and after 3 months and 15 months. Evidence that at least 80% of the nominal concentration throughout the test is maintained	2
10	Homogeneity of exposure	MP powder added to sediment and mixed with cement drill	2
11	Exposure of assessment	Not addressed	0
12	Replication	4 replicates	2
		Subtotal	**14**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Population abundance and diversity, individual abundance	2
14	Presence of natural (food) particles	OM in sediment	2
15	Detection of effect thresholds	Effect thresholds reported in LOEC and NOEC	1
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	At least 2 environmentally relevant concentrations used	2
18	Aging and biofouling	Exposure time of experiment is long enough for biofilm to develop, however not characterized	1
19	Diversity of MP tested	One polymer type, various shapes, wide range of sizes	1
20	Exposure time	Up to 15 months	2
		Total	**26**
Mechanisms explaining effects			
*	Effects	MP adversely affected the abundance of macroinvertebrates, which was caused by a reduction in the number of Naididae	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"A reduction in food intake due to the **dilution** of **organic matter** in the sediment, together with the uptake and **longer retention** of MP by the Naididae worms, *could have* caused a **depletion** of **energy reserves (2)** over time, as previously found in laboratory tests for other benthic invertebrates."	

Paper: Rehse, Kloas and Zarfl (2016)[34]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (1 - 4 and 90 - 106 µm) and particle size distribution confirmed with pictures	2
2	Particle shape	Shape given (sphere) and shown in pictures	2
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in mg/L and number of particles/L	2
6	Chemical purity	Effect of chemicals ruled out using provider's material safety data sheet	1
7	Lab preparation	Beakers were loosely covered with glass petri dishes to reduce airborne contamination, use of glass materials	1
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Homogeneity of exposure not possible (p94 Results)	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed in the same experiment	1
12	Replication	4 replicates	2
		Subtotal	**14**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Immobilization and abnormal behavior or appearance (being trapped at the water surface, malformation)	2
14	Presence of natural (food) particles	No food added	0
15	Detection of effect thresholds	Effect thresholds reported with confidence intervals	2
16	Quality of dose-response relationship	7 concentrations including control	2
17	Concentration range tested	More than 1 environmentally relevant concentration was used within the range tested.	2
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	Up to 96 h	0
		Total	**22**
Mechanisms explaining effects			
*	Effects	Immobilization	
*	Demonstrated mechanism	"Since we *can* exclude chemical effects by additives and pollutants attached to the MP and adherence of particles to outer structures of the daphnids, immobilization *can* be *related* to **physical effects by ingestion (1)**."	
*	Speculated mechanism	-	

Paper: Reichert et al. (2018)[154]

Technical subset	***Criterion***	***Explanation***	***Score***
1	Particle size	Min/max and average sizes given in the main text (37-163 µm), measured with ImageJ and particle size distribution provided in the SI	2
2	Particle shape	Shape given (irregular) and shown in pictures	2
3	Polymer type	Polymer type given (PE) but not measured	1
4	Source MP	Source given (Novoplastic)	2
5	Data reporting	Data reported in g/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Additional pump added to assure suspension of plastic particles	1
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	3 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Health effects (bleaching and necrosis)	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Only environmentally unrealistic concentration used	0
18	Aging and biofouling	Microbial biofilm to assure more realistic exposure (section 2.1)	1
19	Diversity of MP tested	One polymer type, various sizes, small range of sizes	1
20	Exposure time	4 weeks	2
		Total	**21**
Mechanisms explaining effects			
*	Effects	"Negative effects on health (i.e. bleaching and tissue necrosis)"	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Further, the latter study showed that 5.7% of the **ingested particles** were **retained** in the corals digestive system for at least 24 h, *potentially* affecting **energetics (2)**, **pollutant toxicity (4)** and trophic transfer." Exposure to MP increase tissue necrosis and bleaching *might* be due to the high number of **attached MP (5)**	

Paper: Revel et al. (2018)[56]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Reported and measured, however only a range is given 0.4-400 µm	1
2	Particle shape	Not reported	0
3	Polymer type	Polymer types given (PE, PP) and confirmed with FTIR	2
4	Source MP	Production in lab described, however not the origin of MP	1
5	Data reporting	Data reported in µg/L for water and particles/kg for sediment	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Cotton lab coat, rinsing equipment, measures taken to prevent contamination from air	2
8	Verification of background contamination	Background contamination MP in sediment measured visually at the start of the experiment	1
9	Verification of exposure	Not addressed	0
10	Homogeneity of exposure	Non-homogenous exposure, aggregates formed	0
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	9 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Cell viability, phagocytosis activity and efficiency	0
14	Presence of natural (food) particles	No addition of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	More than 2 environmentally realistic concentrations used	2
18	Aging and biofouling	MP were grinded to a powder	1
19	Diversity of MP tested	2 polymer types, wide size range (more than 1 order of magnitude)	1
20	Exposure time	10 days	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	Decrease in coelomocytes viability, no alteration of phagocytosis activity, phenoloxydase and acid phosphatase. The exposure to PE and PP MP only induced a slight, but significant alteration in cell viability and a tendency to a decrease in PO and AcP enzymes which play a role in the immune system.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"PO and AcP activity which play an important role in the immune system, had a slight tendency to decrease. This indicates that exposure to relevant MP *could* alter **cellular integrity (6)** and increase **susceptibility** of worms to environmental stress."	

Paper: Revel et al. (2019)[55]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Particle size distribution measured with a Beckman Coulter, min/max size values and average size with standard deviation provided (0.4 - 950 µm)	2
2	Particle shape	Not reported	0
3	Polymer type	Polymer types given (PE and PP) but not confirmed	1
4	Source MP	Production in lab described, however not the origin of MP	1
5	Data reporting	Data reported in µg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Thorough rinsing, measures taken to avoid contamination from air, Cotton lab coat	2
8	Verification of background contamination	Blanks performed and measured with µFT-IR	2
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Possible formation of agglomerates	0
11	Exposure assessment of organisms	Ingestion quantitatively assessed with µFT-IR	2
12	Replication	5 replicates	2
		Subtotal	**13**
Applicable for risk assessment			
13	Endpoints	Condition index, Clearance rate and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	More than 2 realistic concentrations used	2
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	2 polymer types, wide range of sizes (more than 1 order of magnitude)	1
20	Exposure time	10 days	1
		Total	**21**

Mechanisms explaining effects

*	Effects	Increase in SOD, CAT and phosphatase activities. No effect on clearance rate and histopathological parameters.
*	Demonstrated mechanism	-
*	Speculated mechanism	Significant increases in SOD and CAT activities *could* be indicative of a **change** in the **redox balance (8)**. "This *could potentially* lead to induction of **oxidative stress (10)** in digestive glands. However, the degree of responses remained low and longer-term studies should be conducted to clarify the effect of MP on oxidative stress and the influence of MP size and aggregation status." "Induction of oxidative stress could also have been induced by **additives (4)** since we used commercial plastics in order to evaluate the toxicity of environmentally relevant MP."

Paper: Revel et al. (2020)[155]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Particle size distribution measured with a Beckman Coulter, min/max size values (0.4-500 µm) and average size with standard deviation provided.	1
2	Particle shape	Shape given (fragment) but not shown	1
3	Polymer type	Polymer types given (PE and PP) but not confirmed	1
4	Source MP	Production of MP in own lab, however the origin of MP not provided	1
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Thorough rinsing, measures taken to avoid contamination from air, Cotton lab coat	2
8	Verification of background contamination	Not performed	0
9	Verification of exposure	Microscopic counting only in stock solutions	1
10	Homogeneity of exposure	Possible formation of agglomerates	0
11	Exposure of assessment	Ingestion quantitatively assessed with µFT-IR	2
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Clearance rate, tissue alteration, antioxidant defense, immune alteration and DNA damage	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	Authors state that environmentally realistic concentrations were used and compare to MEC	2
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	2 types of MP, various shapes, wide size range	1
20	Exposure time	10 days	1
		Total	**20**
Mechanisms explaining effects			
*	Effects	No effects were found	

Paper: Ribeiro et al. (2017)[156]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (20 µm) and confirmed with optical microscope (OM) and DLS	2
2	Particle shape	Shape (sphere) given and shown in pictures under OM	2
3	Polymer type	Polymer type given (PS) and identified using a FTIR	2
4	Source MP	Source given (Sigma-Aldrich)	2
5	Data reporting	Data reported in mg/L and particles/ml	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Avoidance of plastic mentioned	1
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	No homogenization reached; particles ended at the bottom.	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed in the same experiment	1
12	Replication	3 replicates	2
		Subtotal	**14**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Condition index and suborganismal endpoints	2
14	Presence of natural (food) particles	No addition of natural food or sediment	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	One environmentally relevant concentration tested. Comparison to MEC is hampered by the lack of info on MP <50 µm, however authors reason that one order of magnitude higher is a good compromise. Reference is given	1
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	14 days	1
		Total	**18**
Mechanisms explaining effects			
*	Effects	"MP induce effects on antioxidant capacity, DNA damage, neurotoxicity and oxidative damage."	
*	Demonstrated mechanism	"Tissue-specific sensibility is involved in the clam's response to PS exposure by *inducing* **oxidative stress (10)**, with the gills providing a more effective response than digestive gland."	
*	Speculated mechanisms	"The present results indicated that after a week of depuration, MP were still present in both tissues." "The presence of small aggregates of MP in the haemolymph indicates that PS MP were transported into the circulatory system, indicating a possible translocation, where they can be retained for several weeks and then transported to **several tissues (1)** where *they can* cause **harm**." "*The mechanism of genotoxicity of PS MP remains unknown*, but it is suggested that it can be related to **ROS production** and **oxidative stress**, not handled by the antioxidant defense mechanism, as occurs with nanoparticles." "The accumulation of MP in this tissue might impair the **digestive system (2)** with a consequent **decrease** of **feeding behavior**."	

Paper: Rist, Baun and Hartmann (2017)[70]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size measured and given (6 µm) with standard deviation	2
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Phosphorex)	2
5	Data reporting	Data reported in mg/L and particles/mL	2
6	Chemical purity	No measures taken for Tween 20 and sodium azide	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Not mentioned, only stock suspension vortexed	0
11	Exposure assessment of organisms	Ingestion quantified in separate experiment	1
12	Replication	10 replicates	2
		Subtotal	**11**
Applicable for risk assessment			
13	Endpoints	Mortality, reproduction, growth, feeding rate	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	Only unrealistic concentrations used	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	21 days	2
		Total	**18**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Romano et al. (2018)[157]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Size distribution measured with a Mastersizer but only D10 (40 µm), D50 (140 µm) and D90 (310 µm) reported without error	1
2	Particle shape	Shape given (fragment) and shown in pictures	2
3	Polymer type	Polymer type given (PVC) but not confirmed	1
4	Source MP	Source given (Toxemerge)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	PVC fragments analyzed for PAHs, PCBs, pthalates, arsenic, lead, cadmium and mercury and below detection limit, additionally a solvent control was used	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Ethanol was used to help evenly distribute the fragments in water, however not measured/characterized	1
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment			
13	Endpoints	Surborganismal endpoints	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations, including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, various shapes, small range of sizes	1
20	Exposure time	96 hours	0
		Total	**14**

Mechanisms explaining effects		
*	Effects	Increase in whole body trypsin and chymotrypsin activities. Localized thickening of the mucosal epithelium. No tissue damage.
*	Demonstrated mechanism	-
*	Speculated mechanism	"The increased whole-body trypsin and chymotrypsin activities *may* indicate an attempt to **enhance digestion (2)** to compensate for **epithelial thickening** of the **intestine** and/or to digest the plastics." "Other potential explanation *may* have been a compensatory secretory response to improve digestion and absorption. Beside intestinal thickening, the trypsin and chymotrypsin activities were higher in the fish exposed to MP. This seems to support an attempt by the intestine to digest the consumed fragments."

Paper: Seoane et al. (2019)[79]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Nominal size (2 µm) given and confirmed with DLS (2274.0 ± 100.9 mm).	2
2	Particle shape	Spherical shape given and shown in pictures	2
3	Polymer type	Polymer type (PS) given but not confirmed	1
4	Source MP	Name of provider given (Micromod)	2
5	Data reporting	Data reported in µg/ml and particles/ml	2
6	Chemical purity	Presence of chemicals not ruled out	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	Monitored using SEM pictures every 24 h, however no evidence that at least 80% of the nominal concentration is maintained.	1
10	Homogeneity of exposure	Not mentioned, aggregates formed	0
11	Exposure of assessment of organisms	Hetero-aggregates between MP and bacteria shown in SEM pictures	2
12	Replication	3 replicates	2
		Subtotal	**14**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth and photosynthetic efficiency and suborganismal endpoints (cell morphology, autofluorescence, esterase activity, reactive oxygen species (ROS) levels, cytoplasmic membrane potential and neutral lipid content)	2
14	Presence of natural (food) particles	NA	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Close to worst case scenario concentrations	0
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	One polymer type, one shape, one size per experiment	0
20	Exposure time	72 h	2
		Total	**20**
Mechanisms explaining effects			
*	Effects	Slight decrease in growth rate. Significant decrease in the esterase activity and the lipid reserves of MP-exposed cells.	
*	Demonstrated mechanism	"MP-exposed cells **modulate their energy metabolism (9)** to properly acclimate to the **stress conditions**."	
*	Speculated mechanism	Contact, even temporal *could* be detected and considered as a **stress (6)** by the cells and may be translated into biochemical signals, triggering a response to deal with. It *could* be described as the "billiard ball effect". As documented in humans, cells *may* sense mechanical cues, although the details underlying how cells respond to mechanical forces are *not well understood yet.* The *potential* ***release*** of **chemicals (4)** from MP could be another explanation to the indirect toxicity detected." "In the present study, **oxidative stress** was *not detected* in MP-exposed cells; therefore, the decrease in lipids observed cannot be associated with its oxidation, but to modulation of energy metabolism to properly acclimate to the stress conditions, maintaining a healthy status."	

Paper: Silva et al. (2019)[54]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max and average sizes values given (32–63 µm, 63–250 µm and 125–500 µm) and PSD done by sieving. < 10 bins	1
2	Particle shape	powder/Irregularly shape given and shown in pictures with OM	2
3	Polymer type	Polymer type (PE) given but not confirmed	1
4	Source MP	Name of provider given (Sigma-Alderich and Goodfellow)	2
5	Data reporting	Data reported in g/kg	1
6	Chemical purity	Acid- and milli-Q washed, but not with organic solvents	0
7	Lab preparation	Equipment washed, rinsed. Samples & filters covered. Plastic avoided.	2
8	Verification of background contamination	Blanks and controls were applied and subtracted from samples. MP measured visually	1
9	Verification of exposure	Checked in water and sediment in two doses at the start of experiment	1
10	Homogeneity of exposure	Directly mixed in sediment (which is sufficient as in bed sediment, no settling occurs)	2
11	Exposure of assessment of organisms	Ingestion quantitatively assessed with stereoscope	1
12	Replication	13 replicates	2
		Subtotal	**16**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, Emergence	2
14	Presence of natural (food) particles	Food and sediment (without OM) added	2
15	Detection of effect thresholds	LOEC provided, and EmT50 with error	2
16	Quality of dose-response relationship	6 concentrations including control	2
17	Concentration range tested	Realistic based on literature	2
18	Aging and biofouling	Exposure time long enough to allow for biofouling	1
19	Diversity of MP tested	Smaller range of sizes, wide range of shapes	1
20	Exposure time	28-days partial life cycle assays	2
		Total	**30**
Mechanisms explaining effects			
*	Effects	Reduction larva's growth and delay on imagoes emergence	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Present study points that the ingestion and persistence of smaller-sized PE particles in the gut could *likely* cause a significant **reduction** in the **ingestion** of organic items and **interfering** in **food processing (2)**."	

Paper: Sjollema et al. (2016)[35]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (6 µm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not checked	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in mg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Actual concentration measured with a flow cytometer but only for the large MP at the end of the experiment	1
10	Homogeneity of exposure	Test vials were gently mixed on a shaker achieving a homogenous microbead distribution. Adequate homogenization was confirmed previously using fluorescent microbeads in the same size range.	1
11	Exposure assessment of organisms	Not assessed	0
12	Replication	3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Photosynthetic efficiency and growth	2
14	Presence of natural (food) particles	Not applicable for algae	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	No environmentally realistic concentration tested	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	72 h	1
		Total	**16**
Mechanisms explaining effects			
*	Effects	No effect on the photosynthetic efficiency or growth	

Paper: Straub, Hirsch and Burkhardt-Holm[158]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (32-63 m for PMMA and PHB), and confirmed with pictures	2
2	Particle shape	Shape not mentioned in the text but shown in pictures	2
3	Polymer type	Polymer types given (PMMA, PHB) but not confirmed	1
4	Source MP	Name of provider not given in the main text	0
5	Data reporting	Data reported as MP per individual	0
6	Chemical purity	Not mentioned, addition of a SpanTween-surfactant	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Equal distribution onto the bottom of the beaker (not in the whole system)	0
11	Exposure assessment of organisms	Ingestion quantified in separate experiment	1
12	Replication	24 replicates	2
		Subtotal	**8**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding rate, assimilation efficiency, and wet weight change	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No environmentally realistic concentration tested	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	1
20	Exposure time	28 days	2
		Total	**16**
Mechanisms explaining effects			
*	Effects	Decrease of the assimilation efficiency, lower wet weight gain	
*	Speculated mechanism	"The physical presence of the MP in the **digestive tract** generally leads to a **reduced uptake of food (2)**, which in turn **lowers energy intake** with subsequent physiological effects." "A longer gut retention time, *possibly* leading to **gut obstruction (1)**, *might* explain the negative effects on weight gain relative to the particle-free control." "The presence of MP in the gut, however, had more effects on WWch than the presence of natural silica particles, if we assume the latter were ingested."	
*	Demonstrated mechanism	-	

Paper: Sun et al. (2018)[159]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average diameter size given (1 µm) and measured with DLS (1626 ± 362 nm)	2
2	Particle shape	Shape (beads) given and confirmed with TEM images Fig.S1	2
3	Polymer type	Polymer type given (PS) and shown in the bacteria	2
4	Source MP	Source given (Sigma Aldrich)	2
5	Data reporting	Data provided in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Homogeneity of stock solutions using sonication, not shown	0
11	Exposure of assessment of organisms	Interaction bacteria and MP shown in separate experiment	1
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Cell viability and suborganismal endpoints	2
14	Presence of natural (food) particles	No natural particles present	0
15	Detection of effect thresholds	Effect thresholds not reported explicitly	0
16	Quality of dose-response relationship	6 concentrations including control for cell viability, 2 concentrations including control for intracellular ROS generation	2
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	2 h	0
		Total	**16**
Mechanisms explaining effects			
*	Effects	Inhibition of growth	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"The growth promotion of the bacteria cells *might* be attributed to hermetic responses, which was due to the defensive and adaptive **responses of cells to stress (6)**."	

Paper: Sussarellu et al. (2016)[28]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average sizes given (2 and 6 µm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not checked	1
4	Source MP	Source given (Polyscience)	2
5	Data reporting	Data reported in particles/ml and mg/L	2
6	Chemical purity	Full analysis of chemicals in MP done. Effect by chemicals ruled out and control used for Tween-20	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Daily verification of the exposure with a flow cytometer	2
10	Homogeneity of exposure	Water inflow was pressurized, and air bubbling was used. MP were supplied to tanks with Tween-20	1
11	Exposure assessment of organisms	Ingestion visually quantified in the same experiment	1
12	Replication	3 replicates	2
		Subtotal	**14**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding, Fecundity, Offspring development and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	One environmentally relevant concentration tested	1
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	Up to 8 weeks	2
		Total	**22**
Mechanisms explaining effects			
*	Effects	Increased consumption and absorption efficiency, disturbance in energetics	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Consumption of microalgae and absorption efficiency appeared significantly higher in exposed oysters, *suggesting* a **compensatory effect** on **food intake (2)** and **absorption efficiency** and an enhancement of mechanical digestion." "A disturbance in individual energetics revealed by DEB modeling *suggested* that micro-PS particles have threatened the **physiological integrity (8)** of oysters and consequently **increased** the **maintenance costs**, as described in response to various stresses and species (45–47). MP *may potentially* act as **endocrine disruptors (4)**. The chemical analyses of virgin micro-PS only revealed bibenzyl and 1(2H) naphthalenone,3,4, dihydro4phenyl in destructive conditions after dichloromethane extraction. Bibenzyl-diol core molecules may have endocrine disruption properties, as established in mammal cells, because they are structural analogs of estrogens."	

Paper: Tang et al. (2018)[74]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (1 μm) but not measured	1
2	Particle shape	Not reported	0
3	Polymer type	Polymer type given (PS) but not measured	1
4	Source MP	Source given (Saierqun)	2
5	Data reporting	Data reported in mg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Description of method to obtain homogenous exposure	1
11	Exposure assessment of organisms	Not addressed	0
12	Replication	3 replicates	2
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Symbiont density and chlorophyll content	2
14	Presence of natural (food) particles	No addition of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Only unrealistic concentration used	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one size	0
20	Exposure time	Up to 24 h	0
		Total	**11**
Mechanisms explaining effects			
*	Effects	No effect on symbiotic relationship. Chlorophyll content increased. Increase in antioxidant enzymes. Decrease in detoxifying and immune enzyme. Up-regulated coral genes related to stress response. Down-regulated genes involved in sterol transport and EGF-ERK1/2 pathway.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"These results *suggest* that acute exposure of MP can activate the **stress response (6)** of the scleractinian coral *P. damicornis* and repress its **detoxification** and **immune system (8)** through the JNK and ERK signal pathways."	

Paper: Van Cauwenberghe, Claessens, et al. (2015)[160]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size values of the 3 MP present in the mixture given (10, 30, 90 μm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Coulter Standard latex beads, Analis)	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Not assessed	0
7	Lab preparation	Not mentioned for effect assessment	0
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Use of a magnetic stirrer	1
11	Exposure assessment of organisms	Quantitatively assessed in separate experiment	1
12	Replication	At least 5 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Only suborganismal endpoints assessed cannot unambiguously be linked to higher level	0
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No environmentally realistic concentration used	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	14 days	1
		Total	**13**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Von Moos, Burkhardt-Holm and Köhler (2012)[114]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max sizes given (0 - 80 µm) but not confirmed	1
2	Particle shape	Shape mentioned (nonuniform) but not shown	1
3	Polymer type	Polymer type given (HDPE) but not confirmed	1
4	Source MP	Source given (Abifor Zürich)	2
5	Data reporting	Data reported in g/L	1
6	Chemical purity	Presence of chemical additives ruled out by referencing the material data sheet from provider	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Exposure beakers were equipped with aeration stones to attempt an even distribution of MP in suspension	1
11	Exposure assessment of organisms	Ingestion quantified in the same experiment	2
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Condition index and suborganismal endpoints	2
14	Presence of natural (food) particles	Food added (half a drop of LiquifryMarine per beaker) only after 48 h	1
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations tested including control	0
17	Concentration range tested	No environmentally realistic concentration used	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, wide range of sizes (more than 1 order of magnitude)	1
20	Exposure time	Up to 96 h	0
		Total	**16**
Mechanisms explaining effects			
*	Effects	Histological changes and strong inflammatory response	
*	Demonstrated mechanism	"In the **digestive gland (1)** MP caused the formation of **granulocytomas** (after 3 h) and a steady **decrease** in **lysosomal stability** (after 6 h)." "The formation of **granulocytomas** *is* a non-neoplastic **inflammatory cellular response (1)**." "*We provide proof* of principle that MP are taken up **into cells** and cause significant **effects** on the **tissue** and **cellular level."**	

Paper: Vroom et al. (2017)[109]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given for beads (15 µm) but not confirmed. Size distribution of PS fragments (<30µm) given and confirmed with photograph and LAS software, however not used for effect study (figure S1 SI)	1
2	Particle shape	Shape given (bead) and shown in pictures	2
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Phosphorex)	2
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Effects of solvent and styrene monomers ruled out using references.	1
7	Lab preparation	Filtered seawater with 1 µm filter	1
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	MP were quantified using stereoscope software LAS	1
10	Homogeneity of exposure	Not assessed	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed in the same experiment; Ingestion quantified in separate experiment	1
12	Replication	At least 53 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	More than 1 environmentally realistic concentration included	2
18	Aging and biofouling	Not clear if aged MP were used in the effect assessment. PS granules were pulverized to PS fragments, however not used in effect study	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	11 days	1
		Total	**20**
Mechanisms explaining effects			
*	Effects	No effects found	

Paper: Wan et al. (2019)[161]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (5 and 50 µm) and confirmed with SEM, no indication of error measurement	1
2	Particle shape	Spherical shape given and confirmed with SEM	2
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Sources given (Microsphere-Nanospheres and Phosphorex)	2
5	Data reporting	Data reported in µg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not explicitly mentioned, Sonication prior to exposure	1
11	Exposure of assessment of organisms	Ingestion qualitatively assessed with laser scanning microscope in separate experiment	1
12	Replication	5 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Suborganismal endpoints that cannot be unambiguously linked to a threat at the individual or population level	0
14	Presence of natural (food) particles	No feeding during exposure and no additional particles used	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	Not compared with MEC	0
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	One polymer type, two sizes, but separate experiment, one shape	0
20	Exposure time	7 days	1
		Total	**12**
Mechanisms explaining effects			
*	Effects	Alterations in the microbiome at the phylum and genus levels in larval zebrafish, including changes in abundance and diversity of the microbiome. Changes in glycolysis-related genes and lipid metabolism-related genes, confirming that polystyrene MP disturbed glycolipid and energy metabolism.	
*	Demonstrated mechanism	"**Alterations** in the **microbiome (7)** at the phylum and genus levels in larval zebrafish, confirming that PS MP disturbed glycolipid and **energy metabolism (8)**."	
*	Speculated mechanism	-	

Paper: Wang et al. (2019)[32]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Particle size distribution (S3,4) given (10-11 μm) and confirmed with coulter counter	2
2	Particle shape	Spherical shape given and confirmed with images of by microscope software. see SI	2
3	Polymer type	Polymer type given and confirmed with FTIR	2
4	Source MP	Name of provider given (Thermo Fisher Scientific Corporation, USA)	2
5	Data reporting	Data reported in particles/ml and μg/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	In exposure solutions, possible changes in the concentration of prepared solutions were measured over four time points. Evidence that at least 80% of the nominal concentration is maintained. See SI.	2
10	Homogeneity of exposure	Sonication before use, however not during exposure	1
11	Exposure of assessment of organisms	Ingestion assessed qualitatively	1
12	Replication	4 replicates	2
		Subtotal	**16**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, development and epithelial cells lining the digestive tract	2
14	Presence of natural (food) particles	Food added in the chronic tests (14 d), not in the acute tests (24 h)	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	At least 6 concentrations including control	2
17	Concentration range tested	More than one environmentally realistic concentration used	2
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	One polymer type, one size, one shape	0
20	Exposure time	24 h epithelial cells lining the digestive tract, and 14 d survival growth, development and survival	1
		Total	**25**
Mechanisms explaining effects			
*	Effects	No effects on survival, growth and development. Abnormal ultrastructures of intestinal epithelial cells were observed including fewer and disordered microvilli, an increased number of mitochondrion and the appearance of autophagosome	
*	Demonstrated mechanism	"**Abnormal ultrastructures** of **intestinal epithelial cells (1)** were observed including fewer and **disordered microvilli (1)**, an increased number of mitochondrion and the appearance of autophagosome."	
*	Speculated mechanism	"These phenomena *could* **affect nutrition absorption (2)** and **energy metabolism**."	

Paper: Watts et al. (2016)[162]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (8 μm) but not confirmed	1
2	Particle shape	Shape given (sphere) but not confirmed	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	Source given (Spherotec)	2
5	Data reporting	Data reported in particles/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not assessed	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed in a separate experiment	1
12	Replication	10 replicates	2
		Subtotal	**9**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Mortality (not directly assessed) and suborganismal endpoints	2
14	Presence of natural (food) particles	Absence of food	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	Up to 24 h	0
		Total	**11**
Mechanisms explaining effects			
*	Effects	Small effect on oxygen consumption, decrease in hemolymph sodium ions and increase in calcium ions	
*	Demonstrated mechanism	"The **physiological consequences** to the crabs, under short-term exposure, were **minimal**." "Evidently, crabs *are able* to **overcome** these **minor effect**s on **ion exchange** induced by exposure to the polystyrene microspheres used here by minor **physiological regulation (9)**."	
*	Speculated mechanism	-	

Paper: Weber et al. (2018)[23]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (10-150 µm) and particle size distibution measured in the stock suspension and provided	2
2	Particle shape	Shape mentioned (fragment) and shown in SEM pictures	2
3	Polymer type	Polymer type given (PET) and confirmed using FTIR	2
4	Source MP	Self-made MP, source of soft drink bottle not mentioned. Not enough information for reproducibility	1
5	Data reporting	Data reported in particles/ml	1
6	Chemical purity	Used solvent control, however plastics were not checked	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of the exposure done at the start of the experiment using different methods depending on concentration	1
10	Homogeneity of exposure	Homogenization of the exposure reached with the use of cetyl alcohol	1
11	Exposure assessment of organisms	Ingestion quantitatively assessed in separate experiment	1
12	Replication	10 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, development (molting), feeding activity and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	6 concentrations including control	2
17	Concentration range tested	One environmentally realistic concentration included	1
18	Aging, weathering and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, variety of shapes, wide size range (more than 1 order of magnitude)	1
20	Exposure time	48 days	2
		Total	**24**
Mechanisms explaining effects			
*	Effects	No effects found.	

Paper: Welden and Cowie (2016)[57]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (3-5 mm) but not measured	1
2	Particle shape	Shape given (fiber) but not shown	1
3	Polymer type	Polymer type given (PP) but not confirmed	1
4	Source MP	Source given (Gaelforce)	2
5	Data reporting	Data reported in number of fibers, but no concentration given	0
6	Chemical purity	Not mentioned	0
7	Lab preparation	A closed 68 L header tank was used to circulate filtered seawater to prevent introduction of foreign MP.	1
8	Verification of background contamination	Contamination checked during the exposure assessment	1
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure assessment of organisms	MP retention visually quantified	1
12	Replication	No replicates	0
		Subtotal	**8**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding rate and body mass	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison made with MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	8 months	2
		Total	**15**
Mechanisms explaining effects			
*	Effects	Reduction in mean body mass	
*	Demonstrated mechanism	"MP **aggregations reduce** the **nutritional health (2)** of N. norvegicus. The **reduction** in **mean body mass** of the MP-fed individuals indicates that retention of MP results in l**ower growth rates**."	
*	Speculated mechanism	-	

Paper: Wen et al. (2018)[163]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (70-88 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PE) but not measured	1
4	Source MP	Source given (BaseLine ChromTech Research Centre)	2
5	Data reporting	Data reported in µg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	No significant aggregation observed with DLS.	2
11	Exposure assessment of organisms	Ingestion visually quantified	1
12	Replication	3 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, predatory performance and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, small range of sizes	0
20	Exposure time	30 days	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	Decreased in AChE and ALP activity and increase in LDH and COX activity. No effects on survival or growth. Decrease in post-exposure predatory performance. Decrease in AChE activity indicating adverse effects in nervous and neuromuscular function. Decrease in Trypsin activity. Decrease in ALP activity. Nevertheless, juvenile survival and growth were minimally impacted, and thus, *S. aequifasciatus* could cope with near-future temperature increases and MP exposure.	
*	Demonstrated mechanism	"Results *indicate* **deficits** in the **digestive capabilities (2)** of early-stage *S. aequifasciatus*."	
*	Speculated mechanism	-	

Paper: Wright et al. (2013)[12]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (130 µm) and confirmed with SEM pictures and a Mastersizer but error not provided	2
2	Particle shape	Shape mentioned in the SI (irregular) and shown in SEM pictures	2
3	Polymer type	Polymer type given (UPVC) but not confirmed	1
4	Source MP	Source given (Goodfellow Cambridge)	2
5	Data reporting	Data reported in % plastic in sediment (dry weight)	1
6	Chemical purity	Analysis of chemicals done	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	All sediment mixtures were homogenized for five minutes using an electric paint mixer	2
11	Exposure assessment of organisms	Not assessed	0
12	Replication	11 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding activity, immunity, energy reserves and gut residence time	2
14	Presence of natural (food) particles	Addition of food (natural sediments with OM)	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	4 concentrations including control	0
17	Concentration range tested	MEC mentioned of 3% by weight, included 2 environmental concentrations	2
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, irregular shapes, a small range of sizes	1
20	Exposure time	Acute (24 h) and chronic exposure (28 days)	2
		Total	**23**
Mechanisms explaining effects			
*	Effects	Depleted energy reserves	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Our results *suggest* that **depleted energy reserves** arise from a combination of **reduced feeding activity (2)**, **longer gut residence times** of ingested material and **inflammation (1)**." "In our experiments, **depleted energy reserves**, which closely followed the trend for **lipid reserves**, *could* **compromise** somatic **maintenance** and **growth**, **maturity** and **reproduction**." **"Prolonged gut residence times** *imply* that MP, which are of **low nutritional value (2)**, are being retained and subjected to **extensive digestion (2)**, at an **energetic cost**."	

Paper: Wu et al. (2019)[95]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	D_{10}, D_{50}, D_{90} (111, 157, 216 µm PVC) (64, 172, 236 µm PP) values reported and PSD measured with DLS. Less than 10 bins	1
2	Particle shape	Not given, but they say they measured it with laser particle size analyzer. Unclear what shape is tested	0
3	Polymer type	Polymer type (PP and PVC) given but not confirmed	1
4	Source MP	Name of provider given (Aladdin Industrial Corporation)	2
5	Data reporting	Dara reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure of assessment of organisms	Not addressed	0
12	Replication	3 replicates	2
		Subtotal	**7**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Chlorophyll a content and photosynthetic activity	2
14	Presence of natural (food) particles	Food (nutrients) added	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	7 concentrations including control	2
17	Concentration range tested	Authors state that they covered and exceeded actual environmental concentrations. No comparison with MEC.	0
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	Only a small range of sizes used, two types of MP in separate experiments	0
20	Exposure time	7 to 11 days	2
		Total	**15**
Mechanisms explaining effects			
*	Effects	Reduced chlorophyll a content. Decrease and subsequently an increase of photosynthetic activity	
*	Demonstrated mechanism	"Thus, the algae *were* in an **oxidative stress (10)** state."	
*	Speculated mechanism	"There *may* be two reasons for the decrease in chlorophyll a content: first, the **accumulation** of **intracellular reactive oxygen species** damages the cell structure and blocks chlorophyll synthesis; second, MP have a large surface area and strong adsorption ability, and the microalgae and MP would form **hetero-aggregates** of different sizes, and make the **microalgae inactive (5)**." "Fv/Fm and Fv/F0 ratios were relatively stable under normal conditions and were not susceptible to species and growth conditions, but when their values decrease, they indicate that plants are inhibited by light [49]. This *may* be ascribed to MP that **interrupted** the **photosynthetic electron transport (5)** between qa and qb, thus forming more qb-non-reducing PSII reaction centers, which resulted in the reduction of PSII reaction center oxygen evolution."	

Paper: Yin et al. (2018)[164]			
Technical subset	***Criterion***	***Explanation***	***Score***
1	Particle size	PSD measured but average size provided (15 µm) without error	1
2	Particle shape	Shape given (bead) and shown in pictures	2
3	Polymer type	Polymer type given (PS) but not measured	1
4	Source MP	Source given (Tianjin Unibead Scientific Co)	2
5	Data reporting	Data reported in microspheres/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	MP suspended in water were not homogenous	0
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	5 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Feeding activity, Growth, Swimming speed and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentration including control	0
17	Concentration range tested	MEC given in wrong unit, not well motivated	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	14 days	0
		Total	**14**
Mechanisms explaining effects			
*	Effects	Increased foraging time and reduced swimming speed. Lower growth, protein and lipid content. Injury to bile and liver.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"The **accumulation** of MP in the **gastrointestinal tract** stimulated the **intestinal tract** and affected **digestive function**, **reducing food (2)** intake through changes in behavior and appetite. Respiratory stress and lesions caused by MP may be responsible for changes in behavior. MP **adhered to gills and skin may cause a small**, but transient change in oxygen consumption and ion regulation. **Oxidative stress (10)** in fish was induced by PS-MP." "Liver in PS MP group did appear obvious hyperaemia in the present work, *indicating* that MP **induced stress (6)** in liver, thereby *possibly* impacting the function of liver. MP were stored in the intestine, *potentially* **irritating** to the **gastrointestinal lining (1)**. Such changes in the morphology of the intestine *may* **affect absorption** of **nutrients** and further impair fish growth."	

Paper: Yin et al. (2019)[165]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (15 µm) and confirmed with SEM. No indication of measurement error given	1
2	Particle shape	Spherical shape (bead) given and confirmed with SEM	2
3	Polymer type	Polymer (PS) type given and confirmed with FTIR	2
4	Source MP	Name of provider given (Tianjin Unibead Scientific Co. Ltd)	2
5	Data reporting	Data provided in µg/L and particles/L	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	No verification of exposure	0
10	Homogeneity of exposure	Not mentioned	0
11	Exposure of assessment of organisms	Not assessed	0
12	Replication	5 replicates	2
		Subtotal	**11**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth, condition factor, behavior, oxygen consumption, ammonia excretion and suborganismal endpoints	2
14	Presence of natural (food) particles	Fish were fed	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	Authors state that they use an environmentally realistic concentration and compare to MEC	1
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	One polymer type, one size, one shape	0
20	Exposure time	14 days	0
		Total	**16**
Mechanisms explaining effects			
*	Effects	Changes in behavior, increased oxygen consumption and ammonia excretion, lower protein and lipid contents	
*	Demonstrated mechanism	-	
*	Speculated mechanism	**"Suggesting** respiration and metabolism **stress (6).** Led to significantly lower protein and lipid contents, *suggesting* **energy reserve** and **nutrition quality reduction (2)** of fish."	

Paper: Yu et al. (2018)[166]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (5 µm) but not measured	1
2	Particle shape	Shape given (sphere) but not shown	1
3	Polymer type	Polymer type given (PS) and measured with FTIR in previous experiment	2
4	Source MP	Source given (Tianjin BaseLine ChromTech Research Centre)	2
5	Data reporting	Data reported in µg/L and particles/mL	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Aquaria were continuously aerated to avoid agglomeration of MP.	1
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	4 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, Growth and surborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	5 concentrations including control	1
17	Concentration range tested	According to cited reference in paper only unrealistic concentrations tested	0
18	Aging and biofouling	Exposure time long enough to allow biofouling of MP	1
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	21 days	1
		Total	**19**
Mechanisms explaining effects			
*	Effects	Inhibition growth. Reduced activities of AChE and GPT. Decreased activity of GOT, SOD, GSH and PGx at high concentrations. Increase expression gene encoding p38 in the MAPK signaling pathway and decreased expression of genes encoding ERK, AKT and MEK.	
*	Demonstrated mechanism	"In addition, exposure to MP causes damage and induces **oxidative stress (10)** in the hepatopancreas of *E. sinensis*."	
*	Speculated mechanism	-	

Paper: Xu et al. (2017)[167]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given (63-250 µm) but not measured	1
2	Particle shape	Shape given (granule) but not shown	1
3	Polymer type	Polymer type given (PS) but not confirmed	1
4	Source MP	No information on source	0
5	Data reporting	Data reported in items/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Tanks were equipped with air supply to ensure MP were well mixed	1
11	Exposure assessment of organisms	Ingestion visually quantified in faces and pseudofaeces	1
12	Replication	Not clearly stated	0
		Subtotal	**6**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Clearance rate, absorption efficiency and respiration rate	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	Concentrations not compared to MEC	0
18	Aging and biofouling	MP were soaked in artificial seawater for a week	0
19	Diversity of MP tested	One polymer type, one shape, small size range	0
20	Exposure time	1, 5 and 10 days	1
		Total	**11**
Mechanisms explaining effects			
*	Effects	Decreased clearance rate	
*	Demonstrated mechanism	-	
*	Speculated mechanism	**"The mechanism** for reducing the clearance rate in *A. striata* by MP is unknown." "In view of the absorption efficiency and respiration being unaffected in exposed *A. striata*, the reduction in clearance rate *implied* that **energy uptake** should be reduced and hence affect **energy allocation** to growth and reproduction, not to mention that the possible **digestive interference (2)** caused by the MP."	

Paper: Zhang et al. (2017)[80]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (1 µm) and confirmed with SEM pictures	2
2	Particle shape	Spherical and block shapes mentioned and shown in SEM pictures	2
3	Polymer type	Polymer type given (PVC) but not confirmed	1
4	Source MP	Source given (Shanghai Youngling Electromechanical Technology Co.)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Absence of additives mentioned	1
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of the contamination	0
9	Verification of exposure	No verification of the exposure	0
10	Homogeneity of exposure	mPVC uniformly distributed, bPVC not	1
11	Exposure assessment of organisms	Exposure assessment of organisms (adsorption) measured qualitatively with SEM	1
12	Replication	3 replicates	2
		Subtotal	**13**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth inhibition, chlorophyll and photosynthetic efficiency	2
14	Presence of natural (food) particles	No natural particles added	0
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	5 concentrations including control for growth inhibition, 3 concentrations including control for other endpoints	1
17	Concentration range tested	No comparison with MEC	0
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	Up to 96 h	2
		Total	**18**
Mechanisms explaining effects			
*	Effects	High concentrations (50mg/L) of mPVC had negative effects on algal photosynthesis since both chlorophyll content and photosynthetic efficiency decreased.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"Interactions between MP and algae and **physical damage (5)** *may be* the *probable* reason for toxic effects of MP on algae. Algae *could* adsorb mPVC on the surface of cells and these mPVC could wrap up caveolaes on the surface." "It *could* **limit** the transfer of **energy** and substance between cells and environment and lead to **decrease** of **nutrition (2), light, CO_2 and O_2** from medium into cells. The harmful metabolite of algae also had the potential to be locked in the cell to disturb the algal growth."	

Paper: Zhang et al. (2019)[115]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Particle distribution was analyzed using Beckman Coulter (5.846 ± 0.329 μm).	2
2	Particle shape	Shape (bead) mentioned but not confirmed	1
3	Polymer type	Polymer type given (PS) and confirmed with Raman spectroscopy	2
4	Source MP	Name of provided given (Polyscience)	2
5	Data reporting	Data reported in mg/L and particles/ml	2
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of background contamination	0
9	Verification of exposure	concentration checked in ingestion experiment (3 days), however not in main experiment	0
10	Homogeneity of exposure	Sonication prior to exposure, no other measures taken	0
11	Exposure of assessment of organisms	Ingestion quantitatively assessed with fluorescent microscope. With digestion step	1
12	Replication	3 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, sex ratio, developmental time, number of clutches, number of nauplii/clutch, fecundity, and suborganismal endpoints	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	3 concentrations including control	0
17	Concentration range tested	2 environmentally realistic concentrations used	2
18	Aging and biofouling	Not addressed	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	Two generations. Short in terms of days, but effects were demonstrated.	2
		Total	**20**
Mechanisms explaining effects			
*	Effects	Significant reduction in survival rate, number of nauplii/clutch, and fecundity. Restored in the recovery generation	
*	Demonstrated mechanism	"Proteomic analysis *demonstrated* that MP exposure increased several cellular biosynthesis processes and, in turn, **reduced energy storage (2)** due to the trade-off, hence compromising survival and reproduction of the treated copepods."	
*	Speculated mechanism	-	

Paper: Zhao et al. (2019)[168]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Average size given (1 µm) but not measured	1
2	Particle shape	Shape given (sphere) and shown in pictures	2
3	Polymer type	Polymer type given (PVC) but not confirmed	1
4	Source MP	Source given (Shangai Youngling Electromechanical Technology)	2
5	Data reporting	Data reported in mg/L	1
6	Chemical purity	Not mentioned	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	Not mentioned	0
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Forming of homo-aggregates	0
11	Exposure assessment of organisms	Visually shown with SEM pictures	1
12	Replication	3 replicates	2
		Subtotal	**10**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Growth, chlorophyll content and photosynthetic efficiency	2
14	Presence of natural (food) particles	NA for algae	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	6 concentrations including control	2
17	Concentration range tested	Only unrealistic concentrations used	0
18	Aging and biofouling	Not mentioned	0
19	Diversity of MP tested	One polymer type, one shape, one size	0
20	Exposure time	0, 24, 48, 72, 96 h	1
		Total	**17**
Mechanisms explaining effects			
*	Effects	Reduced algal growth, chlorophyll content and photosynthetic efficiency	
*	Demonstrated mechanism	"The SEM images provided an intuitive visual method to observe the behaviors and interactions between MP and microalgae. It was found from the SEM images that microalgae were **wrapped** by MP beads. The **physical blockage (5)** and aggregation were also **responsible** for the **cytotoxicity** of *K. mikimotoi*."	
*	Speculated mechanism	-	

Paper: Ziajahromi et al. (2017)[58]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max size values given for fibers (0 - 1000 µm) and spheres (1- 4 µm), but PSD only given for fibers	2
2	Particle shape	Shapes given (fiber, spheres) and shown only for fibers	2
3	Polymer type	Polymer type given for fibers (polyester) and confirmed with FTIR	2
4	Source MP	Source given for spherical MP (Cospheric)	2
5	Data reporting	Data reported in mg/L and particles/L	2
6	Chemical purity	Fibers cleaned with ethanol and solvent control used	2
7	Lab preparation	Beakers washed with ultrapure water, converting with cling wrap	1
8	Verification of background contamination	Controls checked visually for contamination in acute experiment	1
9	Verification of exposure	Not mentioned	0
10	Homogeneity of exposure	Description of method used to obtain well-dispersed suspension	1
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	At least 4 replicates	2
		Subtotal	**18**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Mortality, growth and reproduction	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Detection of effect thresholds (LC_{50}, EC_{50}) with confidence intervals	2
16	Quality of dose-response relationship	7 doses, including control	2
17	Concentration range tested	1 dose is environmentally realistic	1
18	Aging and biofouling	No aging	0
19	Diversity of MP tested	2 polymer types, 2 shapes, wide size range of fibers (more than one order of magnitude)	2
20	Exposure time	8 days	1
		Total	**30**
Mechanisms explaining effects			
*	Effects	Decrease in survival (acute high exposure), decrease in growth and reproduction	
*	Demonstrated mechanism	"Unlike previous studies, we did **not observe any ingested fibers** in *C. dubia*. However, malformations were *observed* in the carapace of organisms exposed to **polyester fibers**. This *demonstrates* that the adverse impact of MP fibers on exposed aquatic organisms is not solely due to ingestion but also **external physical damage (5)**, and that the latter can significantly affect survival, growth and fecundity of *C. dubia*."	
*	Speculated mechanism	-	

Paper: Ziajahromi et al. (2018)[31]

Technical subset	*Criterion*	*Explanation*	*Score*
1	Particle size	Min/max sizes given (1 - 4, 10 - 27, 43 - 54, 100 -126 µm) but not confirmed	1
2	Particle shape	Shape given (bead) but not shown	1
3	Polymer type	Polymer type given (PE) but not confirmed	1
4	Source MP	Source given (Cospheric)	2
5	Data reporting	Data reported in particles/kg of sediment	1
6	Chemical purity	Not mentioned, surfactant Tween-20 added	0
7	Lab preparation	Not mentioned	0
8	Verification of background contamination	No verification of contamination	0
9	Verification of exposure	Verification of the exposure at the start of the experiment	1
10	Homogeneity of exposure	MP were homogeneously distributed throughout the sediment	2
11	Exposure assessment of organisms	Ingestion qualitatively assessed	1
12	Replication	4 replicates	2
		Subtotal	**12**
Applicable for risk assessment	***Criterion***	***Explanation***	
13	Endpoints	Survival, growth and emergence	2
14	Presence of natural (food) particles	Addition of food	2
15	Detection of effect thresholds	Effect thresholds are not reported explicitly	0
16	Quality of dose-response relationship	2 concentrations including control	0
17	Concentration range tested	One environmentally relevant concentration	1
18	Aging and biofouling	No aging, pristine particles used	0
19	Diversity of MP tested	One polymer type, one shape, different size ranges separately tested	0
20	Exposure time	Up to 10 days	1
		Total	**18**
Mechanisms explaining effects			
*	Effects	Our results suggest that environmentally realistic concentrations of **MP** in sediment can **adversely affec**t the **survival**, **growth** and **emergence** of sediment-dwelling organism C. *tepperi*.	
*	Demonstrated mechanism	-	
*	Speculated mechanism	"This (survival and development) *can be* attributed to the longer residence time of MP in the gut of C. *tepperi* compared to sediment particles due to the *likelihood* of MP to **agglomerate** in the **gut** of C. *tepperi*, in particular for the smaller PE MP, which showed a very strong tendency to aggregate in the water phase. This could potentially result in **blockage** of the **digestive tract (1)** and consequently **inhibit food uptake (2)**. The **delayed emergence** in the presence of 100-126 µm (largest) MP *may be* explained by **changing feeding capacity (2)** during larvae development in the emergence assay, potentially affecting the size preference of ingested MP."	

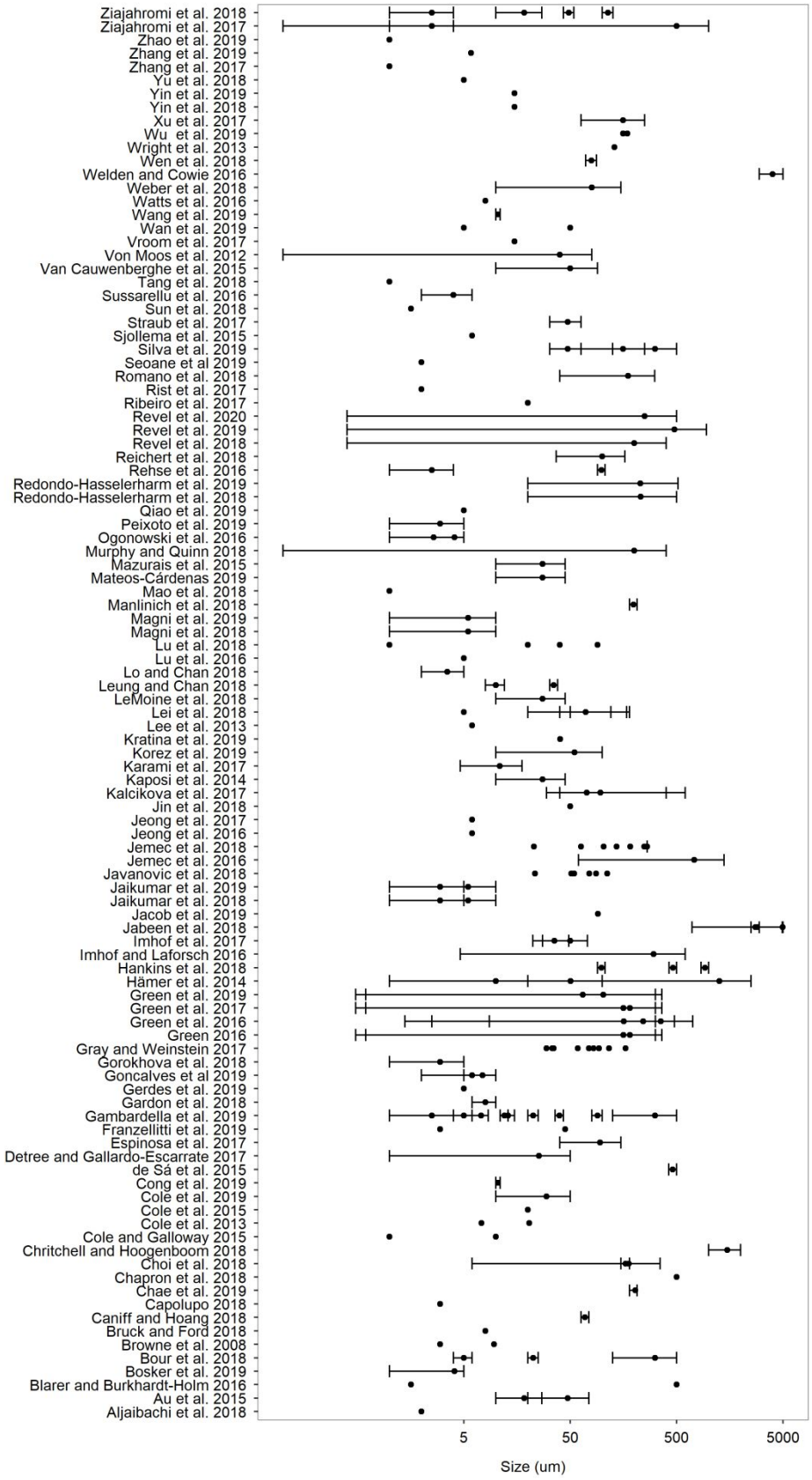

Figure S1. Size ranges used in the scored studies. Lines represent the size range reported and data points represent the reported or calculated average size.

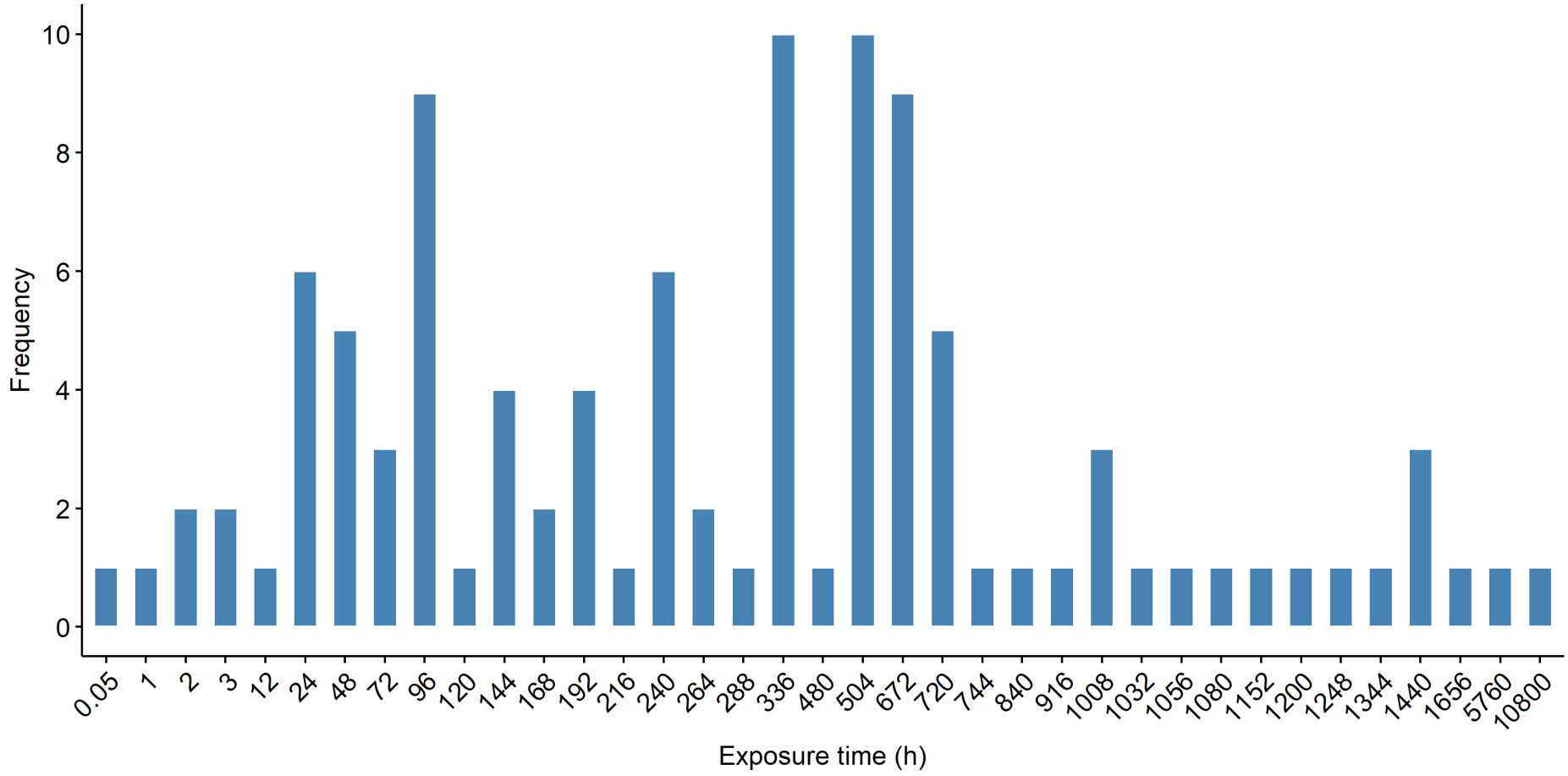

Figure S2. Exposure duration in hours for *n=105* studies.

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