How do we know that microplastics are different from natural particles in their effects on biota?

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Just accepted

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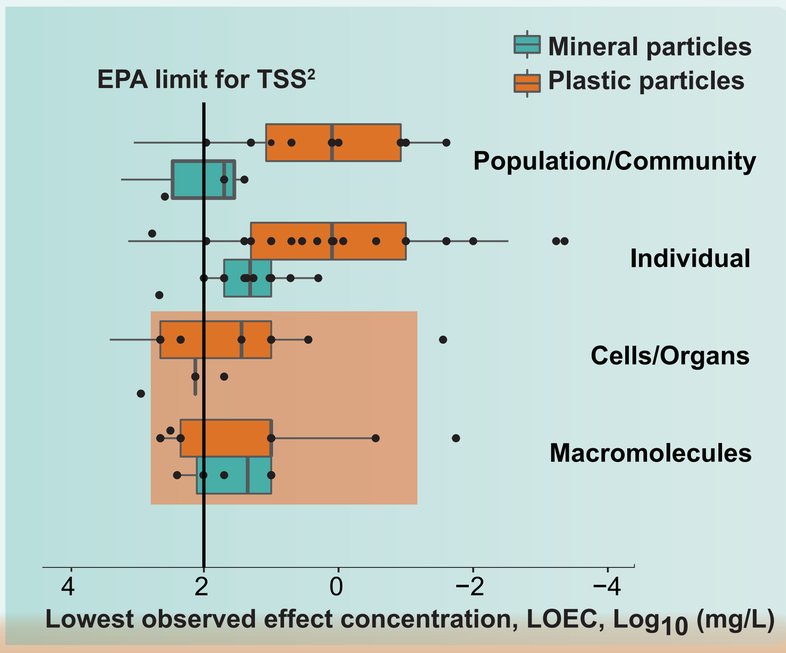
Highlights

- MP and natural mineral particles induce similar effects in biota;
- Flawed experimental designs preclude diagnostics of MP effects;
- Reference particles must be used to identify MP-specific effects;
- MP impacts should be assessed based on ecological soundness.

LOEC metadata for effects of MP and natural mineral particles



Literature survey (28 studies; 1962 – 2017) on effects of particle suspensions (MP, mixed sediment, specific minerals);

Species from several trophic levels and endpoints for different organization levels are represented;

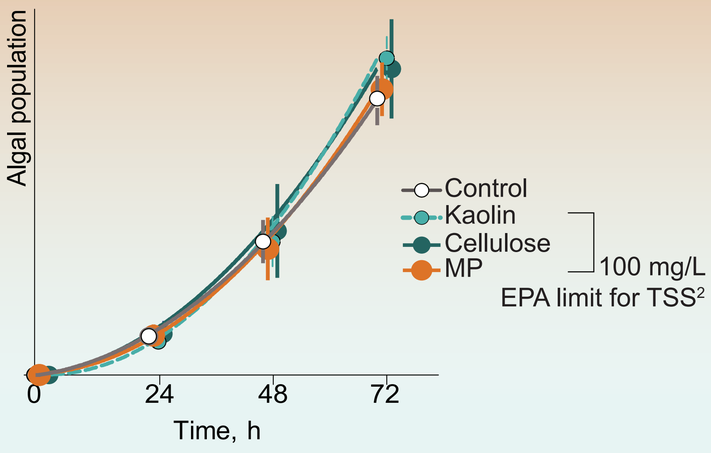
High variability in LOEC values, with no significant difference between particle types for suborganismal responses;

The higher-level responses, however, occur at significantly lower concentrations of MP compared to mineral particles;

To evaluate the validity of this difference, both particles types should be compared under the same conditions.

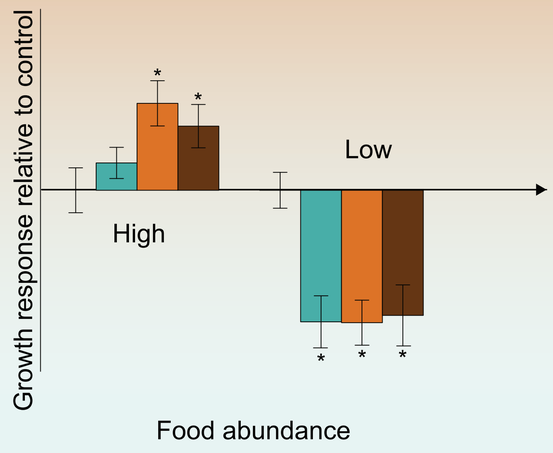
Relative toxicity of MP should be assessed by benchmarking to natural particles and using standard experimental conditions

Primary producers



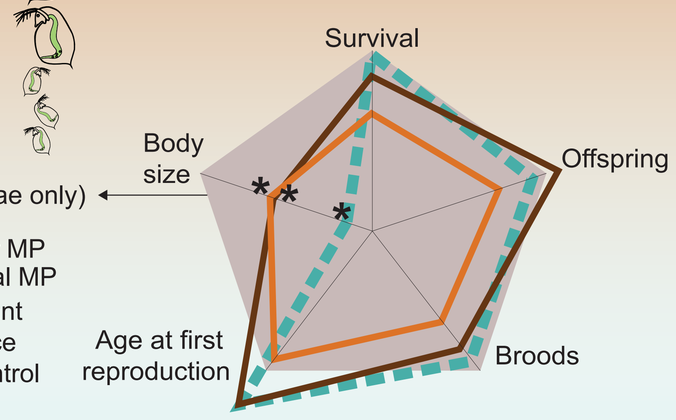
- At particle concentrations corresponding to turbid conditions, algal growth is not affected by MP or natural particles;
- No difference among MP, kaolin, and cellulose treatments.3

Individual grazers

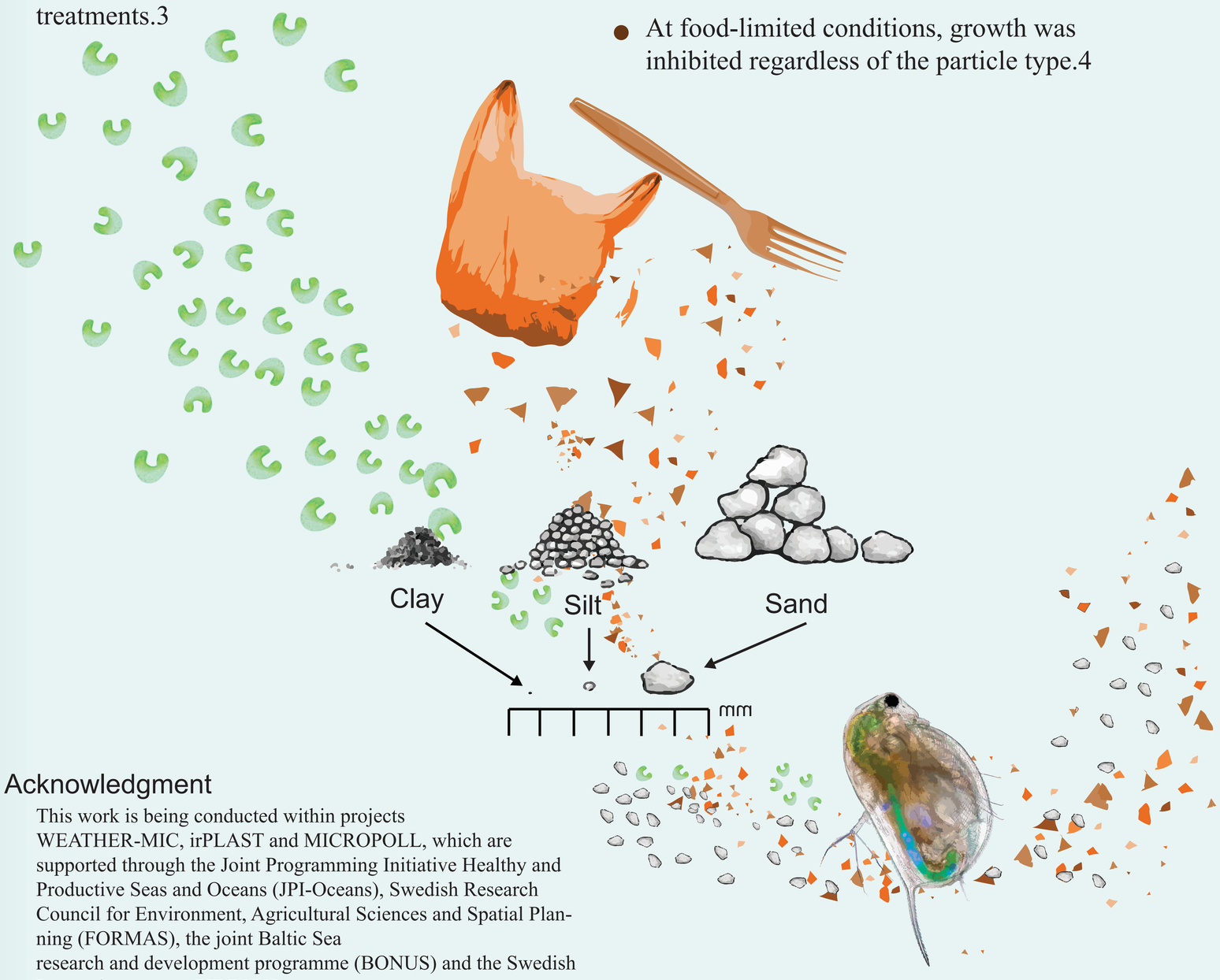


- Daphnia growth response to MP and kaolin depends on the food availability;
- At high algal concentration, daphnids grew better when MP were present;
- At food-limited conditions, growth was inhibited regardless of the particle type.4

Grazer populations



- Irregular MP caused higher mortality and lowered reproduction compared to spherical MP and kaolin, albeit not statistically significant;
- Growth was significantly inhibited by all particle types and most strongly by kaolin;
- Reproductive onset was advanced (not significantly) by the presence of kaolin and spherical MP.4



Conclusions

- Microplastics are a minor fraction of the microparticles naturally present in the water and the sediment;
- To understand environmental risks of microplastics and to address their specific effects, we need adequate controls in our experimental studies;
- Future research needs to focus on understanding the effect mechanisms of microplastic exposure in various biota and environmental settings, so that we can identify populations and environments at risk.

Acknowledgment

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References

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