



Changemaker Challenge - [Update your submission](#)

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Research topic / research question / title:

Daphnids in distress? Study of effects of different types of microplastics on organisms at the base of freshwater ecosystems.

1. Research topic (max 200 words).

“The number of microplastic particles in our oceans outnumber the stars in our galaxy! By 500 times!” – according to a recent report by Ecowatch.

Microplastics are anthropogenic waste particles of sizes 5mm or lesser that are now littering habitats all around the world, from poles to equator. They are classified as primary and secondary microplastics based on their source and mode of entry into the environment. While primary microplastics are intentionally produced and added to a range of cosmetic products like face washes, tooth pastes, scrubs and exfoliants; secondary microplastics are formed within the environment by the breakdown of larger plastic debris. Their abundance coupled with their small palatable sizes suggests that various organisms may ingest them. The uptake of microplastics is also well documented across many species groups. However, my research attempts to answer the yet un-answered “So What?” question- especially on organisms that form the base of aquatic food chains, as it aims to understand the effects that these microplastics have on the health and reproductive output of different Cladoceran species from around the world, forming the crucial base levels of aquatic food chains.

2. How will you be carrying out your research? (max 200 words)

To study the impact of microplastics, I will conduct a series of laboratory experiments on three different Cladoceran species at the base of freshwater foodwebs: *Daphnia magna*, *Daphnia Pulex* and *Ceriodaphnia dubia*. These species are specifically chosen as they have wide distribution ranges, and are thus representative of ecosystems across the world. Furthermore, the three species represent different size classes from large to small respectively, yet have similar life histories that makes comparisons across species possible. I will use fluorescent microbeads, as a model for primary microplastics. As it is quite difficult to obtain environmental samples of secondary microplastics, in quantities necessary for our experiments – I shall grind larger plastic granules using a Cryo-mill to obtain weathered microplastics, which have similar characteristics of shape and size to that of secondary microplastics present in the environment. I shall conduct both acute exposure (high concentration, short duration) and chronic exposure (lower concentration, long duration) experiments to understand the effect of both primary and secondary microplastics on health and reproductive output of these organisms, using an internationally recognised testing standard focussed on assessing fitness. Following the experiments, ‘No effect concentration’ and ‘Lowest observed effect concentration’ may be calculated through statistical data analysis to estimate current risk in the environment. Furthermore, the sensitivity of the three species to primary and secondary microplastics may be compared. The study report will indicate the potential adverse effects of



microplastics on health & reproduction, and thus fitness of organisms at the base of freshwater ecosystems.

3. Why is this research important / How is your research going to improve the world? (max 200 words)

To this day, little is known about the possible adverse impacts of microplastics on ecosystem health, human health and risks involved with the same. In this research I address the knowledge gap at its roots, as I try to understand the possible negative impacts on organisms at the base levels of the foodweb, specifically on their health and reproduction.

This is especially important for these lower organisms, as negative effects on reproduction and health can lead to a reduction in their population size and thus affect the higher trophic levels that depend on them in the food chain, by limiting food availability. Hence, the entire aquatic ecosystem is detrimentally affected by "Domino effect".

Furthermore, comparing sensitivity among different species to wide-spread contaminants like microplastics, is essential for environmental risk assessment to assess their potency as pollutants. To this end, my research is more appropriately "Ground-Filling" than "Ground-Breaking" as it aims to fill the critical knowledge gap about impact of microplastics on freshwater ecosystems. This can highlight the urgency of regulations on future production of products containing microplastics, and the need to undertake imminent measures to reduce existing quantities in the environment, to policy makers. It can also create awareness among general public about the careful choice of everyday use cosmetics, which could be hazardous to the environment.

4. What will the money be used for? (max 200 words)

If I am privileged to win this grant, I shall use the extra funding to expand my study design and enhance its ecological relevance. In nature, ecosystems are quite intricately interlinked through complex food webs, which cannot be mimicked easily in laboratory conditions. However, my goal is to understand the ability of microplastics to transfer from lower to higher trophic levels through the food web. To study this, I will conduct an experiment whereby I shall feed Daphnids exposed to microplastics to a potential predator: Glass worm. The subsequent presence of microplastics in the gut of glassworm would confirm that microplastics can travel through food web, and flow through the ecosystem. This is especially important as it has been recently found that certain classes of highly hazardous chemicals called Persistent Organic Pollutants (POPs), are environmentally adsorbed on the surface of microplastics in high concentrations. Thus, microplastics could additionally act as a vector for these dangerous toxins to travel through the ecosystem, potentially to the top most predator: Humans! A part of the grant shall be used towards this experiment as laboratory maintenance costs of these organisms, as well as procurement and grinding costs of microplastics are quite high. Another part of the grant shall be used for communication of the results. The usefulness of critical research like mine lies in the efficiency of communication: among scientific community, policy makers and general public alike.

Part of the funds shall be used to create a youtube video explaining the hazards of microplastics and my results in a public-friendly manner, and to set up a blog to report important results from research on microplastics (not only mine, but others carried out



so far and in the future). In this regard, the platform for outreach provided by Dopper foundation would also be invaluable to create awareness.