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Microplastic in the marine nearshore waters of South Georgia: a source to sink approach

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The polar plastics research community have recommended the spatial coverage of microplastic investigations in Antarctica and the Southern Ocean be increased, and that focus is given to areas with likely microplastic and zooplankton presence and overlap, such as South Georgia. Presented here is a baseline estimate of microplastics in the nearshore, marine waters of South Georgia, the first systematic study of the north-east coast of the island. We estimate the mean concentration of microplastics in seawater to be $2.39 \pm 3.58/L$ (\pm SD), approximately one order of magnitude higher than the majority of other studies of sea surface waters south of the Polar Front. The maximum concentration of microplastics in wastewater from King Edward Point research station was $1.44 \pm 4.93/L$ (mean \pm SD). Following FT-IR polymer analysis and categorisation of microplastics solely by material, multivariate analysis revealed a 22% similarity in the microplastic profiles of wastewater and the seawater it enters. We hypothesise that microplastic pollution from the research base constitutes a fraction of the input into the local marine environment. To explain the observed discrepancy, we hypothesise alternative sources of contamination to be microplastic transported from afar, microplastic from ships (estimated to be up to 36.8 million synthetic fibres per year) and precipitation based on the concentration of microplastic in a single snow sample ($15.89 \pm 23.72/L$, mean \pm SD). There was no significant difference in the microplastic concentration between seawater sites, and no significant bilateral relationship between concentration and distance from the research station outlet, however we recommend further finescale mapping of the nearshore hydrological regime to develop a holistic picture of microplastic dispersal and retention at the coast.

South Georgia is a biodiversity hotspot to which the potential hazard of microplastic pollution is relatively unknown. This research is part of a wider project examining the ecological fate of microplastics in the marine nearshore waters of South Georgia using a source to sink approach. Additional research currently producing preliminary results includes determining the level of microplastic ingestion by keystone plankton and economically important fish species, as well as assessing the potential for trophic transfer of microplastics to higher predators in the region.