New technique can show link between prey and microplastics

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Scientists have developed a new method to investigate links between top predator diets and the amount of microplastic they consume through their prey.

The new research from Abertay University in collaboration with Plymouth Marine Laboratory (PML), the University of Exeter and Greenpeace Research Laboratories, offers a potential insight into the exposure of animals in the ocean and on land to microplastics.

The development of this new non-invasive method—funded by the Natural Environment Research Council (NERC) - combines two existing techniques to analyse wild gray seal (Halichoerus grypus) scats (feces), for prey species in the seals' diet and the presence of microplastics.

The first part of the method uses metabarcoding, a molecular technique that assesses the DNA present in the scat to identify which prey species have been eaten by the seal. The second part then isolates the microplastics, allowing researchers to assess the quantity of the microplastics and record characteristics, such as shape and color, which generates a better understanding of their sources.

By looking at both of these factors together, the method allows scientists to see whether there are links between the levels of microplastic exposure in these top predator species and whether this is related to the type of prey they are eating. This is particularly useful because top predators, such as seals, tend to consume microplastics through trophic transfer; that is, by eating prey that have already consumed microplastics themselves, which passes to the predator.

In organisms lower down the food chain, microplastics can cause effects including intestinal damage, energy depletion and reduced reproduction, and can act as a carrier for harmful chemical contaminants. By understanding top predator diets, scientists can examine disruptions to these food web interactions and potential threats to species and habitats. The method could be used to investigate where the microplastics are coming from, how they are traveling through the ecosystem and where they are ending up, helping researchers to study their fate and effects.

This new technique is not just applicable to top predators in the marine environment. Because the method relies on collected scat, it could be applied to predators in freshwater ecosystems or on land as well, helping to build our understanding of the ways that microplastics are impacting every environment on Earth.

Lead author, Dr. Sarah Nelms, said: "Trophic transfer is an indirect, but potentially major, route of microplastic ingestion for top predators. Accessing information on their diet is crucial if we are to understand the extent to which these important animals are exposed to plastic pollution. We hope our new method can unlock this, as yet, understudied area of microplastics research."

Dr. Penelope Lindeque, Head of the Marine Plastics Research group at Plymouth Marine Laboratory, said: "Metabarcoding (the use of a DNA region, called a barcode, to identify the taxa within a sample) is a powerful technique which can used to determine what an animal has eaten by looking at the DNA of the ingested prey in the scat of the predator. This paper has, for the first time, further developed this powerful technology to identify not only what prey a predator has eaten, but also what small pieces of plastic. Unfortunately, as microplastics are now so prevalent in our environment, such novel techniques are needed to help determine the impact of the microplastics and ultimately influence their prevention."

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