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New method for detecting microplastic particles in fish stomachs

A novel approach for identifying and isolating anthropogenic – including microplastic – particles in fish stomachs has been devised by researchers in Belgium. The new method may enable scientists and policymakers to better assess the presence, quantity and composition of particles ingested by marine life, and improve understanding of the environmental effects of marine plastic pollution.

It is estimated that 10% of the world's plastic ends up in the oceans[1]. Indeed, in some parts of the sea, such as the North Atlantic Gyre, plastic accumulation has reached concentrations as high as 20 328 pieces per km^2. Many of these plastics measure less than 5 mm, and are referred to as 'microplastics'.

The majority of marine microplastics can be found at the sea's surface layer, where they pose a particular threat to marine organisms that eat plankton and so may accidentally ingest microplastic particles during feeding. As these creatures tend to be at the first level of the marine food chain, microplastics can bioaccumulate up the food chain to pose further risk to other wildlife and human consumers.

In order to determine their impact on the marine creatures that ingest them, effective methods for the isolation and identification of microplastics are needed. To date, most researchers have relied on visual examinations of stomach contents, but these are highly subjective and produce limited data. In addition, while some chemical approaches do exist, they are hampered by significant shortcomings, such as time-consuming processes.

The researchers therefore devised an improved chemical method for isolating anthropogenic particles, including microplastic particles, from fish stomachs, whereby stomach content samples are digested using a sodium hypochlorite solution before being filtered, rinsed with a nitric acid solution, exposed to ultrasound waves and then centrifuged.

The proposed approach holds a number of advantages over other chemical isolation techniques in terms of time, cost and efficiency. Notably, it is compatible with subsequent chemical analysis by Raman spectroscopy, a technique in which a light source is shone on a sample to provide a 'molecular fingerprint' by which molecules can be identified. By combining the two methods, researchers can therefore not only isolate particles but also precisely identify them.

The novel method, which is the first of its kind to utilise sodium hypochlorite in this way, was tested on the stomach contents of nine fish sampled from European seas: three Atlantic herrings (*Clupea harengus*), three European pilchards (*Sardina pilchardus*) and three European anchovies (*Engraulis encrasicolus*). In total, 35 non-degraded particles were successfully isolated using the new technique. Raman spectroscopy confirmed 16 of these to be anthropogenic, of which 11 were microplastics.

The researchers behind the protocol highlight that, when coupled with Raman spectroscopy, this novel isolation method enables scientists to accurately determine the type and number of microplastic particles being ingested by marine fauna. As such, the methodology should be of particular interest to policymakers involved in efforts to monitor and assess the effects of plastic pollution on marine ecosystems.

1. Thompson R (2006) Plastic debris in the marine environment: consequences and solutions. In: Krause, J., Von Nordheim, H., Brager, S. (eds) Marine Nature Conservation in Europe. Bundesamt für Naturschutz, Stralsund, pp 107–116.