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Plastics and microplastics in Norwegian cod and mussels

Plastic and microplastic pollution in the oceans is currently under intense global scrutiny. Until recently, limited data was available on the presence of microscopic plastic pieces in the Norwegian environment, particularly in the case of marine organisms. Through this PhD project, it has been established that Norwegian marine animals, represented by cod and mussels, interact with plastics and microplastics. The results show that fish and mussels do contain plastics, and a controlled laboratory study furthermore illustrated that mussels ingest toothpaste-derived microplastics, and that the ingestion affect the mussels.

To clarify whether Atlantic cod and mussels from our coast are interacting with plastics and microplastics, two field studies along the Norwegian coast were performed. The stations studied ranged from the Oslofjord along the Norwegian coastline to the Barents Sea in the north. The first study examined the occurrence of plastics and microplastics (larger than 0.15 mm) in cod stomachs, the second focused on microplastics (larger than 0.07 mm) in whole mussels.

- “The results show, not surprisingly, that cod and mussels from the Norwegian environment, like marine wildlife globally, interacts with plastics and microplastics”, says supervisor Kevin Thomas. Overall, a low frequency of plastic intake was found in cod with a total of 3% across all samples. Bergen was a "hot spot" for plastic ingestion in cod, however, where 27% of the fish had consumed plastic. Microplastics were found in mussels from 14 out of 15 sites, with an average of 1.5 microplastics per individual mussel. Two sites had elevated microplastic levels: Skallneset in the North (Barents Sea) and Akershuskaia in the south (Oslofjord). –“We did expect elevated microplastic levels in mussels from the highly urbanised Akershuskaia”, says the PhD student Inger Lise Nerland Bråte, -"but I was very surprised that we also found relatively high levels in mussels from the Barents Sea". Nerland Bråte emphasises that the results are based on a single study and whether the size of the mussels affects the number of microplastics found, is unknown. Therefore, it is central to study influence of individual’s size during analysis, since mussels from Skallneset were the smallest in size.

A total of 16 different polymers were found combined for both species: nine in cod and 12 from mussels. Five polymers (polyester, polypropylene, polyethylene, polyvinyl chloride and styrene-acrylonitrile) were found in both species. Although the specific sources for the

plastics are unknown, the results show that Norwegian wildlife is predominantly exposed to well-known plastic types, used and manufactured on a large scale.

The key question is whether marine wildlife is suffering from the plastic and microplastic interaction the researchers found. Lab-studies can be used to address this question.

-"Based on our laboratory study using mussels as a test species, we found that microplastics from toothpaste were ingested by mussels, and that this intake led to changes in their tissue (gills and in the digestive system)," says Nerland Bråte. It is however not possible to translate this lab-study directly to what is happening in the environment. It is unknown whether these changes affect the mussels at a functional level, such as impairing their ability to take up algae.

Many knowledge gaps still exist within the research field, and this thesis has further identified new ones such as; what about the microplastics (and maybe even nanoplastics) that are even smaller than the pieces measured in this thesis? Can the plastics found in cod and mussels cause harm? Whether these small plastic pieces do (or will) affect the ecosystem that is already under other stressors such as environmental pollutants is not understood, therefore research on ecosystem effects should be of high priority.

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