

Science for Environment Policy

Antarctic ecosystems suffer toxic impacts of petrochemical lubricants over the long term

Petrochemical lubricants have toxic effects on Antarctic seafloor ecosystems even after five years of degradation, a new study suggests. Examining the impacts of a standard lubricant and one marketed as biodegradable, the researchers were able to show that algae, which form the basis of the food chain, remained affected even after five years. Furthermore, the biodegradable lubricant appeared to provide no environmental benefits, as it had greater impacts in the long term.

Antarctica contains unique wildlife that is reliant on its fragile ecosystem. As a continent without any permanent human inhabitants it is often considered pristine. However, spills and leakages of petrol and oils do occur and their impacts on the Antarctic environment are not well understood.

For this study, researchers examined the effects of two lubricants — a standard oil lubricant and one marketed as more biodegradable — on seafloor algae called diatoms. As these algae are 'primary producers', at the bottom of the food chain, they can give a good indication of whether the ecosystem will be affected more widely.

The research team collected seafloor sediments and divided them into three treatments, one set was contaminated with standard lubricant, one set with biodegradable lubricant and a 'control' set which was uncontaminated for comparison. The contaminated sediments were treated with the lubricants until they reached a concentration of 4000 milligrams per kilogram, contamination levels similar to those found in sediments near Antarctic bases. They then put the sediments into open plastic trays lined with mesh and returned them to the seafloor in an uncontaminated section of the coast. The sediments remained there for five years and were sampled by divers after five weeks, two years and five years.

After five years the concentrations of the standard lubricant had dropped by 80%, and that of the biodegradable lubricant by 84%. However, despite these reductions the diatom communities still showed evidence of the toxic effects of the lubricants after five years with the contaminated and control sediments showing significant differences in the dominant species, abundances and diversity.

The greatest effects of the contamination on species' abundances peaked at two years, with the samples taken at five years showing that the diatom community was slowly recovering. Both the standard and biodegradable lubricants had substantial effects on the diatom community initially; surprisingly, however, the biodegradable lubricant had a greater long-term effect, with impacts that were greater at five years after contamination.

The authors conclude that both the standard and biodegradable lubricants have long-term effects on Antarctic seafloor ecosystems, extending beyond five years. This highlights the extra need for care to avoid leakages and spills. The biodegradable lubricant, although it did fall in concentration by slightly more than the standard lubricant, does not seem to offer any environmental benefits as it still affects algae in the long term.



21 May 2015
Issue 414

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Source: Polmear, R., Stark, J.S. Roberts, D. & McMinn A. (2015). The effects of oil pollution on Antarctic benthic diatom communities over 5 years. *Marine Pollution Bulletin* 90: 33–40. DOI: 10.1016/j.marpolbul.2014.11.035.

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

