European Commission

Science for Environment Policy

Natural reduction of mercury levels in fish slower than predicted

Mercury, in the form of monomethylmercury, can accumulate in fish to high concentrations, presenting the greatest concern for human exposure to this potent neurotoxin. New long-term research of fish in a natural setting has shown that removal rates of the toxin from body tissues are likely to be even slower than thought.

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Mercury accumulates in fish through their diet and can reach especially dangerous levels in large, long-lived species that feed on other fish. Previous studies to predict rates of mercury loss in fish, by examining uptake and natural 'elimination' or removal from the body, have been mostly short-term and conducted in laboratory settings.

In this Canadian study, researchers examined the elimination rates of monomethylmercury from northern pike over a long-term study period in a natural lake setting. A unique feature of this study was that the source lake for the fish had been enriched with a form of mercury that could be subsequently traced. After three to four years of this exposure, 17 of these long-lived fish were captured and tagged so that they could be later identified when transferred into a nearby lake that contained only natural background levels of mercury.

Over a period of approximately seven years, 11 of the fish were re-captured at varying intervals and a very small amount of muscle tissue was taken to measure mercury levels. The fish were then released back into the lake to be tested again at later dates.

After transfer into the low-mercury lake, the levels of traceable mercury in the muscle initially increased. Levels rose over the first 460 days to three times those measured when they were first transferred. Although this appears unexpected, the researchers suggest that this is likely to be because mercury moves around the body. At first, it is contained in organs and in the blood; however, over time, it is transferred into the muscle, where it is stored.

After this initial increase, there was a decline in mercury over the following 200 days, falling to around 65% of original levels. Over the next three years, however, concentrations stabilised at levels similar to those measured when the fish were removed from the mercury-enriched lake.

The researchers compared their results with those produced by mathematical models that use laboratory-derived elimination rates to predict mercury loss in fish. They found that their observed rates of elimination from the tissues were 1.2 to 2.7 fold slower than model predictions.

They conclude that, although they only studied a small number of fish, the natural, long-term nature of the experiment gives a key insight into elimination rates in the wild. They indicate that model predictions may significantly over-estimate actual rates of mercury loss by fish and that this has important implications for recovery timelines of mercury-contaminated fisheries.

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