USGS Western Ecological Research Center
Publication Brief

science for a changing world

Marine Foraging Ecology Influences Mercury Bioaccumulation in Elephant Seals

Published in *Proceedings of the Royal Society B*, a study authored by researchers at the University of California, Santa Cruz and USGS used satellite-tracked northern elephant seals to show that marine foraging behavior can influence mercury exposure in the Pacific Ocean.

Mercury contamination of oceans is prevalent worldwide and concentrations of the bioaccumulating form of mercury, methylmercury, are increasing more rapidly in the mesopelagic zone (200 – 1000 m deep) than in surface waters. Yet, mercury bioaccumulation in deep ocean predators has been little studied.

Northern elephant seals (*Mirounga angustirostris*) travel thousands of kilometres twice each year to eat deep-ocean fish and squid within coastal and open-ocean regions of the northeast Pacific Ocean. To study mercury bioaccumulation in these predators, researchers linked data from satellite tags, dive-depth recording tags, and biochemical analyses (stable carbon and nitrogen isotopes) from 77 adult female elephant seals.

The combined data showed that variability in foraging behavior among individuals influenced mercury contamination. The mercury concentrations they observed in blood and muscle were among the highest concentrations reported for a marine predator.

Elephant seals were grouped into three distinct foraging strategies, which resulted in substantially different mercury bioacummulation:

1. Deeper-diving and offshore foraging seals had the greatest mercury concentrations.
2. Shallower-diving and offshore foraging seals had intermediate levels.
3. Coastal and more northerly foraging seals had the lowest mercury concentrations.

This Brief Refers To:
Peterson, SP, JT Ackerman, DP Costa. 2015. **Marine foraging ecology influences mercury bioaccumulation in deep-diving northern elephant seals.** *Proceedings of the Royal Society B*. doi:10.1098/rspb.2015.0710
http://www.werc.usgs.gov/ProductDetails.aspx?ID=5295

Based on instrument data, northern elephant seals fron the Año Nuevo colony can be sorted into distinct foraging and diving strategies. Photo: Jim Milbury/NOAA Fisheries

MANAGEMENT IMPLICATIONS

- Individual foraging and diving behavior of adult female northern elephant seals substantially influenced mercury bioaccumulation, and seals could be broadly clustered into separate groups based on foraging and diving behavior. This indicates that individuals are not at equal risk to mercury exposure.
- Although mercury toxicity benchmarks for marine mammals are difficult to develop, 99% of elephant seals sampled exceeded the prominently used clinical neurotoxicity threshold for marine mammals, which is based on thresholds developed for humans.
- The high mercury concentrations we observed in elephant seals indicate that the mesopelagic zone in the northeast Pacific Ocean is an important source of mercury exposure to marine predators.

RESEARCH CONTACT

Josh Ackerman
USGS Western Ecological Research Center
jackerman@usgs.gov
www.werc.usgs.gov/ackerman

Sarah Peterson
UC Santa Cruz
sarahpeterson23@gmail.com