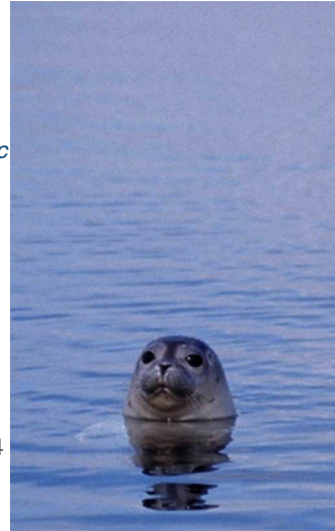


Seals as Sentinels Research

Heavy Metals and Trace Elements in Northwest Atlantic Harbor Seals

In 2000, MERI launched *Seals As Sentinels: Assessing the Impacts of Toxic Contaminants in Northwest Atlantic Seals*. This landmark project has generated the first extensive, region-wide body of contaminants data in marine mammals along the northwest Atlantic coast (from Canada to New York) and has earned national and international recognition in the scientific and regulatory communities.



MERI began collaborating with the Northeast Region Marine Mammal Stranding Network in 2001 to respond to stranded marine mammals in the downeast and mid-coast Maine area and to collect tissues for contaminants research. Through this collaboration, MERI initially collected tissues from 34 stranded harbor seals (*Phoca vitulina concolor*) and 3 gray seals (*Halichoerus gryphus*), primarily pups and yearlings, that stranded at locations along the coast from eastern Maine to Long Island, New York between 1991 and 2001-2002. Seal blubber, liver, and kidney samples were analyzed for a wide range of persistent organic pollutants (POPs) and metals.

Findings

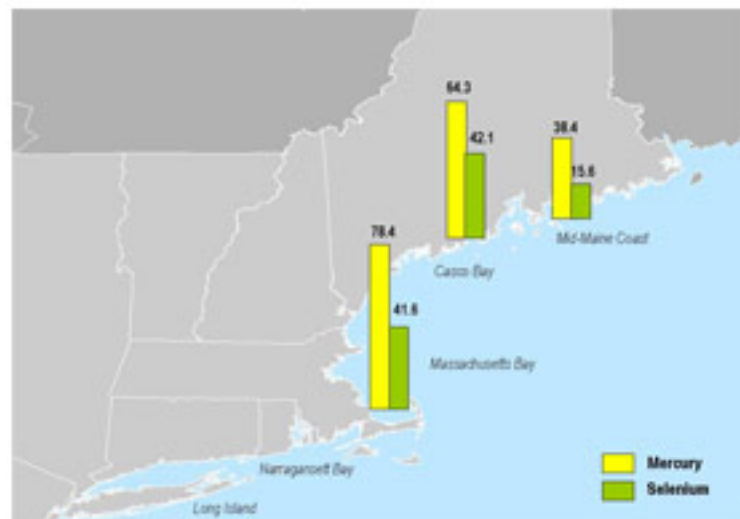
Concentrations of mercury found in liver of the adult harbor seals are shown. While hepatic mercury levels in the younger seals were relatively low, concentrations in adult seals (mean 64.8 $\mu\text{g/g}$, wet weight) were similar to those reported in adult seals from the Baltic Sea and other polluted marine regions.

Seal liver and kidney samples were also tested for arsenic, cadmium, chromium, lead, silver, selenium, copper and zinc, but these metals were not detected at levels of concern.

Elevated mercury levels are known to be common in livers of marine mammals, and seals have evolved biochemical mechanisms involving selenium to detoxify (demethylate) and store mercury in the form of less toxic (divalent) mercury-selenide complexes. However, the ability to detoxify and store mercury may not be present in newborn and young seals following exposure to the mother's burden *in utero* and while nursing, thus, these young and developing seals may be at risk for mercury toxicoses.

Mercury concentrations found in liver of adult harbor seals along this coast exceed the estimated threshold level of 60 $\mu\text{g/g}$ lw for liver damage in mammals, suggesting that harbor seal pups may be exposed to harmful levels of mercury during gestation and lactation.

These observations, together with reports of at least two, and possibly three large-scale viral epizootics among these seals since the 1980s, suggest that the population is currently at risk for contaminant-related health effects.



Publications resulting from this research:

Shaw, S.D. (2007). Chapter 7. How are seals, as top predators, impacted by toxic contaminants in Casco Bay and the Gulf of Maine? In: *Toxic Pollution in Casco Bay: Sources and Impacts*. Casco Bay Estuary Partnership (<http://www.cascobay.usm.maine.edu>).

Shaw, S.D. (2005). Seals as Sentinels: Assessing Toxic Contaminants in Northwestern Atlantic Coast Seals. Final Project Report to the National Oceanographic and Atmospheric Administration. Marine Environmental Research Institute, Blue Hill, ME, 69 pp. Contract No. EA133F04CN0062.

Shaw, S.D. (2002). An Investigation of Persistent Organic Pollutants (POPs) and Heavy Metals in Tissues of Harbor Seals (*Phoca vitulina concolor*) and Gray Seals (*Halichoerus grypus*) in the Gulf of Maine. *Final Report to the State of Maine Department of Environmental Protection*, Augusta, ME, 16 pp.