

# LEAD ISOTOPES INDICATE LEAD SHOT EXPOSURE IN ALASKA-BREEDING WATERFOWL

ANGELA MATZ<sup>1</sup> AND PAUL FLINT<sup>2</sup>

<sup>1</sup>*US Fish and Wildlife Service, Environmental Contaminants Program,  
Fairbanks, AK 99701, USA.*

<sup>2</sup>*US Geological Survey - Alaska Science Center,  
4210 University Dr., Anchorage, AK 99508, USA.*

ABSTRACT.—Although use of lead shot in waterfowl hunting has been banned in the United States since 1991, lead concentrations with possible population-level effects continue to be documented in waterfowl breeding in Alaska, including threatened Spectacled Eiders (*Somateria fischeri*). The presumed source is ingested lead shot, which waterfowl consume intentionally or incidentally while feeding in wetlands containing spent shot. Lead shot is still used in many parts of rural Alaska for subsistence waterfowl hunting. Further, legal use of lead shot for upland game hunting may occur in waterfowl breeding habitats. Availability of spent shot may be prolonged by permafrost, which frequently underlies wetlands used for breeding and retards the sinking of shot beyond the reach of feeding waterfowl. Exposure to lead from shot can be documented using radiographs or dissection, but these methods are cumbersome or applicable only post mortem, respectively. Analysis of blood for total lead and lead isotope ratios (e.g., <sup>206</sup>Pb / <sup>207</sup>Pb) is a simpler and more efficient technique. Lead isotope ratios vary geographically, and lead products such as shot can have distinct, ore-specific signatures. We compared lead isotope ratios from shot and breeding and wintering area sediments to those in blood from Spectacled, King (*S. spectabilis*), and Common Eiders (*S. mollissima*) and Long-tailed Ducks (*Clangula hyemalis*). Birds were sampled on the Yukon-Kuskokwim Delta and the North Slope of Alaska. We also analyzed bird blood for total lead concentrations. Isotopic signatures from birds with relatively high blood lead concentrations were most similar to the isotopic signatures of lead shot, while signatures from birds with low blood lead concentrations closely matched those of local sediments. Further, lead concentrations in sediment samples were very low making sediments an unlikely source for high blood concentrations. Therefore, spent lead shot is available and consumed by breeding waterfowl in Alaska. Although exposure may result from previously used shot, current lead shot use combined with the persistence of lead shot in Alaskan wetlands mandates that management, including outreach and law enforcement, be directed at entirely eliminating the use of lead shot for subsistence hunting.

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