TOTAL MERCURY CONCENTRATIONS IN TISSUES OF BIRDS AT AGATTU ISLAND, ALASKA

Biological Objective
To quantify total mercury concentrations for four species of birds breeding in the western Aleutians, including Kittlitz’s murrelet and Evermann’s rock ptarmigan, two species of conservation concern in Alaska.

Background
Mercury is a toxic element that is transported atmospherically, distributed globally, and can negatively influence bird populations. Recent studies at several Aleutian Islands have revealed that several avian species had elevated levels of contaminants, including mercury, and demonstrated an east-west gradient with greatest mercury concentrations found at the western end and decreasing eastward along the Aleutian chain. Causes for this pattern are speculative, but possibly indicates a Eurasian source of contamination through atmospheric transport and atmospheric distillation. Mercury in birds can be sampled non-destructively using feathers, which are grown and molted on a regular basis and reflect circulating tissue concentrations at the time and location of feather growth. Feathers from young of the year, as well as eggshell fragments can also shed light on contaminant burdens experienced by adults at the time of egg development. Quantifying baseline values for total mercury concentrations at the western end of the Aleutians will inform managers and policy makers responsible for developing conservation priorities.

Planning/Project Design
Over the course of six summers (2005-2006; 2008-2011) at Agattu Island, located at the westernmost end of the Aleutian chain, FWS biologists studying ptarmigan, seabirds, freshwater fishes, and plant communities also advantageously collected feather and eggshell samples from four species of birds. The species represent a broad range of avian trophic positions and life history strategies. Sampled species include snowy owl (Bubo scandiacus), fork-tailed storm-petrel (Oceanodroma furcata), Evermann’s rock ptarmigan (Lagopus muta evermanni), and Kittlitz’s murrelet (Brachyramphus brevirostris). The latter two species are of special concern in Alaska. Evermann’s rock ptarmigan is a unique subspecies endemic to the Near Islands group (Attu, Agattu, Shemya, Nizki, and Alaid islands), genetically distinct from other Alaskan ptarmigan subspecies, and considered a species of conservation concern owing to their small population size (<1000 individuals). Our knowledge of contaminants in the Kittlitz’s murrelet is minimal, and may provide an important clue to identifying causes for high chick mortality rates observed at Agattu Island, as well as population declines reported elsewhere for the species.

Mercury concentration levels for all four birds species at Agattu will be compared with other regional and global sites with known mercury values. Analyses will provide mercury concentration values in adult feathers, eggshells, and chick feathers of Kittlitz’s murrelets from Agattu, and will be compared to historic levels (1893-1928) using specimens from museum collections. Overall, these analyses will provide a general assessment of mercury concentrations of birds at Agattu Island and will serve as a baseline for future mercury studies. This study was collocated with existing FWS projects, thus making sample collections highly cost-effective.
Implementation
Following the final year of multiple field studies at Agattu Island, feather and eggshell samples were sent to the USGS Pacific Northwest Environmental Mercury Lab (Corvallis, OR) for analysis of mercury concentrations following Environmental Protection Agency Method 7473 using a Milestone Direct Mercury Analyzer (DMA-80). Samples for snowy owls were collected near pellet egestion sites and include four individuals per year over a 3-year time period. Fork-tailed storm-petrel feather samples, collected at colony sites where breeding adults were depredated by common ravens totaled 12 individuals over a 2-year time period. Evermann’s rock ptarmigan tail feathers were collected during a translocation and reintroduction project (Attu to Agattu islands) and includes 25 feathers from 2005, 23 feathers in 2006, with 6 individuals captured and sampled both years, providing intra-individual measurements. Kittlitz’s murrelet samples include 21 adults, 12 chicks, and 21 eggshells collected over 4-years. Analyses are expected to be complete by mid-January 2012.

Adaptive Management
This project meets one of the primary objectives of FWS defined in the National Strategic Plan of the Avian Health and Disease Program: identify existing and emerging avian health and disease risks. Specific activities outlined in the National Strategic Plan and integral to this study include the “investigation of non-infectious diseases (including contaminants)” and “injecting disease expertise” into FWS Refuges’ missions and objectives.

Kittlitz’s murrelet, a species of conservation concern and a candidate for protection under the Endangered Species Act, has shown dramatic population declines over the last 10-20 years. Causes for these population declines are speculative and information gaps exist, including avian health and exposure to environmental contaminants. Time series data based on museum specimens collected between 1893-1928 will help to assess changes in mercury levels over the last century. Results from this study will provide important values to guide managers, policy makers, and researchers involved with the imminent preparation of a listing package for Kittlitz’s murrelet as an Endangered Species.

Accomplishments
This project is the result of collaborations between University of Alaska Anchorage, Kansas State University, the USGS Pacific Northwest Environmental Mercury Lab, Migratory Bird Management, and the Alaska Maritime NWR. Information gained will build upon baseline data from other Aleutian Islands and integrate a range of FWS program areas, including subsistence, environmental contaminants, migratory birds, and climate change. Quantifying mercury concentrations at four avian trophic levels provides managers with a key tool to assess avenues of exposure to Alaskans living at remote locations and living subsistence lifestyles. As global climate change is predicted to exacerbate factors controlling mercury cycling and bioaccumulation in organisms, the FWS will rely on long-term monitoring studies to quantify trends and identify human health concerns. The results of this study are highly transferable and will have broad applications across Alaska by providing critical baseline data for future circumpolar monitoring efforts.