UNDERSTANDING CONTAMINANTS IN LESSER SCAUP

Biological Ojective

Our objective is to assess the degree of exposure and effects of lead, strontium, and radioisotopes on lesser scaup and sympatrically nesting species at some of the most productive waterfowl breeding sites in Alaska. By working with partners, we are able to collect a large amount of data on important contaminant issues in a USFWS Focal Species under threat of the effects of climate change on National Wildlife Refuge lands.

Background

Scaup populations have declined substantially since the 1980s, and reached a low of 3.25 million birds in 2006, 48% below the North American Waterfowl Management Plan goal. Female survival and juvenile recruitment are lower now than during population highs. To date, no single factor has been isolated that fully explains this decline. Several theories have been postulated for reduced survival and recruitment including environmental contaminants and climate change. Recent work has found that total strontium (Sr) concentrations in lesser scaup eggs were negatively correlated with eggshell thickness, radiostrontium levels in scaup eggshells were higher than levels found in eggshells of waterfowl nesting at nuclear waste contaminated sites, and lead (Pb) exposure was elevated in waterfowl at important lesser scaup breeding sites.

Stable Sr in environmental samples derives from weathering of local sources and atmospheric deposition. Atmospheric Sr derives from both natural and anthropogenic sources. For example, fly ash from coal fueled power plants is highly enriched in Sr, up to 200 times greater than typical soil concentrations. Radioactive Sr isotopes are only produced by fission of uranium or plutonium, and radio-strontium in the environment today may have originated from legacy product produced during atmospheric nuclear bomb testing, radiopharmacological uses, leachate from nuclear waste sites, improper or illegal disposal of nuclear waste or products, and current nuclear power and processing facilities. Lead exposure in waterfowl in Alaska generally originates from ingestion of lead shot. Today, sources of spent lead gunshot include illegal use by waterfowl hunters, legal use for hunting non-waterfowl species, shot deposited by waterfowl hunters prior to being banned, and shot deposited by target shooters.

Planning/Project Design

Our work in 2011 and 2012 is on lesser scaup and other waterfowl at remote field camps at Minto Flats State Game Area and Yukon Flats National Wildlife Refuge, plus collection sites in the greater Fairbanks area. Camps are staffed by USFWS and University of Alaska Fairbanks personnel with USFWS acting as the lead in collecting contaminants data. Multiple sites are necessary because different factors may contribute to contaminant exposure at the different sites, such as varying contaminants in urban versus remote breeding areas. To minimize costs and maximize benefits to our trust resources, the USFWS Environmental Contaminants Program in the Fairbanks Fish and Wildlife Field Office is working with partners, including University of Alaska Fairbanks, Alaska SeaLife Center, University of Michigan, Fairbanks North Star Borough, Alaska Department of Environmental Conservation, and other USFWS programs including Office of Law Enforcement, Migratory Birds, Fisheries and Habitat Restoration, and Yukon Flats National Wildlife Refuge. Our work meets several of the Avian Health and Disease Program objectives, including: establishing avian health baselines through our lesser scaup artificial incubation study and blood lead; identifying existing (lead) and emerging (strontium and radioisotope) avian health and disease risks; and developing and guiding appropriate and effective management actions. We focus on lesser scaup, a

USFWS Focal Species in decline. This project will help identify potentially significant ancillary stressors to lesser scaup at areas with demonstrated climate change effects.

Implementation

In 2011, we began work to address the occurrence and toxic effects of lead, strontium, and radioisotopes in lesser scaup and conspecifics. We will continue this work in 2012. Specifically, we are:

- Collecting lesser scaup eggs and measuring the amounts of strontium and radioisotopes in eggshells and egg contents to determine if embryos are exposed to harmful levels.
- Collecting lesser scaup eggs in the wild, hatching them in captivity, and measuring lead, strontium, and radioisotope concentrations and health metrics in the ducklings to determine if current contaminant concentrations are affecting skeletal or gonad development; hematology; shell strength, quality, and thickness; and hatchability.
- Using stable isotopes to determine whether the source of elevated strontium in lesser scaup eggs is from the breeding grounds or a foreign source.
- Implanting satellite transmitters in lesser scaup with high strontium and radioisotope levels to assess if this cohort uses common wintering grounds or migratory pathways which would suggest a source of these contaminants.
- Collecting greater scaup, canvasback, ring-necked duck, and northern shoveler eggs and analyzing them for strontium and radioisotopes to determine if sympatrically nesting waterfowl also have elevated levels of strontium or radioisotopes in their eggs.
- Measuring the blood lead level of lesser scaup and conspecifics in several age classes at important breeding sites to determine the degree of lead exposure at key wetlands in Interior Alaska.
- Collecting lesser scaup blood samples and eggs from at least three sites over two years to determine if exposure varies among years or between sites.
- Estimating the radiation dose of the common and long-lived radioisotopes produced by fission reactors to lesser scaup embryos.
- Increasing the number of banded waterfowl at these important breeding sites.
- Cooperating with partners to increase samples sizes for avian influenza studies ongoing at Minto Flats.

Management

Results of this project could have significant management implications. Specific actions that may be warranted based on the results of this project include:

- Reduce lesser scaup harvest for certain flyways if specific populations are negatively affected by high strontium, radioisotope, or lead exposure.
- Protect important lesser scaup habitats from current or future perturbations, to reduce confounding stressors on lesser scaup populations, including on National Wildlife Refuges.
- If lead exposure in waterfowl is shown to result from lead shot, managers can expand or sponsor local educational efforts to eliminate the use of lead shot.
- Where target shooting may contribute significant lead shot to a wetland, managers can develop regulations to control input.
- Provide data to the Alaska Department of Health for evaluation of waterfowl as human food.
- Work with partners and regulatory agencies to reduce or mitigate the environmental release of radioisotopes from nuclear power plants, storage sites, medical industry, and other sources.
- Prioritize research on causes of lesser scaup population declines.

Accomplishments

In 2011, we located over 220 nests and collected nearly 500 eggs for contaminants analysis. Seventy six lesser scaup eggs were collected for artificial incubation to determine if Sr and radioisotope levels affected hatching success and duckling health. We also captured, banded, and collected blood and feathers for lead exposure and isotope analysis from over 220 ducks. Initial 2011 results suggest all lesser scaup eggshells had measurable levels of radioisotopes and lead exposure was high at Minto Flats State Game Area. In 2012, we will expand upon this work by collecting nesting hen bone, sediment, and prey samples to determine if strontium in eggs originates from the local environment or is carried to the breeding grounds by the hen; implant scaup with satellite transmitters to determine if birds with high metal and radioisotope burdens use the same migration corridors or wintering areas; and use stable isotopes to tie contaminants data to breeding ecology, site fidelity, and wintering sites.