

**Sea Duck Joint Venture**  
**Annual Project Summary for Endorsed Projects**  
**FY 04 – (October 1, 2003 to Sept 30, 2004)**

**Project Title:** No. 27: Effects of selenium exposure in common eiders

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**Partners:** Alaska SeaLife Center, USFWS, SDJV, USGS, Maine Department of Inland Fisheries and Wildlife.

**Project Description:** The effects of excess selenium exposure are well known in freshwater birds and include multiple embryonic deformities, adverse physiological changes, emaciation, and death with a variety of histopathologic lesions. Selenium concentrations that are commonly considered toxic for freshwater birds have been reported in tissues of some marine birds, and the threatened spectacled eider (*Somateria fischeri*) and Steller's eider (*Polysticta stelleri*) are among the Alaskan sea ducks and waterfowl found with high selenium levels. Because experimental studies of selenium toxicity in marine birds are lacking, little information is available to evaluate the threat represented by the selenium concentrations found in tissues of these species.

**Objectives:** To determine if (1) Selenium exposure has adverse effects on the physiology and immune function of common eiders and to evaluate the histopathological effects of exposure; (2) Tissue selenium thresholds associated with toxicity are higher in eiders than freshwater birds; and (3) Eiders accumulate more selenium in their tissues than freshwater birds when dietary selenium concentrations are similar.

**Preliminary Results:** A preliminary range-finding study was conducted at the National Wildlife Health Center with four (one adult and one juvenile male; one adult and one juvenile female) common eiders. Ducks were started on selenium at 10 ppm mixed in Mazuri® (PMI Nutrition International, Brentwood, MO) #5681 sea duck diet and fed *ad libitum*. The selenium concentration was increased to 80 ppm over a period of 2.5 months. Blood samples (for analysis of selenium and enzymes associated with glutathione metabolism) were collected after each increase in selenium concentration, and blood and tissues (for chemical and enzyme analysis and histopathology) were collected at the end of the preliminary study. The primary feeding study was started at Patuxent Wildlife Research Center in January 2004 and completed in May 2004. Eiders were divided into three groups: control (no added Se), low dose (20 ppm Se in feed) and high dose (60 ppm Se in feed). Blood samples were collected and ducks were weighed periodically throughout the study. T-cell function was tested by the phytohemagglutinin skin test and antibody response was measured by the reaction to sheep red blood cell

inoculation. Tissues for selenium analysis and histopathology were collected at the end of the study. Preliminary histopathology indicates that eiders in the high dose group exhibited lymphoid depletion, necrosis in the integument, and vacuolar change in the liver.

**Project Status:** The experimental portion of the study has been completed, the samples have been analyzed, and histopathology has been evaluated. Data analysis and summary is in progress. It is anticipated that a manuscript will be submitted for publication early in 2005.