Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2009 – (October 1, 2008 to Sept 30, 2009)

Project Title (SDJV Project # 120): Energetics and vulnerability to human impacts of molting Surf and White-winged Scoters in the Puget Sound-Georgia Basin

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Project Description

Scoters aggregate during wing molt to a greater extent than at most other times of year, increasing the risk to scoter populations of localized human disturbances. Recent observations indicate that many thousands of scoters molt in the Puget Sound-Georgia Basin (PSGB) of Washington and British Columbia (BC). Many heavily-used molting sites in the PSGB are subject to diverse and extensive human impacts, particularly when compared to molting sites further north. Padilla Bay, a major molting site in Washington, is bordered by two major oil refineries, is subject to extensive diking and dredging that alter food availability, and is open to hunting in mid-October when breeding females may not have completed molt. In BC, many thousands of Surf and White-winged Scoters molt in the Fraser River Delta. Rapid urbanization in the lower reaches of the Fraser River has likely increased contamination in the Fraser River Delta (Hall and Schreier 1996), although related effects on molting scoters and foods on which they may depend are unknown. To clarify the value of coastal molting habitats, we are evaluating the nutritional condition of scoters during molt and thus their vulnerability to human impacts using data available through concurrent studies and comparisons with captive sea ducks. These results are a substantial response to the SDJV priority to **identify and inventory important sea duck coastal habitats**

Study area Our principal study sites for this work are the area extending from the Fraser River Delta south to Boundary Bay in the Strait of Georgia, BC, and Padilla Bay in northern Puget Sound, Washington. These are the dominant molting sites for scoters in this region, with up to 10,000 scoters per year in each site (E. M. Anderson, J. R. Evenson, unpublished data). Concurrent work in SE Alaska is enabling contrasts between regions in terms of energetics of scoters during molt.

Objectives

To better understand the role of the wing molt period in declines of scoter populations, our project takes advantage of existing resources to complement and expand the scope of ongoing studies. All project objectives emphasize comparison between Surf and White-winged Scoters.

Objectives – New studies
Our new studies evaluate scoter condition during wing molt, including especially the vulnerability of scoters to human threats in the PSGB (Fig. 1).

1. Clarify the degree to which proximate environmental factors (e.g., food limitation) versus endogenous regulation affect nutritional condition of molting scoters. To this end, we will compare wild-caught scoters with captive sea ducks in terms of two sets of measures sampled throughout the molt period:
   a. Body mass and growth rates of primary feathers.
   b. Nutritional condition as reflected in concentrations of plasma metabolites (mainly triglycerides, β-hydroxybutyrate, uric acid).
2. To guide protection efforts, we will relate energetic constraints of scoters during wing molt to existing threats to molting habitat in the PSGB. Specifically, we will:
   a. Summarize human impacts to heavily used molting sites in the PSGB.
   b. Contrast estimates of nutritional condition between scoters molting in Alaska versus sites more heavily impacted by humans in the PSGB.
   c. Estimate energetic costs of movements for molting scoters caused by human disturbances.

Objectives – Expansion of ongoing molt studies

3. To complement and expand the scope of ongoing studies in SE Alaska (SDJV project 107) to a continental scale, we will use identical methods of evaluating molting ecology and strategies in the PSGB. Specifically, we will use surveys, captures, and telemetry to measure molt timing and duration, survival, movements, and changes over time in body mass and foraging rates for scoters molting in the PSGB.

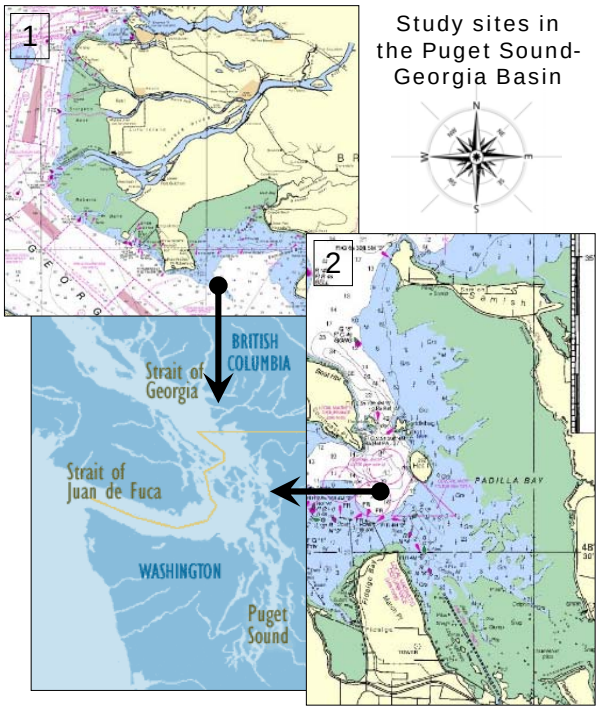

Figure 1. Primary study sites in the PSGB.

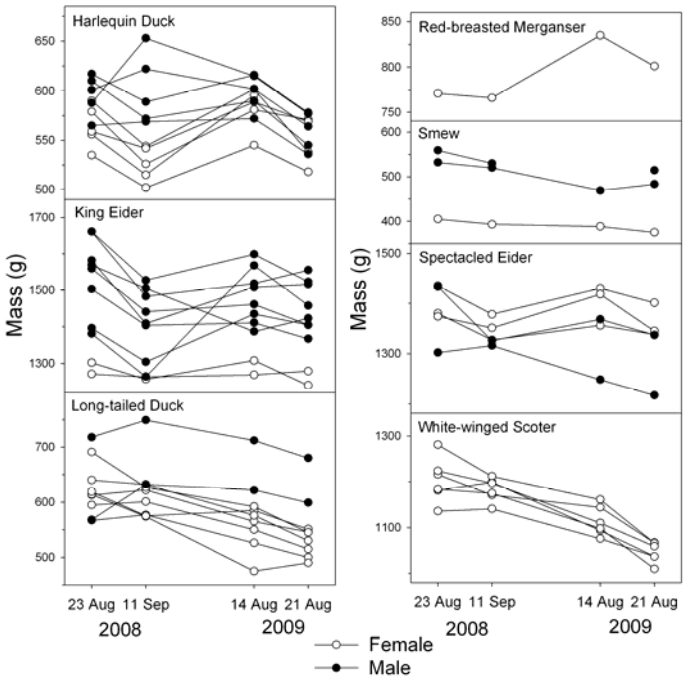

Figure 2. Changes in body mass during wing molt for individual captive sea ducks from which measurements were available for both 2008 and 2009.

Preliminary Results

Scoter captures and tissue sampling During wing molt in 2009, we captured about 500 White-winged Scoters and 1,100 Surf Scoters in the PSGB. We collected blood samples from about 50 individuals of each scoter species for analyses of plasma metabolites, and similar numbers of blood samples were collected by our collaborators in SE Alaska (SDJV project #107). In support of these companion studies based in SE Alaska, we deployed 40 VHF transmitters in our PSGB sites for analyses of foraging behavior and survival; conducted about 150 hours of foraging observations on transmittered scoters; and sampled about 100 primaries for analyses of feather growth rates and stress hormones (all samples were divided about evenly between scoter species).

Measurements of captive sea ducks During wing molt in 2009, we measured 9th primary lengths and mass during two time periods for 171 individuals across 11 species of captive sea ducks. Of these captive sea ducks, we collected blood samples for analyses of plasma metabolites for 12 individuals during each time period. Results from Dry Creek Waterfowl indicate that body mass declines for multiple species of sea ducks during the period of wing

molt, and may differ substantially between years for some species (Long-tailed Ducks, White-winged Scoters) (Fig 2). These results suggest that any observed declines in body mass or nutritional condition of wild caught scoters may not be related exclusively to food limitation. Conversely, preliminary analyses indicate that body mass was more stable during the period of molt for wild scoters versus captive sea ducks, suggesting that environmental factors other than the quantity of food available may entail physiological challenges for captive sea ducks.

Laboratory analyses of scoter tissues For blood samples collected from scoters during wing molt in 2008, we have completed laboratory analyses of plasma triglycerides for 175 Surf Scoters and 56 White-winged Scoters. Controlling for molt stage using 9th primary length, there was no difference in plasma triglyceride levels between molting sites in the PSGB and SE Alaska for either scoter species (both $P > 0.14$). For White-winged Scoters in SE Alaska and for both scoter species in the PSGB, plasma triglyceride levels did not vary through the period of wing molt (all $P > 0.18$, Fig. 3). However, for Surf Scoters in SE Alaska, plasma triglyceride levels increased modestly throughout the period of wing molt ($b = 0.003 \pm 0.001$, $P = 0.021$). This may suggest that for Surf Scoters molt latitude affects the timing of reserve acquisition for fall migration, with individuals that molt further north acquiring reserves later during the molt period.

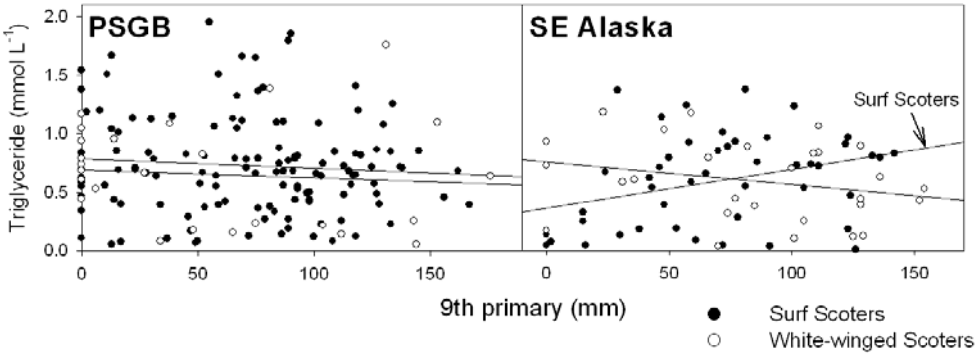

Fig. 3. Levels of plasma triglycerides relative to molt stage (estimated by 9th primary length) for Surf and White-winged Scoters captured in PSGB and SE Alaska molting sites.

Project Status

To date, we have met our projected schedule of accomplishments. In September 2009, we completed a second year of captures of molting scoters in the PSGB, and of captive sea ducks at two facilities in Washington. In each case, we gathered projected numbers of samples of scoter measurements and tissues. Complementary measurements and tissue samples were also gathered from molting scoters in SE Alaska, and we likewise sampled scoter tissues and deployed VHF transmitters in the PSGB in support of SDJV project #107. Laboratory analyses for samples collected from molting scoters in 2008 are complete, and we will complete laboratory analyses for samples collected in 2009 by November 2009. We intend to begin analyses and manuscript preparation by December 2009, including our proposed review of human impacts to PSGB molting sites.

Literature Cited

Hall, K. J., and H. Schreier. 1996. Urbanization and agricultural intensification in the Lower Fraser River valley: impacts on water use and quality. GeoJournal 40:135–146.