Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 05 – (October 1, 2004 to Sept 30, 2005)

Project Title:
Evaluating Effects of the Shellfish Industry on Scoter Populations in Coastal British Columbia

Project Number: 15

Principal Investigator(s) ***(name, affiliation, mailing and email address):***
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Partners (*anyone else providing some kind of support)*:
US Fish and Wildlife Service, US Geological Survey, Nestucca Oil Spill Fund, NSERC Strategic Grant

Project Description (*issue being addressed, location, general methodology)*:
Coastal British Columbia supports important concentrations of surf scoters and white-winged scoters. The habitats used by scoters also support shellfish aquaculture, an industry that has the potential to expand dramatically. Our research investigates the interactions between scoter populations and the shellfish industry, with the intent of evaluating potential effects, either detrimental or beneficial, of shellfish aquaculture on scoter population sustainability, at local and regional scales and short- and long-term time frames.

The research is designed to use several approaches at three coastal sites (Baynes, Barkley, and Desolation Sounds) to: (1) answer questions about basic scoter biology that will indicate potential mechanisms by which shellfish aquaculture (or other activities) could have population-level effects, (2) directly evaluate relationships of shellfish aquaculture to behaviour, survival, and habitat quality, (3) provide information necessary to set appropriate management goals for scoters, and (4) provide implications for management of shellfish aquaculture optimizing long-term sustainability of both the industry and scoter populations.

Specific research directions include: (1) documenting scoter abundance and distribution in relation to habitat attributes, proximity to shellfish aquaculture, and seasonal and annual variation, based on intensive surveys and habitat sampling; (2) describing movements and foraging behaviour of radio-marked individuals; (3) quantification of survival rates of radio-marked birds; (4) evaluation of various radio-marking packages on scoters; and (5) describing scoter trophic interactions with their primary prey.

Objectives *(should identify how the project addresses SDJV priorities*):

This work will lead to a clearer understanding of non-breeding biology of these poorly studied species, as well as an explicit conclusion about the population-level effects of shellfish aquaculture. Further, this work will allow us to estimate effects of other forms of habitat change.

Preliminary Results:
Findings and results to date include:

We have collected data over 4 winters (2001-02 through 2004-05) at several sites throughout the Strait of Georgia, British Columbia, including Baynes Sound, Malaspina Inlet, and Barkley Sound, which represent an array of habitats and intensities of aquaculture activity.

Our broad suite of research activities included measurement of: changes in scoter abundance over time, habitat affiliations, diet, prey availability, foraging behavior, energetics, survival, and movements. We contrasted our findings with a priori predictions under scenarios of negative, neutral, and positive effects of aquaculture.

Our main study site, Baynes Sound, is characterized by broad, soft-substrate tidal flats; shellfish farming in the area consists primarily of beach-cultured clams, with some deep-water oyster culture. We found that numbers of scoters had more than doubled since 1980-81; however, much of this increase was likely in response to the invasion of the varnish clam in the 1990s. Habitat associations of both scoter species were related primarily to environmental factors, and not to clam-farming activities. Scoters fed almost exclusively on clams, mainly varnish clams and the cultured manila clam, and scoters depleted standing stocks over winter by approximately 20 percent. Scoter foraging effort was largely independent of clam densities and estimates of average time spent foraging was less than 25%. Movement data indicated surprisingly small home ranges, with most individuals remaining on a single tidal flat through winter. Taken together, the weight of evidence indicates that clam-farming at this site was neutral or perhaps even beneficial for scoters. Although clam farmers use anti-predator netting to exclude scoters from part of the intertidal zone, overall clam availability may actually be increased through movement and reproduction of clams from under the nets.

Our second study site, the Malaspina Complex, is a rocky, fjord-like inlet. Most shellfish aquaculture involves deep-water oyster culture, although off-bottom mussel culture is gaining popularity. Surf scoters, the only scoter present in large numbers, feed primarily on mussels. Scoter numbers were positively related to shellfish aquaculture operations, particularly in early winter. Scoters consumed naturally-recruited mussels from aquaculture structures, the most abundant and profitable food resource in the area. Once mussels were mostly depleted from aquaculture structures, numbers of scoters decreased as they dispersed from the study area or moved into intertidal foraging habitats. These data suggest that scoters benefit from presence of aquaculture structures in this area.

We conclude that shellfish aquaculture represents a positive or, at least, neutral habitat change for scoter populations. We suspect that wintering scoters in the Strait of Georgia

have redistributed as aquaculture has become more common in several areas. We caution that changes in the intensity or practices of the industry could change this relationship.

Project Status ***(e.g., did you accomplish objectives, encounter any obstacles, do you have plans for the future?)***

Data collection has been completed, and we are in the process of analyzing data and writing up results. To date, the following papers have been published or accepted, with several others to be submitted soon:

ˇydelis, R., D. Esler, W. S. Boyd, D. Lacroix, and M. Kirk. 2006. Habitat use by wintering surf and white-winged scoters: effects of environmental attributes and shellfish aquaculture. Journal of Wildlife Management: in press.

Lewis, T. L., D. Esler, and W. S. Boyd. 2006. Sea ducks are significant predators in soft-bottom intertidal habitats: effects of predation by wintering Surf Scoters and White-winged Scoters on clam abundance. Marine Ecology Progress Series: in press.

Iverson, S. A., W. S. Boyd, D. Esler, D. M. Mulcahy, and T. D. Bowman. 2005. Comparison of the effects and performance of four radio transmitter types for use with scoters. Wildlife Society Bulletin: in press.

Lewis, T. L., D. Esler, W. S. Boyd, and R ˇydelis. 2005. Nocturnal foraging behavior of wintering surf scoters and white-winged scoters. Condor 107:636-646.

Lacroix, D.L., W. S. Boyd, D. Esler, M. Kirk, T. L. Lewis, and S. Lipovsky. 2005. Surf scoters aggregate in association with ephemerally abundant polychaetes. Marine Ornithology: in press.