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

**Project Title (SDJV Project #62):** The Value of Herring Spawn vs. Alternative Prey to Surf Scoters (SUSC) and White-winged Scoters (WWSC) in the Puget Sound-Georgia Basin (PSGB)


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**Figure 1.** SUSC consuming herring spawn on SE Vancouver Island, B.C.

**Project Description**

Pacific scoters and other sea ducks congregate in dramatic numbers each spring to consume herring spawn. The critical question is, does spawn availability affect population trends because alternative prey are inadequate? In the PSGB, spawning stocks have declined substantially over time, including spatial and temporal reductions in spawning activity in the Strait of Georgia and a 94% decline in spawn biomass in the dominant spawning stock in Puget Sound. For Surf Scoters (*Melanitta perspicillata*) and White-winged Scoters (*Melanitta fusca*), we are assessing (1) whether nutrient acquisition is related to variation in spawning activity, and (2) whether alternative prey at key winter foraging sites are inadequate to meet the needs of scoters when spawn is less available.

**Objectives**

The following objectives are a substantial response to the SDJV priority to **identify and inventory important sea duck coastal habitats** because few studies have considered winter habitat requirements beyond food habits.

At the ***Local Scale***, we are evaluating:

1. Changes in size-adjusted body mass of scoters (a measure of fat acquisition) relative to proximity and timing of spawning events.
2. The dietary source of scoter reserves, based on stable isotopes and fatty acids, to assess (a) the significance of scoter consumption of spawn to changes in stored reserves and (b) the foraging locations of scoters prior to settling on PSGB spawning grounds (i.e., migrant status).
3. As criteria for evaluating the ability of alternative prey to meet the needs of scoters when spawn is less abundant, we will use changes of prey density in benthic surveys and bioenergetics models to estimate seasonal declines in (a) scoter prey and (b) scoter carrying capacity in important winter habitats.

At the ***Regional Scale*** we are using shoreline surveys (and telemetry of individual scoters via collaborators), to compare seasonal shifts in distributions of scoters to:

4. Changes in standing stocks of scoter prey at our study sites.
5. The timing, duration, biomass deposition, and location of herring spawning events.

## Preliminary Results

**Table 1**. Summary of data collected 2003-2005. SDJV funds enabled needed replication of scoter censuses and prey analyses in 2004-05.

| ***Data Description*** | ***Collection Times*** | ***Number of Samples*** | ***Data Use*** |
|---|---|---|---|
| Scoter captures<br>*(only B.C. noted here)* | 4 weeks in 2002-03<br>10 weeks in 2003-04 | 93 SUSC, 132 WWSC<br>266 SUSC, 263 WWSC | Evaluate role of spawn consumption in building fat reserves for SUSC vs. WWSC; related diet analyses |
| Scoter censuses<br>*(Puget Sound)* | Jan-May 2004<br>Jan-May 2005 | weekly at 12 spawning areas<br>weekly at 12 spawning areas | Assess influence of spawn characteristics on aggregative response of SUSC vs. WWSC |
| Scoter prey<br>*(3 Puget Sound sites)* | Dec, May, Aug of 2003-04<br>Dec, May, Aug of 2004-05 | 1,728 infaunal, 348 epifaunal<br>1,728 infaunal, 569 epifaunal | Model whether the availability/quality of alternative prey can substitute for declining spawning stocks |
| Scoter dive cycles<br>*(5-min focal animal)* | Nov, Feb, Apr 2003-04<br>Nov, Feb 2004-05 | 799 SUSC, 592 WWSC<br>900 SUSC, 551 WWSC | Use in above model to describe scoter effort in obtaining prey |

1. The number of scoters that aggregate at a spawning area is mainly related to the biomass of spawn available, though factors such as the timing, duration, and location of the spawning event are also important.
2. Though both scoter species appear to benefit from spawn consumption (see below), SUSC aggregate to much greater extents than WWSC at spawning areas. Just days after spawn initiation at larger spawning areas in Puget Sound, **SUSC numbers increased by 500-1500%, though increases at spawning events that are smaller or have collapsed were often negligible**. Censuses, diet analyses (using stable isotope and fatty acid analyses – Figure 2), as well as related telemetry results strongly suggest that SUSC travel greater distances to reach spawning events than WWSC.
3. Both **SUSC and WWSC increased fat stores by 12-15% within days to weeks of consuming spawn** (Figure 3). Scoter collections on spawning areas in SE Alaska in the spring of 2005 indicate that SUSC continue to build reserves throughout spring migration. Initiation of spawning events is progressively later at higher latitudes. We are analyzing tissues with longer turnover times and collaborators are using results of telemetry efforts to evaluate our conjecture that **many SUSC build reserves for migration and perhaps reproduction by tracking these spawning events at the continental scale**.

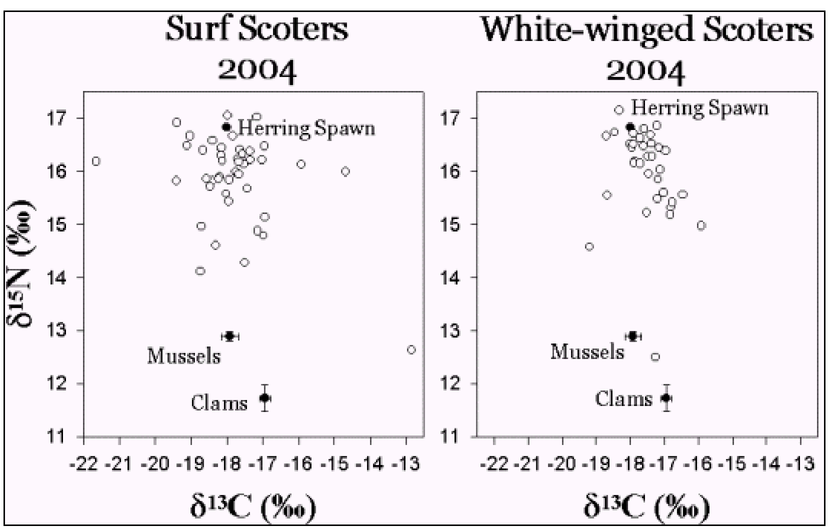


**Figure 2.** $^{15}$N and $^{13}$C isotopic analyses of common prey items and scoter blood plasma (open circles) for scoters captured throughout the 2004 period of spawn on SE Vancouver Island, B.C. SUSC travel greater distances to reach spawning events, as supported by their more variable isotopic signatures (with no indication of non-spawn foods in feces) and corroborated by related census and telemetry efforts.

4. Our preliminary data, as well as data from other wintering locations of scoters on the Pacific Coast, indicate that **standing stocks of key bivalve prey decline over winter**. Thus, spawn may be a critical supplement to alternative prey for spring conditioning of scoters.
5. In this and our related studies, we are defining the **unique seasonal requirements of SUSC vs. WWSC** as a basis for developing individual strategies for monitoring and protection. In addition to spawn, our related work indicates that many SUSC appear to rely for spring conditioning and molting on abundant epifaunal prey in eelgrass habitat. Thus, documented declines in both spawn and eelgrass habitat may have contributed to unique population trends: **since the 1970s, WWSC have increased by 30% and SUSC have declined by 45% in northern Puget Sound** (J. L. Bower, unpublished data).

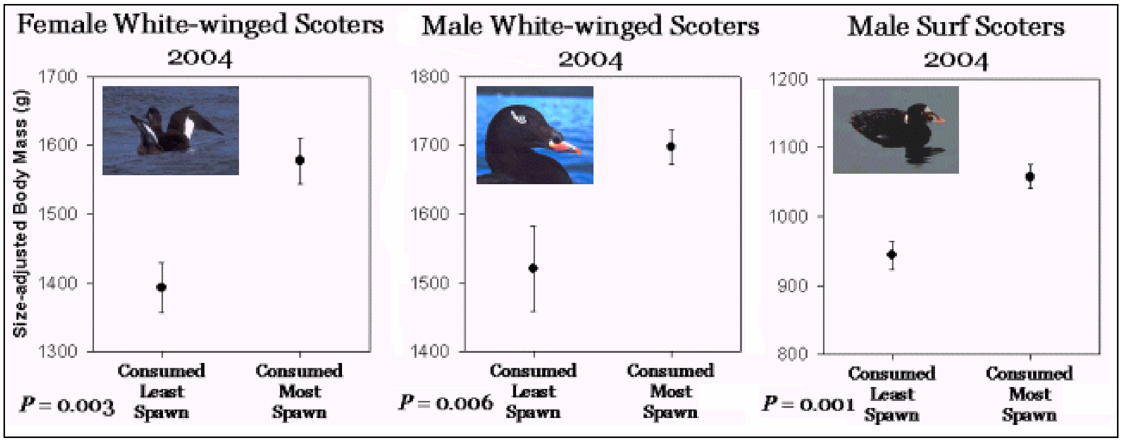


**Figure 3.** For all cohorts, scoters that had recently consumed relatively more spawn (based on statistical comparisons of stable isotopes from scoter blood plasma and spawn) had built greater reserves as measured by size-adjusted body mass. Fatty acid signatures of scoter adipose depots verify that spawn was the primary source of these greater reserves. All birds are after hatch year in age and too few female SUSC were captured to include in these analyses.

## Project Status

We completed principal fieldwork in August of 2005 and intend to complete all laboratory analyses by August of 2006. A full-time laboratory technician has processed about 60% of 4,373 samples of benthic prey collected from 2003-2005. Approximately 35% of stable isotopes from scoter blood and prey (about 600 samples total) and 30% of fatty acids from scoter adipose and prey (about 300 samples total) have been processed. We plan to complete final analyses and submit related manuscripts by August 2007. This schedule is about 6 months later than we had previously planned due to (1) the addition of related work on spawning grounds in SE Alaska and (2) more extensive benthic sampling at our key winter foraging sites in Puget Sound.