Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2007 – (October 1, 2006 to Sept 30, 2007)

Project Title (SDJV Project #65): Spring Migration of Surf Scoters Along the Pacific Coast: Important Habitats and Energetic Implications

YEAR 3 of a 3 YEAR STUDY

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Project Description
Although Pacific Surf Scoters have been the subject of a growing body of research during winter, little is known about their spring migration ecology. Spring migration conditions can have important implications for waterfowl productivity, and habitat conditions and nutrient reserve levels during spring migration have been implicated as important factors affecting broad-scale and long-term population declines. An important part of establishing connectivity and cross-seasonal effects through the annual cycle is the determination of distributions and habitat requirements at critical annual cycle stages. Satellite and VHF transmitters have been deployed on Surf Scoters across their Pacific wintering range, including Baja California Mexico, San Francisco Bay, Puget Sound, and the Strait of Georgia. As part of a collaborative study of Surf Scoter spring migration ecology, we are using a combination of satellite telemetry, radio telemetry, and surveys to document spring distributions of Pacific Surf Scoters throughout Southeast Alaska, with a focus on identifying important stop areas and associated habitat attributes. We also collected birds to obtain information on spring energetics. In this document, we describe the findings from the final year of this 3-year project.

Objectives

This project has several objectives: (1) to identify important Surf Scoter late spring migration stop areas, (2) to identify habitat attributes that correspond to identified important areas (e.g. herring spawn events, bathymetry, substrate type), and (3) to relate the spatial and temporal use of these sites to their habitat attributes. This project has direct implications for the identification of important coastal habitats – a high priority in the SDJV Strategic Plan. In addition, this work will contribute to studies of body mass variation in relation to areas (e.g., San Francisco Bay and Strait of Georgia), seasons (late winter, pre-migration, migration), and spawn occurrence, as well as to studies of the cross-seasonal persistence of contaminants in Surf Scoters. Our studies will provide an important link for understanding nutritional status and relationships among wintering, migrating, and breeding areas.

Preliminary Results

Identifying Important Stop Sites

This project relies on satellite telemetry data from cooperators all along the Pacific coast. This broad deployment allows for strong inferences about migration strategies of Pacific Surf Scoters in general, rather than just those from any particular wintering site. Table I shows the number of satellite transmitters (75 total) deployed by wintering site over the past several years. Transmitters that were not active throughout the spring migration period are not included in the deployment numbers. Individuals that did not migrate along the coast (i.e. migrated inland directly from the wintering area) were not included in stop site analyses.

Table I. Number of satellite transmitters (PTTs) deployed in Pacific Surf Scoters in 2003, 2004, 2005, and 2006. Transmitters that did not leave wintering areas are not included. Numbers in parentheses denote the total number of birds used for migration stop site analyses.

Wintering Site	Partner	2003	2004	2005	2006
Strait of Georgia, BC (**SG**)	CWS/SFU	0	0	8(5)	0
Puget Sound, WA (**PS**)	WDFG	0	7(2)	16(5)	11(7)
San Francisco Bay, CA (**SFB**)	USGS	8(5)	0	9(2)	11(8)
Baja California, Mexico (**BSQ**)	USGS - ASC	0	0	2	3(3)
	Total	**8(5)**	**7(2)**	**35(12)**	**25(18)**

We used satellite transmitter location data from all study years to identify migration stop events within Southeast Alaska. A migration stop event was defined as a series of at least two consecutive location days by an individual within 22 km of each other (based on the scale of movements by pre-migratory Surf Scoters). We determined an area of use for each migration stop event, and used these areas of use to identify important stop sites, defined as sites (within a 5 km radius) used as a migration stop by at least two individuals at any time during the study period. A total of 72 migration stop events in Southeast Alaska were documented for 37 individual satellite-marked Surf Scoters. We identified 14 important stop sites within Southeast Alaska (Figure 1), which were used by 35 individual satellite-marked scoters in 62 migration stop events.

Important stop sites were identified at Northern Lynn Canal, Berners Bay, Eagle Harbour, Stephens Passage, Gastineau Channel, Young Bay, Tracy Arm, Seymour Canal, Hobart Bay, Vixen Inlet, West Behm Canal, Klawock Inlet, and Annette Island. The area of Northern Lynn

Canal, including Chilkat Inlet, Chilkoot Inlet, and Taiya Inlet, was identified as a single important stop site although it did not strictly meet our criteria. We were unable to identify a distinct 5 km radius important stop site in this area due to the very high number of overlapping areas of use (22 migration stop events, 17 individuals). Given the apparent intense use of this area, we considered the entire area a single important stop site. Radio-telemetry and survey data from previous years support the conclusion that Northern Lynn Canal is a heavily used and important stop area for spring-migrating Surf Scoters.

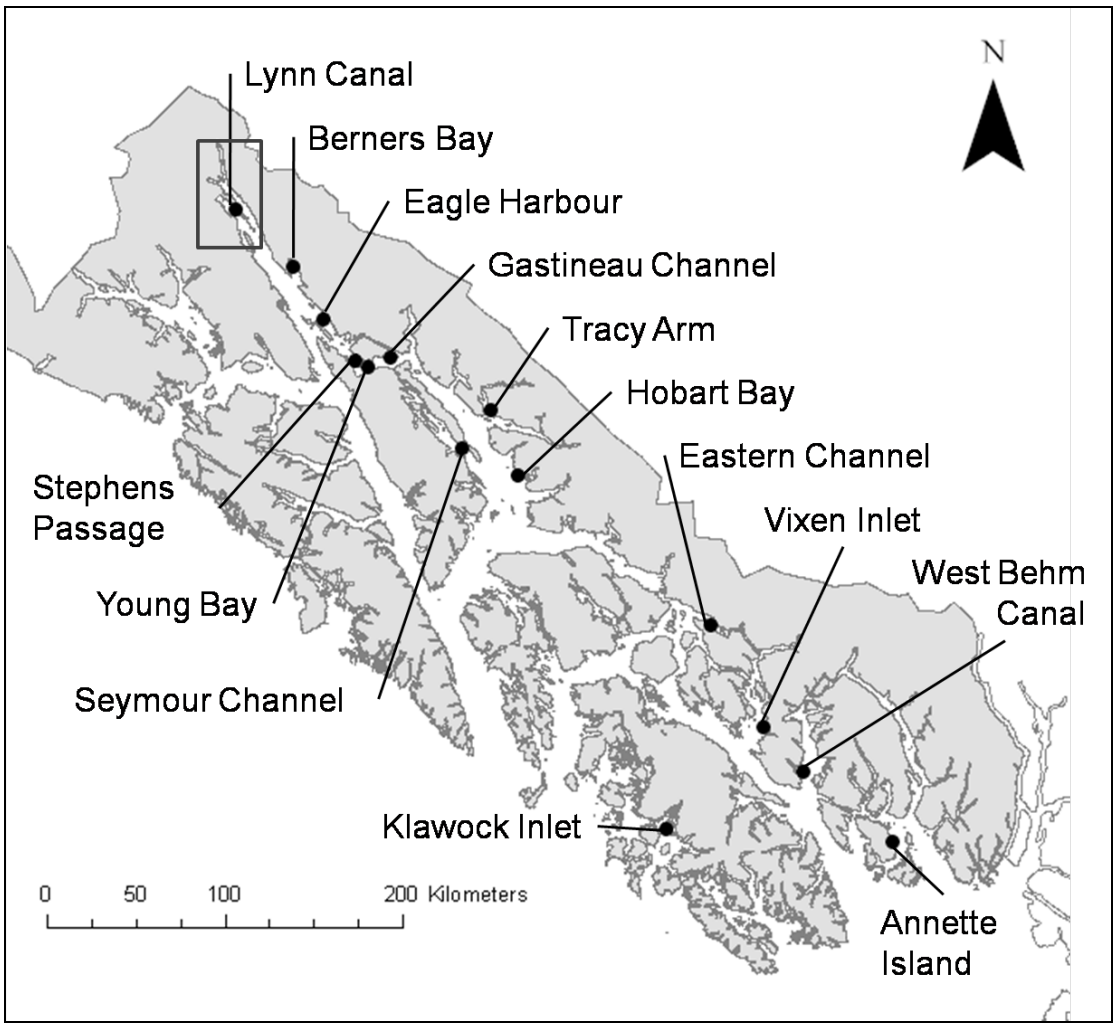

Figure 1. Important stop sites of satellite-marked spring migrating Surf Scoters in Southeast Alaska, 2003 – 2006. The box highlights northern Lynn Canal, which appears to be an exceptional stop area within Southeast Alaska.

Habitat Attributes of Important Stop Sites

We assembled Geographic Information System (GIS) data on shoreline habitat features of Southeast Alaska that we considered to be potentially important predictors of Surf Scoter stop site use. Shoreline habitat data were obtained from a shoreline ecosystem database compiled by

The Nature Conservancy. This dataset characterizes shoreline habitat within Southeast Alaska using information from multiple sources, and integrates information about the physical characteristics, wave exposure, and bathymetry of the study area shoreline. In addition, we compiled the distribution of major herring spawn locations in 2003-2006 from the Alaska Department of Fish and Game and combined these distributions into a single layer representing herring spawn distribution within all study years. Preliminary analyses indicate differences in the habitat attributes of important stop sites in comparison to randomly selected sites (Table II). We used logistic regression models to evaluate the use of stop sites in relation to habitat characteristics and an information theoretic approach to model selection to calculate Akaike's Information Criterion adjusted for small sample sizes (AIC_c) for each model within a candidate set. Important stopover site use was strongly related to distance from the outer coast and distance from herring spawn. Within the candidate model set, the coast + spawn model best explained stop site use (w_i= 0.97), with no other model receiving strong support.

Table II. Habitat attributes of important stop sites of spring-migrating Surf Scoters in comparison to random sites. Attributes are summarized by 5 km radius plots. Means are reported with 95% CI.

Predictor variable	Units	Stopover site	Random site
Distance to herring spawn	km	8.2 ± 6.2	47.2 ± 7.9
Distance to outer coast	km	88.2 ± 17.8	45.7 ± 9.8
Depth	m	79.5 ± 27.7	79.1 ± 19.8
Width	m	118.6 ± 47.9	153.5 ± 54.6
Length	km	28.9 ± 7.6	40.4 ± 7.9
Substrate	%	48.3 ± 13.9	50.1 ± 7.8
Streams	number	8.5 ± 3.5	19.9 ± 6.1
Exposure index		212.5 ± 17.2	171.1 ± 16.3

Use of Important Stop Sites

Preliminary habitat analyses within Southeast Alaska indicate that the distance to herring spawn is strongly related to the use of an area as a stop site within Southeast Alaska. We are examining the use of herring spawn sites by spring-migrating Surf Scoters along the Pacific coast, in both British Columbia and Southeast Alaska. Satellite telemetry data shows that the northward migration Surf Scoters generally coincides with the northward progression of spawn along the coast (Figure 2). Documented migration stop events also often coincide both spatially and temporally with herring spawn events. Stop site use may have important energetic and productivity implications, as shown by the seasonal mass variation during spring migration (Figure 3). The relationship between stop site use and the presence of herring spawn at these sites gives further support to potential importance of herring spawn as an important energy source during spring migration.

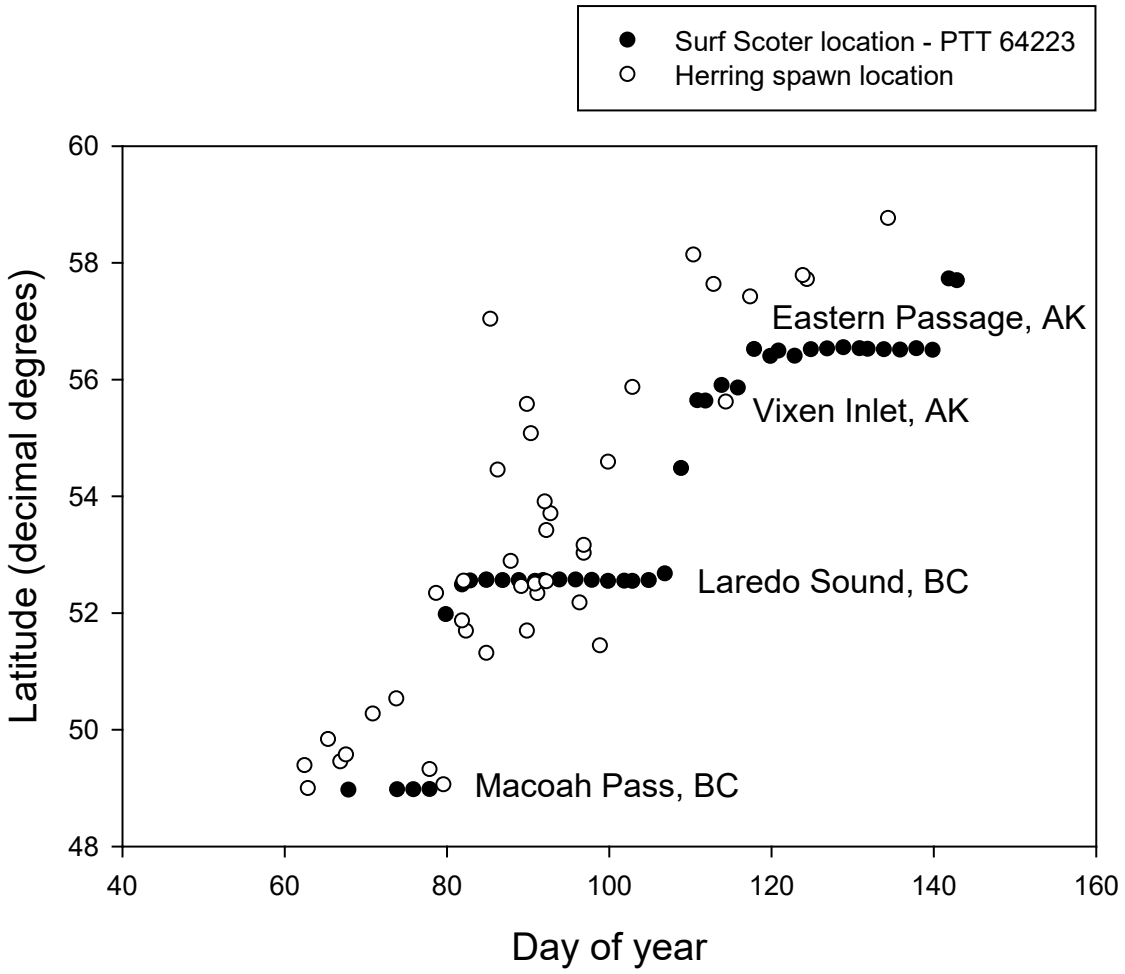

Figure 2. Location and timing of herring spawn events and a single PTT-marked Surf Scoter during spring migration along the Pacific coast from British Columbia to Southeast Alaska, 2006. Note that herring spawn is present for approximately 14 days after the spawn date.

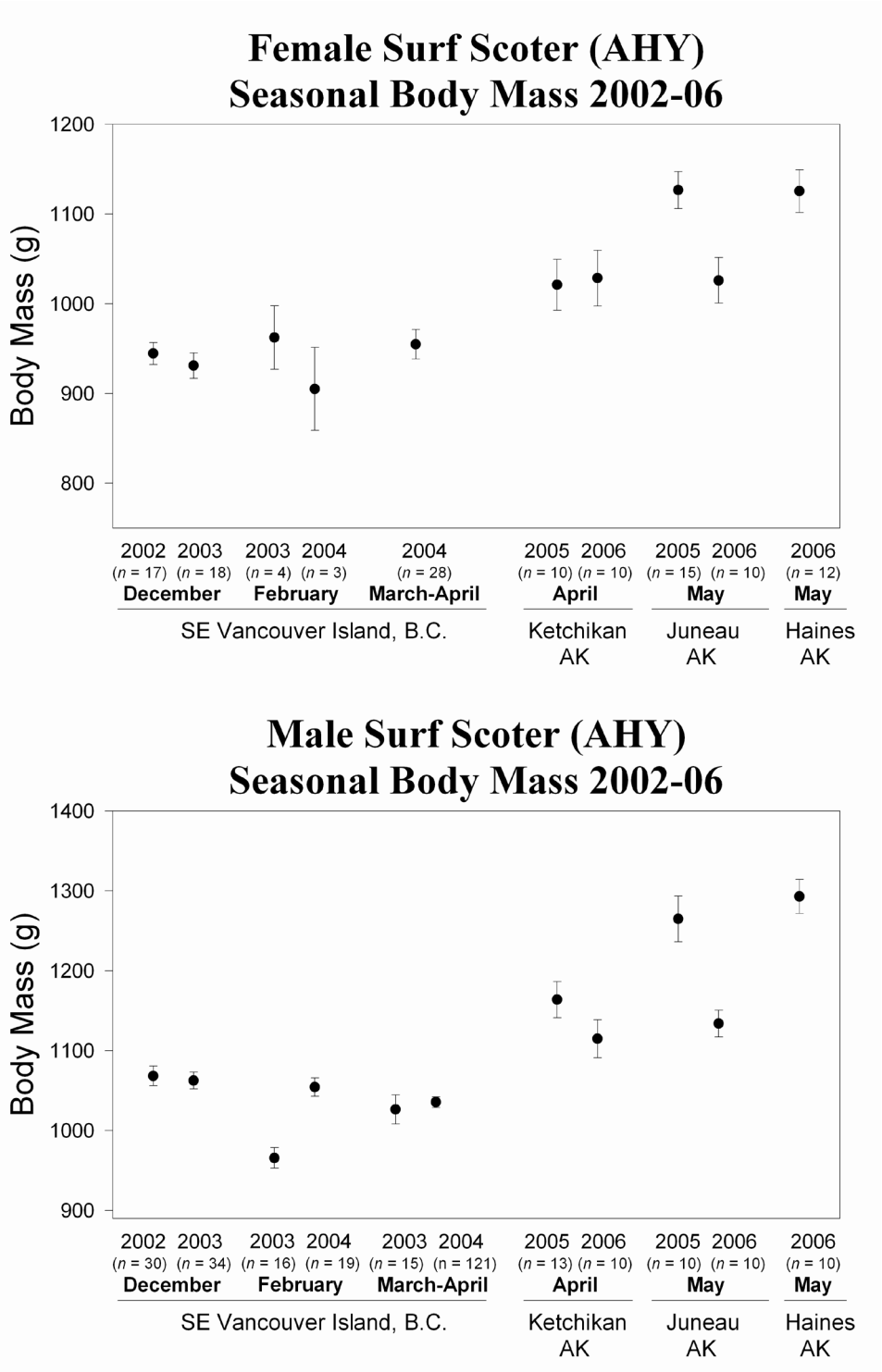

Figure 3. Seasonal body mass variation in female and male Surf Scoters in 2002 – 2006.

Project Status

We have identified important stop areas in Southeast Alaska, and have identified a number of habitat attributes that appear to influence the use of these sites, in particular the proximity to herring spawn events and the distance from the outer coast. The identification of important stop sites, such as Northern Lynn Canal, has direct implications for the identification of important coastal habitats. Overall, this project has greatly added to information about the distribution and habitat requirements of Surf Scoters during spring migration, a potentially critical annual cycle stage.

In the final year of this 3 year project, data from partners is currently being analyzed and written up for incorporation into reports, theses, and publications.

Project Funding Sources (US$).

SDJV (USFWS) Contribution	Other U.S. federal contributions	U.S. non-federal contributions	Canadian federal contributions	Canadian non-federal contributions	Source of funding (agency or organization)
6000					
		5000			UWyoming
	5000				USGS
		5000			Washington DFW
				11600	SFU

Total Expenditures by Category (SDJV plus all partner contributions; US$).

ACTIVITY	BREEDING	MOLTING	MIGRATION	WINTERING	TOTAL
Banding (include only if this was a major element of study)					
Surveys (include only if this was a major element of study)					
Research			**32,600**		