Sea Duck Joint Venture
Progress Report – September 2009

Project Title: Molting ecology of Surf and White-winged Scoters in Southeast Alaska (SDJV Project # 107).

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Project Description:
Although Surf and White-winged Scoters (*Melanitta perspicillata* and *M. fusca*) are being studied at most parts of the annual cycle, the period of wing molt has not been addressed on the Pacific coast. Surveys have shown that at least 185,000 scoters, a sizeable proportion of the Pacific populations of these species, undergo wing molt in SE Alaska. To provide a comprehensive evaluation of the ecology of these sea ducks, and to consider potential constraints on population dynamics, we are conducting research to quantify several aspects of molt ecology. This will provide data to evaluate population dynamics and identify important habitats of these declining species - high priorities in the SDJV Strategic Plan.

Objectives:
Our research addresses the following questions:

1) What is the timing of wing molt and does it vary by species, sex, age, or year?
2) What is the species, sex, and age composition of flocks of molting scoters?
3) How does body mass vary over the wing molt process, after accounting for effects of species, sex, age, date, and year?
4) What is the foraging intensity of scoters during wing molt, relative to during winter? Do they forage nocturnally?
5) What are survival rates during wing molt and do they vary annually?
6) How far do individuals move during wing molt, what habitats do they use, and is there annual variation in movements or habitat use?
7) What proportion of birds marked in the first year of study are recaptured in the second year, and how far from original capture sites are recapture locations?

Preliminary Results:

A second year of field work for this project is currently underway in Upper Seymour Canal on Admiralty Island in Southeast Alaska. Field activities for 2009 began on 27 July and are projected to continue until 27 September.

To investigate the question of chronology of wing molt, scoters were captured during four periods in 2009 totaling 15 days (30 July – 4 August, 12-14 August, 28 August – 1 September, and 12-14 September) with a total of 405 scoters captured. The 2009 captures had only three mortalities, a reduction from 2008, when there were six mortalities amongst 310 captured birds. In 2009, there was one within-year recapture, of a second year female White-winged Scoter that had been first captured 4 days earlier. There were no between-year recaptures.

All scoters were identified to species. Sex was determined based on plumage and cloacal characteristics, and age class was estimated based on bursal depth. We measured morphometric features (diagonal tarsus, culmen, bill width, and feather-free bill on SUSC) as well as wing attributes (wing chord and ninth primary length) to determine stage of wing molt. Feather wear of individuals with fully grown wings was used to determine whether the primaries had been molted recently. Finally, body mass was measured (± 1g) on an electronic scale to allow consideration of variation in mass in relation to stage of molt, species, age, and sex. All data are referenced to a uniquely-numbered metal tarsus USFWS band attached to each captured scoter. To address questions concerning survival, movements, and foraging effort during the period of wing molt, VHF radio transmitters were deployed on 53 individuals (Table 1). Scoters with transmitters were monitored in the intervals between the capture periods. Feather and blood samples were collected from a subset of the captured scoters, for stable isotope, plasma metabolite, and contaminant analysis.

Table 1. Scoters captured and marked with VHF radio transmitters in Seymour Canal, Alaska, 2009.

	SUSC female	SUSC male	WWSC female	WWSC male	Total
# captured	102	228	15	60	**405**
# radios deployed	21	12	7	13	**53**

Among scoters with transmitters attached, three mortalities have been confirmed (as of September 19). Mortalities were all Surf Scoters, two second year females and one ATY male. The females survived at least 4-5 days post-capture. Mortality signals for the females were then heard 6 and 8 days post-capture, respectively. One appeared to be eaten by a mammalian predator and one by an avian predator. We could not determine whether the birds were killed by a predator or if they died and were subsequently scavenged. All other radio-marked individuals are being monitored for the duration of the field season or until the individuals leave the study area.

To date, 350 hours of diurnal foraging observations, 40 crepuscular observations (both dawn and dusk) and 50 nocturnal observation periods have been recorded. Very little diving activity during the crepuscular and nocturnal periods has been observed to date, with the vast majority of foraging activity occurring between sunrise and sunset. Foraging observations are ongoing.

Surveys are also being conducted throughout the season to determine total numbers of scoters in Seymour Canal, as well as species and sex composition of flocks. Numbers in 2009 have been very similar to 2008. Our first census in 2009 was conducted early than the first in 2008, and we found only 7400 scoters in Upper Seymour Canal on 28 July. By 6 August, the total number of scoters in the study area had increased to 16 500 (16 000 were counted on 4 August, 2008), and then dropped to 12 800 by 26 August. A count on 7 September found just over 8000 scoters still present in the area. One more count will be completed before 28 September, weather permitting.

Species and sex composition were surveyed in a subsample of flocks during each census count. Male Surf Scoters were most abundant and female White-winged Scoters were least abundant in all surveys. Throughout the season, the proportion of females increased as well as the proportion of White-winged Scoters. In late July, the flocks observed were composed of 85% male Surf Scoters and by late August this proportion had decreased to 75%. The proportion of female Surf Scoters increased from 10 to 15% during the same interval and male White-winged Scoters also increased, from 5 to 10%. Female White-winged Scoters only account for approximately one percent the study population (although 3.7% of the captured scoters were female WWSC).

As the field season is still in progress, further data summaries and analysis from 2009 will be provided in the 2010 final report.

2008 Data Summaries:

Wing Molt Chronology: Wing molt initiation dates were back-calculated for each individual scoter from the length of the right 9th primary feather at time of capture. Estimates of feather growth rates were based on captive scoters and within-year recaptures of scoters in Puget Sound-Georgia Basin. With molt initiation date as the response variable, a candidate model set was created with species, location and cohort (sex/age class) as the explanatory variables. The candidate model set included all additive combinations of the explanatory variables and all two-way interactions. Generalized linear models with an information-theoretic approach were used to evaluate these candidate models, and the top supported models indicate that all the explanatory variables tested affect wing molt initiation dates (Table 2).

Table 2. General linear model results assessing variation in wing molt initiation dates for Surf and White-winged Scoters molting in SE Alaska and Puget Sound-Georgia Basin; the top two best-supported models and the null model are shown.

Model	No. Parameters	ΔAIC_c	AIC_w
Sp + Loc + Cohort[a] + Sp x Loc + Sp x Cohort + Loc x Cohort	14	0.00	0.77
Sp + Loc + Cohort + Sp x Cohort + Loc x Cohort	13	2.47	0.22
Null	2	1710.11	0.00

Note: [a]Cohort is a combination of sex and age class (second year or after second year)

In general, there were wide ranges of wing molt initiation dates in almost all cohorts (excepting adult White-winged Scoter females in SE Alaska, where n=2) (Table 3). Mean initiation dates for most cohorts were earlier in SE Alaska than in Puget Sound-Georgia Basin by 5-24 days, depending on cohort. Mean initiation date of wing molt was about 20-35 days later for adult female Surf Scoters than for males or subadults, in both study sites.

Table 3. Dates of initiation of wing molt in White-winged and Surf Scoters in Southeast Alaska and Puget Sound-Georgia Basin (SY= second year, ASY=after second year, se=standard error).

			SE Alaska			Puget Sound-Georgia Basin		
Species	**Sex**	**Age**	**Mean initiation**	**se**	**Range**	**Mean initiation**	**se**	**Range**
WWSC	M	SY	21-Jul	1	8 Jul - 7 Aug	30-Jul	2	18 Jul - 12 Aug
	F	SY	26-Jul	1.2	16 Jul - 1 Aug	25-Jul	4.9	27 Jun - 6 Aug
	M	ASY	24-Jul	1	7 Jul - 17 Aug	02-Aug	0.7	28 Jun - 29 Aug
	F	ASY	20-Jul	0.8	19 Jul - 21 Jul	13-Aug	2.3	28 Jul - 2 Sept
SUSC	M	SY	12-Jul	0.9	1 Jul - 29 Jul	17-Jul	0.9	28 Jun - 4 Sept
	F	SY	24-Jul	3.9	5 Jul - 4 Sept	30-Jul	2	20 Jun - 6 Sept
	M	ASY	20-Jul	1	27 Jun - 22 Aug	04-Aug	0.9	4 Jul - 13 Sept
	F	ASY	18-Aug	4.9	14 Jul - 8 Sept	25-Aug	0.4	6 Jul - 22 Sept

Body mass variation: No strong correlations between body mass and 9th primary growth were found in molting scoters in SE Alaska (Figures 1 and 2). Mass did decline slightly with increasing 9th primary length in the subadult cohorts of both species and there was a slight upward trend in body mass in adult female Surf Scoters, but these trends are far from significant. Moreover, body mass during wing molt is as high (or higher) than it is during other phases of the annual cycle (D. Esler and S. Slattery, unpubl data) (Table 4).

Figure 1. Body mass (g) in relation to length of 9th primary (mm) in Surf Scoters molting in SE Alaska in 2008.

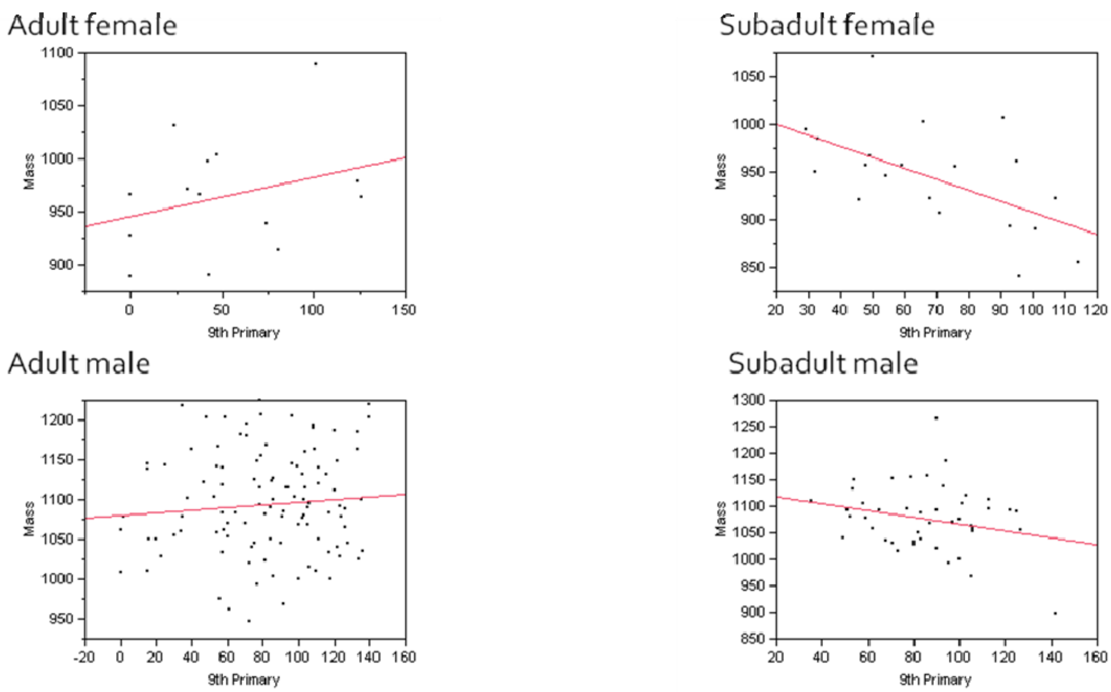

Figure 2. Body mass (g) in relation to length of 9th primary mm) in White-winged Scoters molting in SE Alaska in 2008.

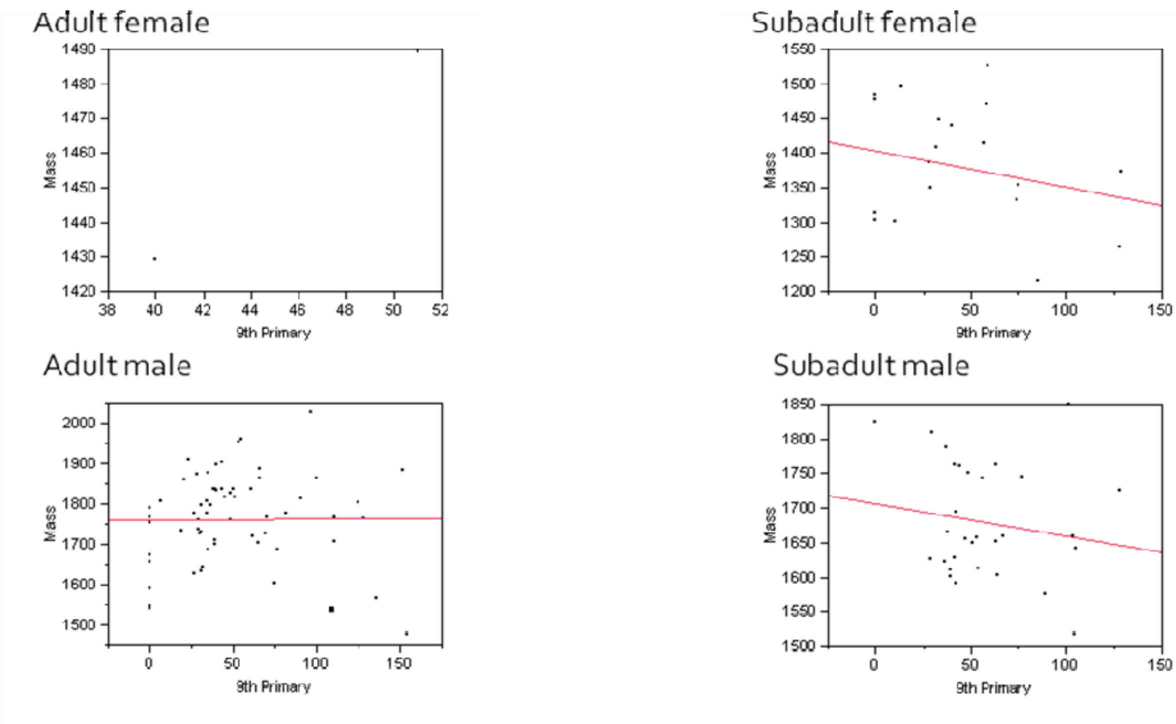

Table 4. Mean mass of Surf and White-winged Scoters during breeding, wing molt, and winter in the Northwest Territories (NWT), SE Alaska (SEAK), Puget Sound-Georgia Basin (PSGB), British Columbia (BC), and Baja California (BAJA). Highlighted rows indicate birds undergoing wing molt.

		SUSC				WWSC			
		Female		Male		Female		Male	
Site	Season	Subadult	Adult	Subadult	Adult	Subadult	Adult	Subadult	Adult
NWT	June (egg)[a]						1530		1564
NWT	June (non-egg)[a]						1298		1494
SEAK	Jul-Sept	944	965	1075	1100	1381	1459	1680	1752
SEAK	Nov-Dec	873	970	1001	1105				
PSGB	Jul-Sept	934	941	1066	1066	1438	1476	1705	1729
BC	Nov-Dec	909	945	1000	1064	1328	1404	1477	1573
BC	Feb		920	991	1012				
BC	Mar-Apr	802	862	925	968	1306	1379	1452	1553
BAJA	Nov-Dec	841	876	957	1005				
BAJA	Feb	832	914	944	1077				
BAJA	Mar-Apr		1113	984	1298				

Note: [a]Egg and non-egg indicate whether or not females were producing eggs at time of capture, based on vitellogenin levels in blood samples.

Foraging effort: Foraging effort was assessed by monitoring scoters that were tagged with VHF transmitters. Dives are easily detected and quantified by recording when a bird's signal disappears and reappears. Hourly foraging effort is defined as minutes spent underwater per hour. Preliminary summaries of these data indicate that during wing molt females of both species seem to be spending more time foraging than do males (Table 5). This is in contrast to studies of Surf and White-winged Scoter foraging behavior in British Columbia during the winter, which found little evidence for differing foraging rates between sexes (Kirk *et al.* 2007 and Lewis *et al.* 2008). Hourly foraging rates for Surf Scoters in SE Alaska were very similar during wing molt and winter (C. VanStratt, unpubl. data), and are slightly lower than the rates observed in British Columbia during winter. However, for female White-winged Scoters, foraging rates appear to be higher during molt than during winter. Further analysis of this data will take into account stage of feather re-growth, environmental variables (tide, weather, and wind conditions), and decreasing day length during the wing molt period.

Table 5. Time underwater (min/hr) during diurnal observation periods for scoters in SE Alaska (SEAK), Puget Sound-Georgia Basin (PSGB), and southern British Columbia (Malaspina and Baynes) during wing molt and winter.

		SUSC		WWSC	
		Female	**Male**	**Female**	**Male**
SEAK	Molt	10.5	7.3	18.0	9.2
PSGB	Molt	10.0	5.1		
SE Alaska	Winter	10.4	7.4		
Malaspina	Winter	11.7			
Baynes	Winter	12		13	

Project Status:

With the conclusion of this field season, the planned two years of field work on scoter molting ecology in SE Alaska will be complete. This study is one of the first detailed examinations of scoter molt ecology on the Pacific coast of North America and, in conjunction with the work currently in progress in Puget Sound-Georgia Basin, will answer some basic questions regarding chronology of molt, molting flock composition, foraging behavior, movements, and survival rates. Rian Dickson will continue with further data analysis in 2009-2010, and is expected to complete her MSc. in 2010. In addition to production of a thesis, papers based on this study will be prepared for publication.

Literature cited:

Kirk, M., D. Esler, and W. S. Boyd. 2007. Foraging effort of Surf Scoters (*Melanitta perspicillata*) wintering in a spatially and temporally variable prey landscape. Canadian Journal of Zoology 85:1207-1215.

Lewis, T. L., D. Esler, and W. S. Boyd. 2008. Foraging behaviours of Surf Scoters (*Melanitta perspicillata*) and White-winged Scoters (*M. fusca*) in relation to clam density: inferring food availability and habitat quality. Auk 125:149-157.

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 (name of agency or organization)
$30,470	$13,000 (10K FWS)				SDJV, USFS, USFWS
	$62,860				USGS
				$30,000	SFU

Total Expenditures by Category:

ACTIVITY	BREEDING	MOLTING	MIGRATION	WINTERING	TOTAL
Banding					
Surveys					
Research		**$136,320**			