Sea Duck Joint Venture
Annual Project Summary for Endorsed Projets
FY 2007 (October 1, 2006 to September 30, 2007)

Project Title: Population delineation, winter/spring habitat use, and winter ecology of Pacific Surf Scoters (*Melanitta perspicillata*) from the southern portion of their winter range (SDJV Project # 63).
YEAR 2 of a 3-YEAR STUDY

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Project Description:
Aerial surveys suggest that numbers of breeding scoters in interior Alaska, the Yukon Territory and Northwest Territories have steadily declined since 1978 (Hodges 1996). The true extent of these declines and the population segments to which they apply are unknown because of a lack of information on the timing of movements and affiliations between wintering, breeding and molting areas. Further, little is known about scoter winter ecology, including habitat selection factors and seasonal movements within a wintering area. This lack of information hinders our ability to identify the cause(s) of population change and to effectively monitor and manage functional population units.

Efforts to delineate populations of Pacific surf scoters have been substantial, with deployment of radios (VHF and PTT) across wintering sites from Alaska (Rosenberg and Petrula 1999), British Columbia (D. Esler and S. Boyd, unpubl. data), Puget Sound, Washington (D. Nyeswander and J. Evenson, unpubl. data), and San Francisco Bay, California (J. Takekawa and S. Wainwright-De la Cruz, unpubl. data). These projects have led to important advances in our understanding of winter habitat use, movements during migration, and breeding distributions. Lacking, however, is a comprehensive assessment of these issues for surf scoters that winter in the southern portion of their winter range (southern California to Cabo San Lucas, Baja California), a region that historically supported tens of thousands of Surf Scoters (Saunders and Saunders 1981; Takekawa unpublished data).

This project was designed to contribute to coast-wide considerations of population delineation, and to study the wintering ecology of surf scoters at the southern extent of their winter range.

From November 2006 through March 2007, we monitored the locations, movements, and foraging activities of Surf Scoters wintering in Bahia San Quintín (BSQ), Baja California, and Laguna Ojo de Liebre (ODL), Baja Sur, Mexico. We used telemetry to document movements, habitat-use patterns, foraging behavior, site fidelity, and survival of Surf Scoters wintering at the two lagoons. Additionally, we conducted age- and sex-specific surveys of surf scoters wintering in Baja California to document demographic structure and patterns of differential habitat use by cohorts. All monitoring and survey methods were adopted from other studies in the Strait of Georgia, British Columbia to allow comparability. The data will contribute to a region-wide assessment of class distributions, survival, habitat-use patterns, and forage quality for the surf scoter population wintering in the Pacific.

Objectives: This study is designed to study surf scoters wintering in Baja California. Our objectives were to use satellite and VHF radio telemetry to: (1) describe key migration routes, timing of movements, and affiliations with staging (spring and fall), breeding and molting areas, and to (2) evaluate survival, habitat-use patterns, foraging behavior, and diet of scoters wintering in Baja California.

Preliminary Results:
We captured surf scoters in late November/early December 2006 in Bahía San Quintín (BSQ) and Laguna Ojo de Liebre (ODL). We fixed VHF transmitters to 32 scoters, 16 at each site, among a relatively even sample of cohorts (M-HY = 9, M-AHY = 10, F-HY = 6, F-AHY = 7). Ten VHF radios were implanted abdominally, and 22 were mounted on the back via a prong subcutaneous attachment. Additionally, 5 adult (ASY) female scoters from BSQ were selected for intra-abdominal implantation of PTT-satellite transmitters. We monitored VHF-marked scoters through the month of March; including four returning adult females that were marked the previous winter in BSQ February 2006 (SDJV FY06 #63). We collected data on scoter presence to document survival, location to assess habitat-use patterns, and diurnal and nocturnal foraging effort to assess forage quality. We alternated data collection between sites, spending from 4 to 10 days at each site before switching, monitoring all scoters present as evenly as possible.

Survival – Overall, 16 scoters were present for long enough to have been monitored for foraging behavior at least 3 times, 5 were known to have died, and 11 were missing (monitored less than 3 times). We estimated overall winter survival to be 81% (Table 1) based on a Kaplan-Meier known-fates analysis. Many of the missing birds were from ODL, where observations of unmarked birds indicated that many left the area during February. Of the mortalities, two were at least found by people as we tracked a transmitter to a vehicle in one case (the owner said he found the bird when it was sick) and a house in another (we didn't talk to the occupants). Two mortalities were within 30-days of capture but could not be attributed to surgery because they both had been fixed with external radios. Although we do not have sufficient data to detect significant differences, our data suggest that survival varied among age- and sex-cohorts as all of the mortalities were male (n = 5), and a majority of those were juvenile males (HY) (n = 4).

Table 1: Surf scoter survival. The fate of all radios deployed in Nov/Dec 2006 are listed by month. Survival is calculated individually for each month and cumulatively (Pollock et al. 1989).

	Nov	Dec	Jan	Feb	Mar
Missing	5	7	13	18	20
Present	8	30	22	14	12
Dead	0	2	3	0	0
Monthly Survival	1.0	0.93	0.86	1.0	1.0
Cumulative Survival	1.0	0.93	0.81	0.81	0.81

Foraging Behavior - Radio signals were monitored for a full hour during daylight hours and for 30 minutes during the night for each foraging observation. The radio signal disappears when the scoter is submerged so we are able to document the time of each dive and re-emergence. From the times, we calculated the number of dives, the average time underwater per dive, and the proportion of time the scoter was submerged relative to the total time of the observation.

Overall, we monitored 5,041 dives from 27 scoters during 156 diurnal observations. Scoters dove 32.1 (± 24.8 SD) times per hour observation; dives averaged 34.6 (± 10.5 SD) seconds; and they spent 30.4% (± 21.3 SD) of the time underwater. Juveniles dove fewer times, with shorter dive times, and spent less time underwater than adults (Figure 1). When comparing males and females, or the two sites, there were few considerable differences between the groups (Figure 1). Diurnal foraging was relatively consistent throughout the course of the winter.

It is believed that surf scoters only forage diurnally during the winter (McNeil et al. 1992) and a study from British Columbia showed that foraging rarely occurs during the night (Lewis et al. 2005). Presumably, scoters would utilize nocturnal foraging during decreased food availability. We monitored 269 dives from 15 scoters during 42 nocturnal 30-minute observations. Overall, scoters dove 6.4 ± 12.5 SD times per nocturnal observation, spending 11.8% ± 23.0 SD of the time underwater. Although only 30% of all observations documented diving behavior compared to 82% of diurnal observations, this is notably greater than the 2% documented by Lewis et al. (2005). Unlike diurnal foraging, the frequency of nocturnal foraging and the proportion of time spent diving during nocturnal observations increased later in the season (number of dives: 0.1 ± 0.4 SD (Jan (n = 7)), 5.4 ± 10.6 (Feb (n = 17)), 9.8 ± 15.6 (Mar (n = 18)); proportion of time underwater: 0.0008 ± 0.0022 (Jan), 0.0988 ± 0.1906 (Feb), 0.1814 ± 0.2886 (Mar). Females are largely responsible for the increase in nocturnal foraging, suggesting that the preparation for the energy demands of breeding could be responsible for the increase rather than the demands of migration. Differences in foraging between the sexes showed that females dove more during the night than males, dive times were longer, and they spent a greater percentage of the time underwater (Figure 2). Also in contrast to the diurnal foraging, scoters in BSQ had slightly higher rates of nocturnal foraging, but as with diurnal foraging juveniles had lower rates of foraging than adults (Figure 2).

Scoter Locations – We determined daily locations of radio-marked scoters via biangulation of two consecutive bearings from a boat-mounted antenna (n = 266). Locations were assessed as near to the time of each foraging observation as possible so as to assure a spatial and temporal connection between foraging effort and location. Preliminary assessment shows the scoters to

have exceptionally high site fidelity. Location information will be incorporated into a more in-depth analysis of habitat-use patterns in the near future.

PTT Monitoring – We surgically implanted PTT transmitters in the abdomens of 5 adult female scoters in order to enhance the small data set we had regarding broad-scale temporal and spatial patterns of movement specific to the Baja wintering population. Unfortunately, only one of the five scoters was alive or had a functioning radio long enough to track its northward migration, but it did not leave until the end of May and never traveled to the breeding grounds. Instead, this bird flew as far north as Boundary Bay on the U.S.-Canadian border, spent most of June in the vicinity, and then flew south and spent the rest of the summer near Yaquina Bay, Oregon where she is currently still located. Of the remaining scoters, we detected one mortality in early December, and the fates of the others are uncertain as we lost the three remaining signals between mid-December and early February.

Age-Sex Ratio Surveys - We conducted mid-winter age-sex ratio surveys (Iverson et al. 2004) (1) by foot at various locations along the coast and (2) by boat in BSQ and ODL. Overall we counted 2,642 Surf Scoters: 1,140 adult males, 136 juvenile males, 1,342 females, and 25 scoters of unknown age or sex. Population sex composition was relatively even, with an overall estimate of the proportion of female scoters to the total number of scoters equivalent to 0.508 (mean of sample ratios $F_{TOT} : M_{TOT} = 0.493 \pm 0.043$ SE and $M_{TOT} : F_{TOT} = 0.474 \pm 0.044$ SE). Age composition was strongly adult biased with 0.106 first-year males:total males (mean of sample ratios $M_{1Y} : M_{ADU} = 0.175 \pm 0.053$ SE). Assuming a 1:1 ratio between first year males and first year females, female age ratios equaled 0.112 (mean of sample ratios $F_{1Y} : F_{ADU} = 0.348 \pm 0.245$).

Project Status:
In studying the ecology of scoters wintering in Baja, we not only collected information about a largely unstudied population, including habitat-use patterns, forage quality, seasonal movements within the area, and survival; but this information will be applicable to the overall population and directly supports the objectives of the Sea Duck Joint Venture. Additionally, in the near future we aim to conduct cohort-specific analyses and compare these data with data from other wintering populations, which has the potential to contribute to the overall understanding of population dynamics and demographics of scoters wintering in the Pacific.

In order to meet the first stated objective of this study: to describe key migration routes, timing of movements, and affiliations with staging (spring and fall), breeding and molting areas, we were relying heavily upon the spatial and temporal data from PTT-tagged females. We are able to ascertain generalizations in regard to the timing of movements of radio marked scoters within the winter season (e.g., changes in feeding habits and how they might relate to the energetic needs for migration). Overall, however, we were unable to adequately meet this objective because transmitter failures, mortalities, and non-breeding behavior resulted in very little data from the PTT-tagged scoters beyond the winter season. Similar low success occurred in previous years, although enough data have been generated over the years to indicate migration routes, timing, staging sites, and breeding distribution. Because of the costs involved with deploying satellite transmitters, the low success rate to date, and the feeling that basic patterns have been described, we do not intend to deploy any satellite transmitters in the coming season.

We were able to satisfactorily meet our second stated objective: to evaluate survival, habitat-use patterns, foraging behavior, and diet of scoters wintering in Baja California. Another season of data will be useful for detecting significant trends in the survival data, however, the data we collected suggests there is variation in survival among cohorts and will be valuable for comparing survival among wintering sites. We have sufficient location information from all cohorts and age-sex ratio data from different habitat types to evaluate site fidelity and movements within a site, overall habitat-use patterns, and evaluate segregation of cohorts among habitats. The foraging behavior data we collected makes up a dataset from which we are capable of statistically evaluating differences in foraging behavior among cohorts, between sites, among habitats, and will be compared to similar data collected in British Columbia. We have the capacity to ascertain some generalizations about scoter diet from (1) lipid samples that were collected in previous seasons, and (2) fecal samples collected from 17 scoters during the most recent captures. We had hoped to find a graduate student from CICESE in Ensenada, Baja California to fully evaluate scoter diet as part of their thesis work but there weren't any students that were interested in the project. However, we are currently collaborating with Roberto Carmona at UABC-La Paz, who has a graduate student that is interested in assessing scoter diet and food resources in the coming winter season as part of their thesis work. This student will likely use the samples that have been collected in previous seasons as part of their analysis.

Currently, we are gearing up for an early start to the coming winter season. We will be deploying a total of 50 VHF transmitters at BSQ and ODL in late November to early December 2007 and intend to monitor presence, locations, movements, and foraging behavior through April 2008. There could be another 6 months of life in the abdominally implanted transmitters that were deployed last season, which could potentially increase our sample size by up to 9 scoters. We will also continue conducting age-sex ratio surveys to increase our samples from habitat types and evaluate between-year variation.

Project Funding Sources (US$)

SDJV (USFWS) Contribution	Other U.S. federal contributions	Other contributions	Canadian federal contributions	Canadian non-federal contributions	Source of funding (agency or organization)
$31,460					
	$31,800				USGS
				$36,000	SFU
		$12,000			ESSA

Total Expenditures by Category (US$)

ACTIVITY	BREEDING	MOLTING	MIGRATION	WINTERING	TOTAL
Banding					

Surveys					
Research				**$111,260**	
Communication					
Coordination					

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Sea Duck Joint Venture FY06 Report # 63. Population delineation, winter/spring habitat use, migration ecology and harvest of Surf Scoters (Melanitta perspicillata) from the southern portion of their winter range.

Figure 1: Diurnal foraging effort by surf scoters in Baja during the winter 2006/2007. Mean values and 95% confidence intervals are graphed for three foraging variables: (top) the number of dives per hour observation, (middle) dive times in seconds, and (bottom) the ratio of total time spent underwater during an observation to the total observation time. Data are grouped by: (left) male vs. female, (center) adult (AHY) vs. juvenile (HY), and (right) from the two sites, Bahia San Quintin (BSQ) and Laguna Ojo de Liebre (OJO). Population mean values (solid) and confidence intervals (dashed) are represented by the horizontal lines.

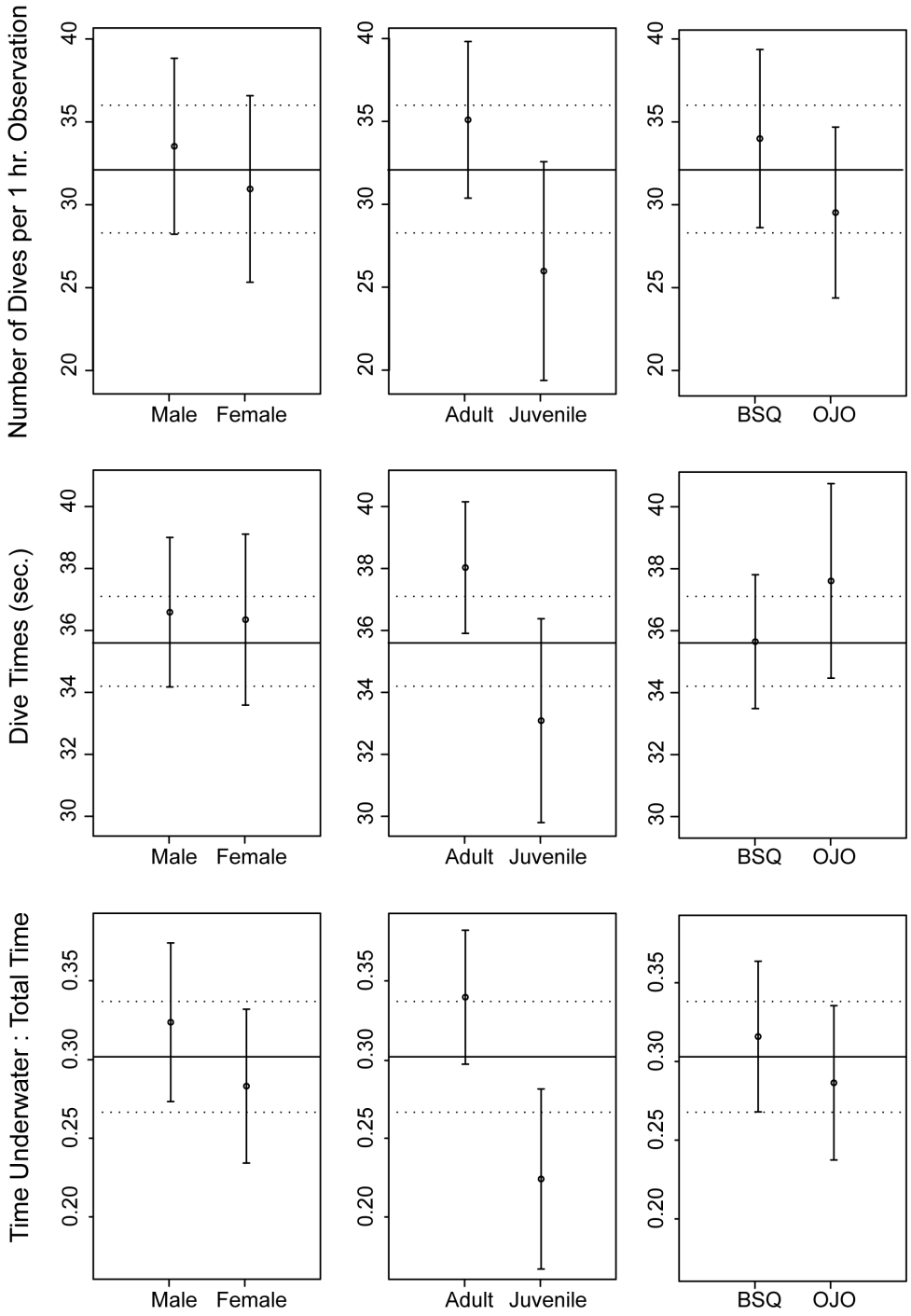

Figure 2: Nocturnal foraging effort by surf scoters in Baja during the winter 2006/2007. Mean values and 95% confidence intervals are graphed for three foraging variables: (top) the number of dives per hour observation, (middle) dive times in seconds, and (bottom) the ratio of total time spent underwater during an observation to the total observation time. Data are grouped by: (left) male vs. female, (center) adult (AHY) vs. juvenile (HY), and (right) from the two sites, Bahia San Quintin (BSQ) and Laguna Ojo de Liebre (OJO). Population mean values (solid) and confidence intervals (dashed) are represented by the horizontal lines.