Sea Duck Joint Venture
Final Report – September 2010

Project Title: Population delineation and wintering ecology of Surf Scoters in Southeast Alaska (SDJV Project #108).

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Project Description:
Population delineation and wintering ecology of Surf Scoters (*Melanitta perspicillata*) have been studied in detail through much of their range. A conspicuous gap existed for Southeast (SE) Alaska, which is near the northern end of their winter distribution. Because SE Alaska is an important wintering habitat for a sizeable number of Pacific Surf Scoters (hereafter scoters), we marked birds with satellite transmitters (PTTs) to quantify links among annual cycle stages and to define management units. Additionally, we conducted detailed studies of wintering ecology that are directly comparable to research from more southerly wintering sites, allowing a full consideration of latitudinal variation in wintering ecology of the species. This work provides data to evaluate factors influencing population dynamics and identify important habitats of this declining species.

Objectives:
Our research addresses the following specific questions:

1) What is foraging effort by wintering scoters in SE Alaska, does it vary by age and sex cohort, and how does it compare to other wintering sites?

2) How does survival vary across cohorts and wintering regions?

3) How does body mass of wintering scoters in SE Alaska compare with those from other wintering areas?

4) How far do individuals move during winter and what habitats do they use?

5) How do age and sex composition vary by habitat, and compare to other wintering regions?

6) What are the key migration routes, migration chronology, and affiliation to specific breeding and molting sites for scoters that winter in SE Alaska?

7) What rate and scale of site fidelity do scoters show throughout the annual cycle, and how does this influence definition of management units?

Results:
We conducted the second full winter of fieldwork for this study in the vicinity of Juneau, Alaska, between 17 November 2009 and 1 April 2010. Scoters were captured between 17 November and 11 December 2009, with an additional capture day on 4 January 2010. A total of 228 surf scoters were captured (Table 1), over twice the number of captures during the prior field season (*n=99*). Sex was determined using plumage and cloacal characteristics, and age class was estimated based on bursal depth. Scoters received a uniquely-numbered USFWS tarsus band and we measured morphometric features (diagonal tarsus, culmen, bill width, feather-free bill, wing chord, and ninth primary length). Body mass was measured (± 1g) to compare variation in mass among sex and age classes. To address questions pertaining to survival and foraging effort, 60 VHF radio transmitters, including 10 re-deployments, were attached to scoters (Table 1). Transmitters were affixed using a subcutaneous prong and glue method (25 single-prong and 25 double-prong prior to re-deployment); we will evaluate differences in survival or radio retention between birds receiving single- and double-prong transmitters. Fecal samples from scoter holding kennels will be analyzed for composition.

To evaluate winter site fidelity and connectivity to breeding and molting areas, five PTT transmitters were surgically implanted in two adult (AHY) male and three AHY female scoters. All remained in the Juneau area throughout winter. In spring, four of these birds migrated to known breeding areas of northwestern Canada (Figure 1). A female, PTT 94944, likely bred near the Great Bear Lake, Northwest Territories based on numerous detections in one location. This bird has since returned to the Juneau area, possibly to winter. A male, PTT 94943, migrated west from the breeding grounds to presumed molting sites in northern Alaska near Prudhoe Bay and in southwestern Alaska near the Kuskokwim Shoals, immediately west of the town of Kipnuk. Additionally, we monitored the fall 2009 movements of an adult female marked in November of 2008 before its transmitter finally failed in mid-January 2010 (Figure 2).

Table 1. Numbers of scoters captured and marked with VHF radio transmitters near Juneau, AK, fall 2009.

	AHY M	AHY F	HY M	HY F	TOTAL
# captured	19	46	78	85	228
# VHF radios	14	19	13	14	60

Mortality of VHF-marked birds was notably high in SE Alaska, especially among hatch-year (HY) birds (Table 2). Apparent mortality of scoters was 0.48 and 0.27 for HY and AHY birds respectively, during 2009/10, and 0.60 and 0.18 for HY and AHY birds, respectively, during 2008/09. Although mortality was higher among HY birds during 2008/09, there was still relatively higher mortality among HY birds during both seasons. Mortality signals were detected for 22 VHF-marked scoters. Of these, 18 radios were retrieved and 3 were located but not retrieved (underground). We located the remaining radio by aerial telemetry outside of the main study site, but were not logistically able to locate it by ground. We never found an intact carcass for any of these birds, and only rarely were there any remains other than feathers. It is unknown whether birds were killed by predators or if they were scavenged after death, but based upon transmitter condition and predation sign, 14 of the 21 ground-located transmitters were likely either preyed upon or scavenged; mustelids were the primary predator/scavenger. The remaining seven ground-located transmitters were either shed or the birds were preyed upon and/or scavenged. Of the 22 mortality transmitters, eight transmitters had double-prongs and 14 had single-prongs. This suggests there is not a prong-attachment effect on survival between single- and double-prongs, as we would predict double-prong transmitters to have more of a negative effect than single-prong transmitters if there were a prong-effect. These results corroborate with results from the 2008/09 season, when mortality was nearly equal among single- and double-prongs (10 double- vs. 11 single-prong).

In most cases, exact dates of mortality are not known. Unlike the 2008/09 season when dates of first mortality signals were normally distributed throughout the winter, those during the 2009/10 season were skewed toward early winter (Nov=7, Dec = 10, Jan = 1, Feb = 3, Mar = 1). Six mortality signals were heard within a week of deployment; however, it is unknown if there was a negative handling effect on these six birds.

Table 2. Summary of scoter mortalities and/or VHF transmitter loss near Juneau, AK, during both winter field seasons.

	AHY M	AHY F	HY M	HY F	TOTAL
# mortality signals (2008/09)	3	1	11	6	21
# mortality signals (2009/10)	4	5	6	7	22

Throughout the season, we monitored diurnal foraging effort of scoters during one-hour observation periods, following the same protocol that was used in the Strait of Georgia, BC and in Baja California, Mexico. This allows direct comparisons between sites and across latitudes. We logged 609 hours of diurnal observation periods over 37 individuals. Additionally, we monitored nocturnal foraging effort of scoters during 30-minute observation periods; we logged 185 nocturnal observation periods over 32 individuals. Similar to the the 2008/09 season, scoters rarely dove at night and their foraging effort (as measured by mean proportion time underwater hr^{-1}) during the winter was lower than that of scoters wintering further south in British Columbia, Canada, and Baja California, Mexico (Figure 3). Overall, scoters at the study site spent an average of 16.7 percent of their time underwater hr^{-1} during the 2009/10 season, compared with 13.6 percent of their time underwater hr^{-1} during the prior season (Figure 4). During 2009/10, near Juneau, AHY and HY male scoters spent 15.6 percent and 17.2 percent of their time underwater hr^{-1}, respectively, while AHY and HY females spent 16.1 percent and 18.5 percent of their time underwater hr^{-1}, respectively. We suggest that because females are smaller and lighter than males, they may have foraged at a greater rate during the 2008/09 season due to colder weather and greater thermoregulatory expense. Preliminary analysis of morphometrics and mass also reveals that scoters wintering in SE Alaska are larger and heavier than birds wintering further south (Figure 5), and that scoters wintering at the northern periphery tend to gain mass throughout the season (Figure 6).

Age and sex surveys were conducted in Juneau on 10 March 2010 and in Petersburg on 16 March 2010. Survey routes were identical to previous years and followed the same protocol used in other areas (Strait of Georgia, BC, Puget Sound, WA, and Baja California, Mexico) allowing direct comparisons between sites and across latitudes. Overall in 2010, 3738 individuals (2951 in the Juneau area and 787 near Petersburg) were observed and classified as either HY male, AHY male, or female. From these data, we calculated ratios of HY:total males and males:females. In Juneau, ratios were 0.10 and 0.87, respectively, and in Petersburg ratios were 0.02 and 1.77, respectively (Figures 7 and 8). We observed more scoters during the 2010 survey than during the two previous surveys (2244 scoters in 2008 and 1213 scoters in 2009).

During the 2009/10 field season, we also collected 30 scoters (10 in January and 20 in March) with two objectives: (1) determine prey types, and (2) gather data to understand trends in body mass throughout winter. Esophageal contents consisted mainly of blue mussels. Prevalence of mussels in the diet may differ from scoters in Washington, where Anderson et al. (2008) determined scoters were eating a more varied diet. Trends in mass data were aforementioned.

Conclusions:
Given the low foraging effort in Alaska and higher foraging effort in Mexico (SDJV Project #63), we conclude that foraging opportunity may limit the southern wintering distribution, but that other factors such as climate or predation may limit the northern distribution. Observed mortality based on telemetry data indicates that mortality is higher in SE Alaska than at sites in British Columbia or Baja. These data suggest that, although food quantity and quality are high in Alaska, risk of predation may be an important influence on winter site choice. Also, foraging data suggest that female scoters, which are markedly smaller and lighter than males, exhibited higher foraging effort than males in SE Alaska, particularly during a cold winter (2008/09). This suggests that thermoregulatory challenges may differentially influence the suitability of wintering sites by different cohorts. This is corroborated by evidence that scoters that winter in Alaska are heavier than those that winter elsewhere (Figure 5). Finally, surveys reveal that proportions of females and young birds are higher at the southern periphery. We suggest that choosing to winter in Alaska offers benefits in terms of foraging opportunity, but individuals must balance this against costs of predation risk and thermoregulatory challenges that may affect

age and sex classes differently. Understanding what mechanisms are driving limitations of each cohort at different latitudes has important conservation implications, as survival and condition is dependent upon these limitations.

Project Status:
In addition to the foraging data summaries, C. S. VanStratt is currently conducting a repeated measures, mixed model analysis of the foraging data. This analysis will provide information about which parameters best explain foraging rates in SE Alaska throughout the winter. B. Uher-Koch will conduct a survival analysis of these wintering birds, as part of his thesis on survival of nonbreeding scoters. A web page depicting locations, movements, and important habitats of PTT-marked birds is available at:

http://alaska.usgs.gov/science/biology/seaducks/susc/index.php

Final analyses by C. S. VanStratt and B. Uher-Koch will provide insight into objectives (1)-(3) and (5), while analysis of the PTT data will provide insight into objectives (4) and (6)-(7). C. S. VanStratt expects to produce a M.Sc. thesis and related manuscripts by spring 2011, while B. Uher-Koch will finish his thesis by spring 2012. This project is in its final stages, and we are confident that the objectives of this study are being met and that the data collected will shed light on the factors affecting the distribution and population dynamics of scoters, especially at the peripheries of their wintering range.

Acknowledgements:
We were again greatly assisted with agency support during the 2009/10 field season; the USFWS provided personnel assistance, vehicles throughout the season, office facilities, storage, and moorage; the USDAFS supplied bunkhouse accommodations and heated garage space for our boat throughout the winter, and NOAA provided well-plowed areas for monitoring from the TSMRI at Lena Point and moorage at the ABL. The USGS contributed both financial support and personnel, including the assistance of Dr. Dan Mulcahy, who conducted PTT surgeries.

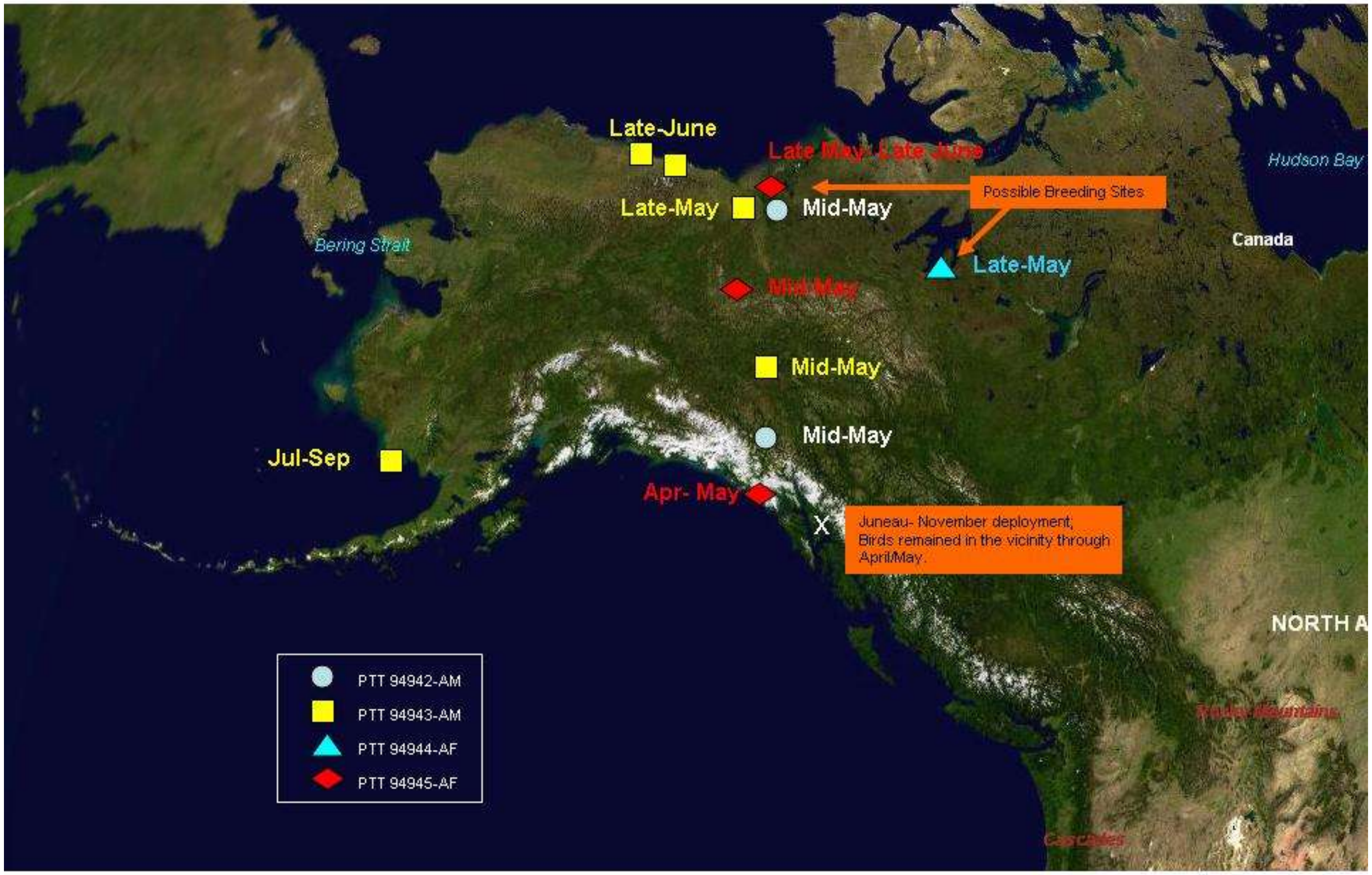

Figure 1. Spring and early fall 2010 locations of PTT birds marked in November 2009 (AM = adult male, AF = adult female).

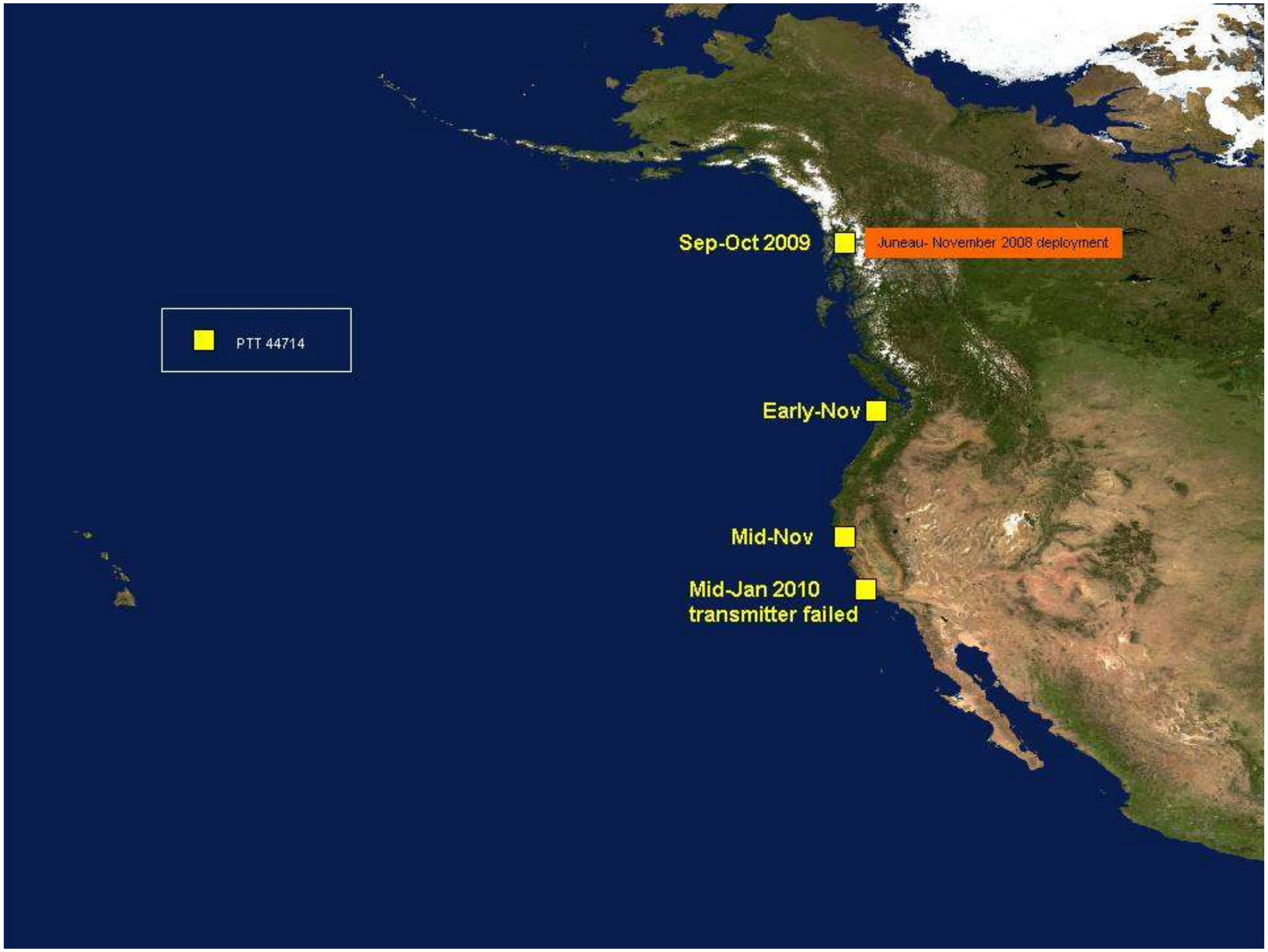

Figure 2. Fall and early- to mid-winter locations of an adult female scoter marked with a PTT in November 2008 in Juneau, AK.

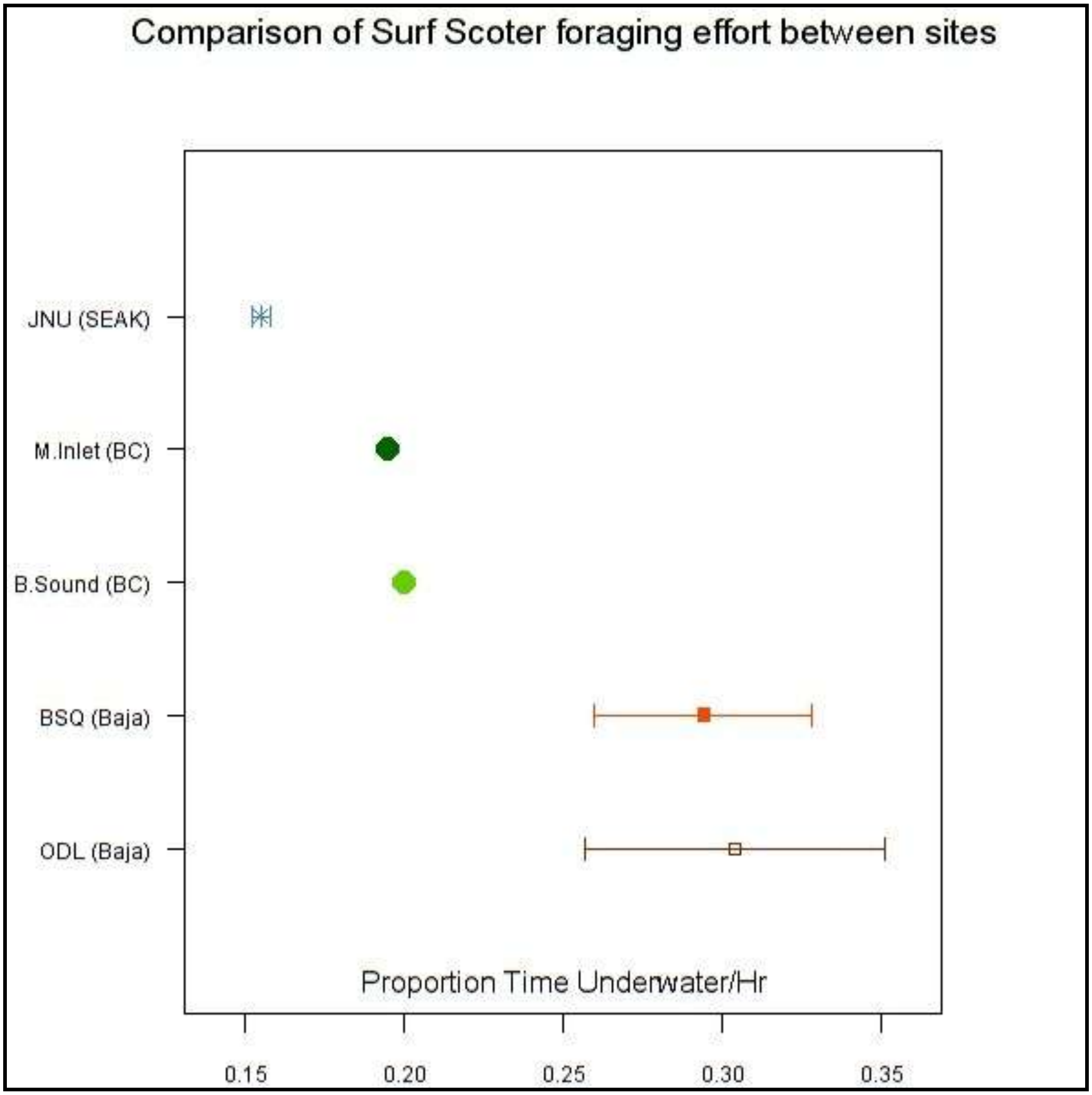

Figure 3. Surf Scoter hourly foraging effort (mean ± 95% CI) at five different sites. Data representative of SE Alaska were obtained from this project. Data representative of the Baja California, Mexico sites were obtained from SDJV Project #63; scoters were monitored at 2 sites in Baja, including Bahía de San Quintín (BSQ) and Laguna Ojo de Liebre (ODL). Malaspina Inlet (M. Inlet) and Baynes Sound (B. Sound) data were obtained from Kirk et al. (2007) and Lewis et al. (2008), respectively, and represent the core of the winter range.

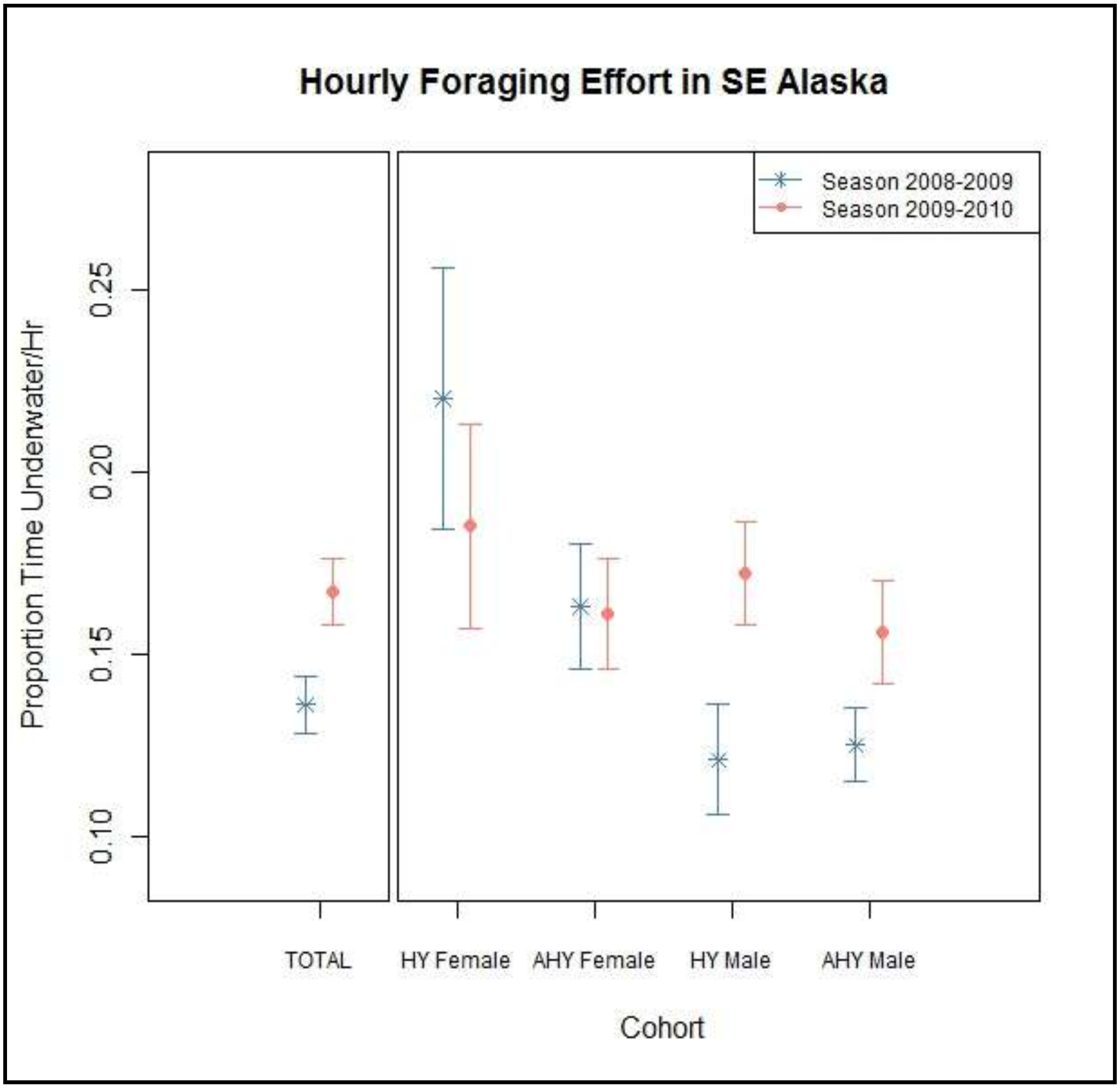

Figure 4. Surf Scoter hourly foraging effort (mean ± 95% CI) during 2008/09 and 2009/10 in SE Alaska. Overall hourly foraging effort was higher during 2009/10. During 2008/09, males foraged significantly less than females.

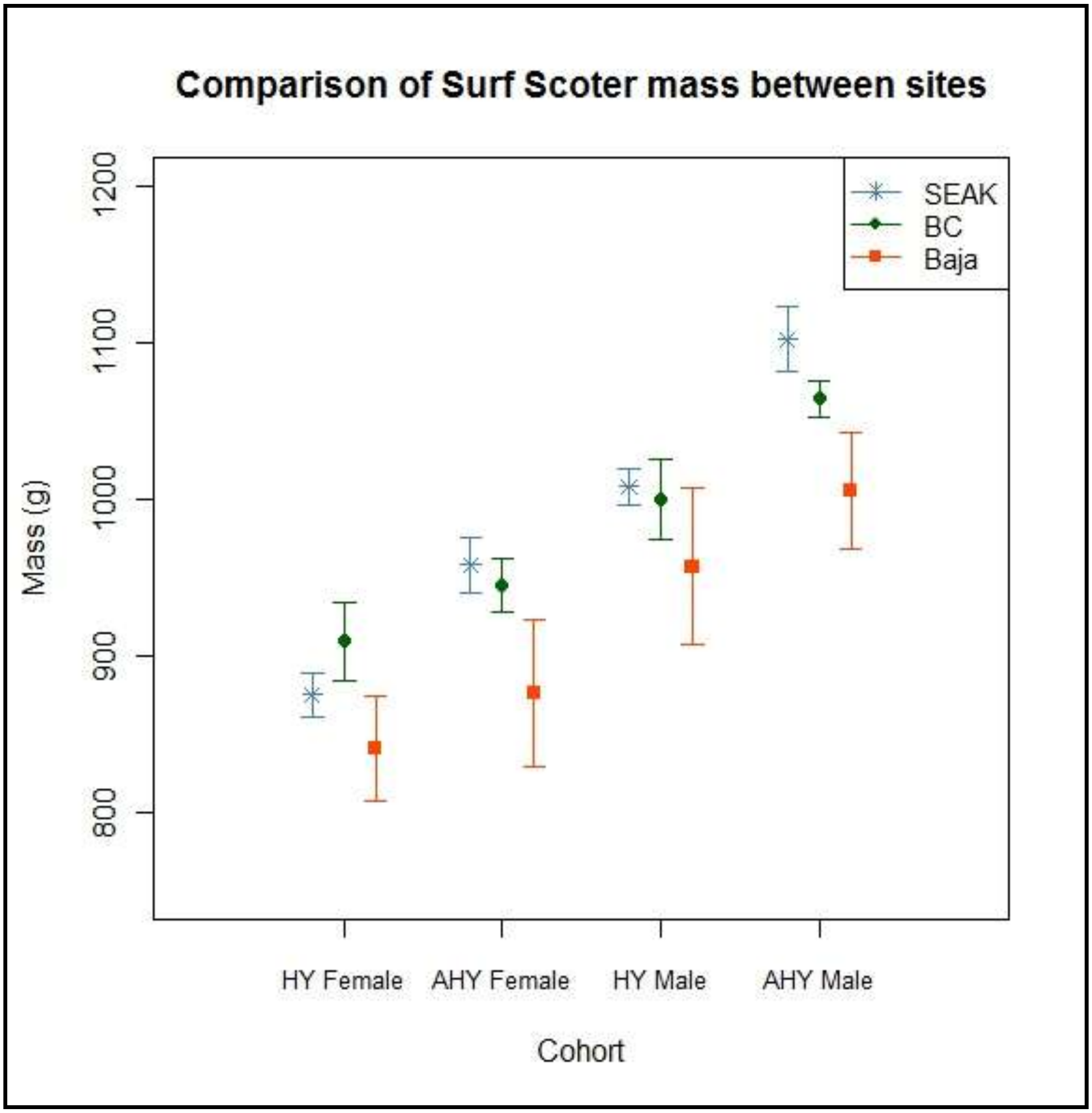

Figure 5. Surf Scoter mass (mean ± 95% CI) among cohorts of birds captured in Nov/Dec at three different latitudes along the Pacific coast. Generally, birds at higher latitudes are heavier.

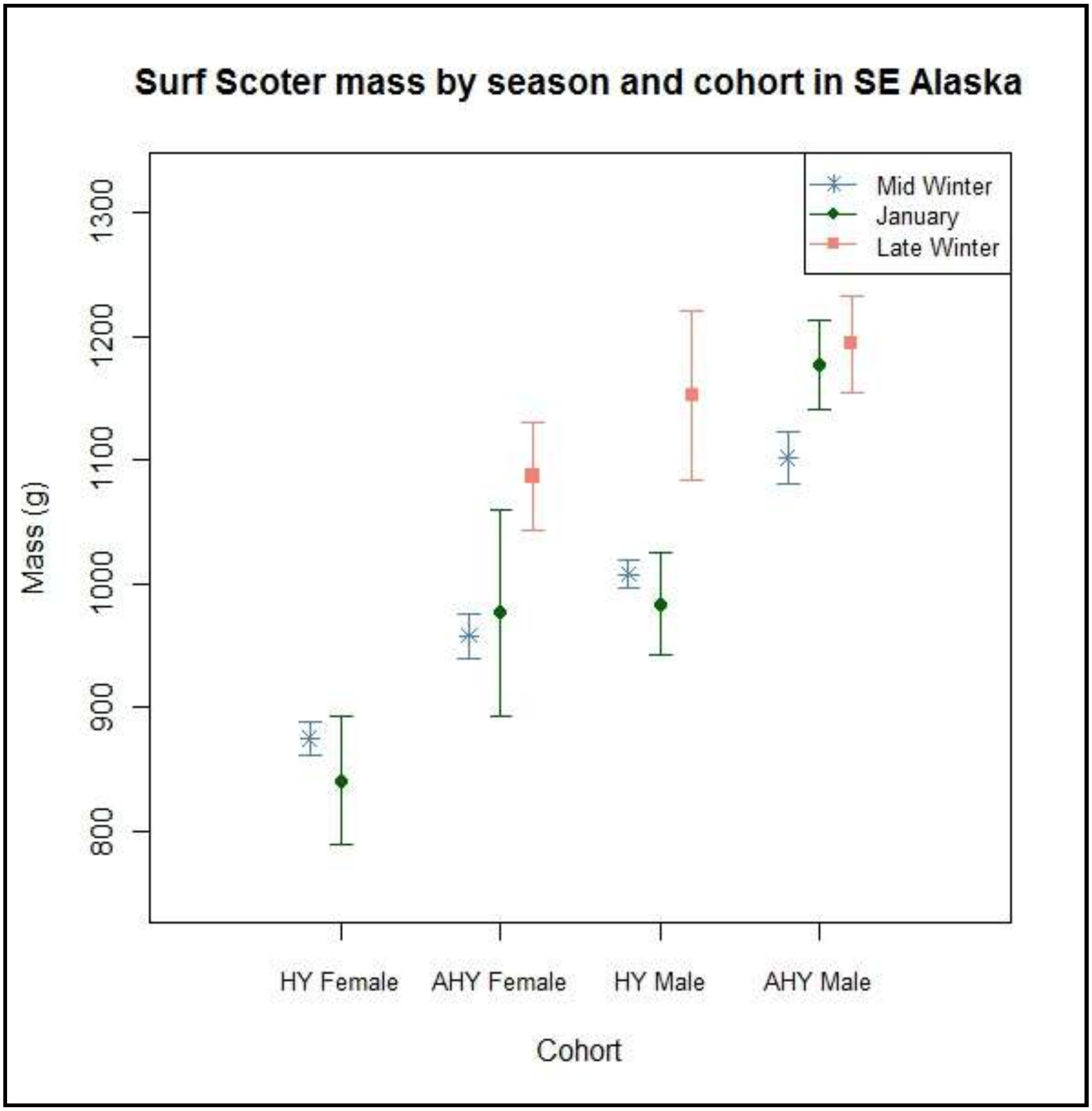

Figure 6. Surf Scoter mass (mean ± 95% CI) by season and cohort in SE Alaska. Mass tends to increase throughout the season for each cohort. For the three cohorts with late winter data, there is a significant increase in mass from mid winter to late winter.

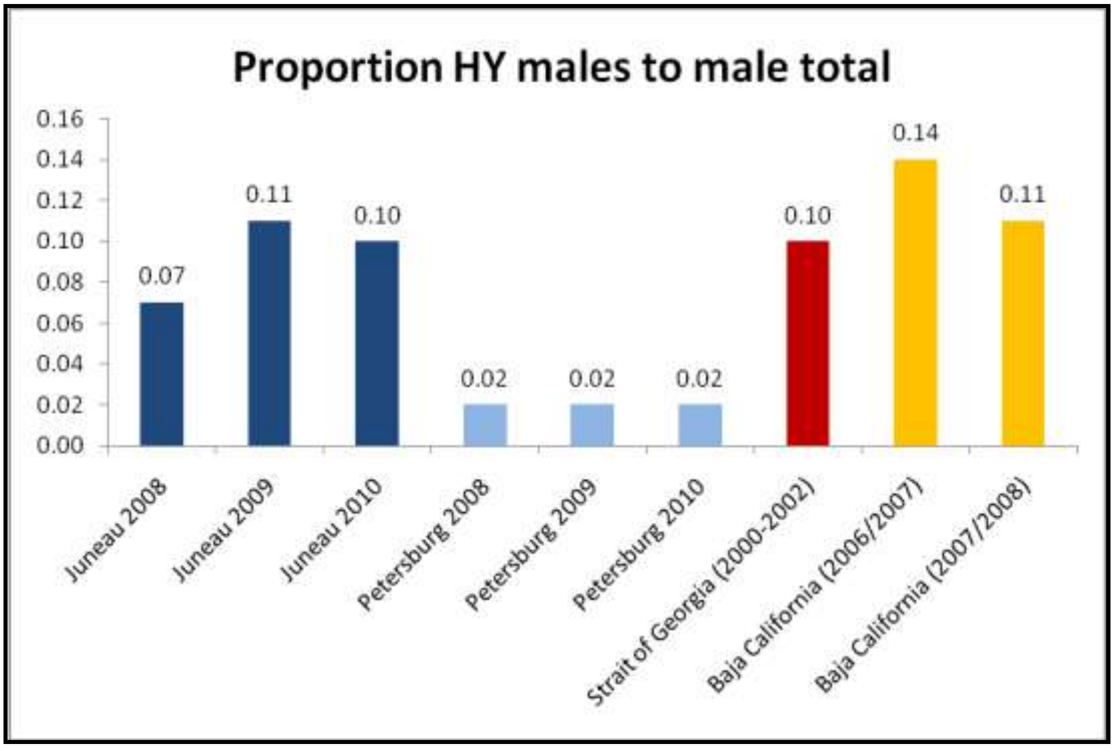

Figure 7. Proportion of juvenile (HY) males to total males based on surveys. There tends to be more juvenile males further south along the latitudinal cline.

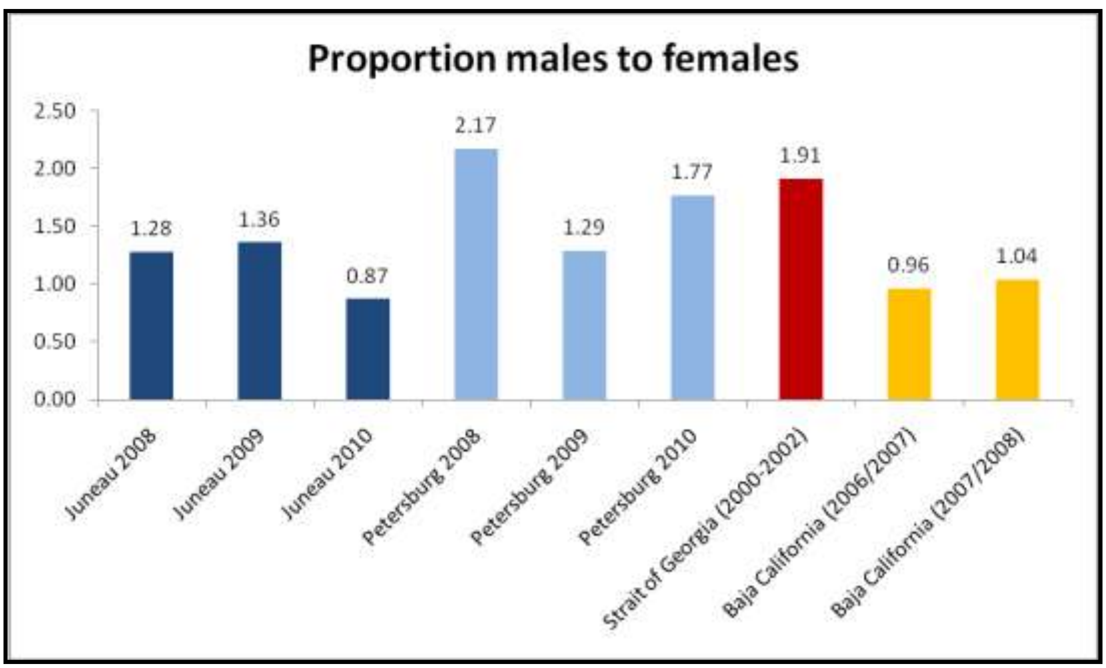

Figure 8. Proportion of males to females based on surveys. There tends to be a higher proportion of males at northern sites and more of a 1:1 ratio at southern sites.

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