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

Project Title (SDJV Project #38): **Assessment of the Pacific Black Scoter Population: Population Size, Distribution, and Links among Populations: An Integrated Approach**

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Project Description: Numbers of Pacific black scoters appear to have declined greatly, although survey data are imprecise and hinder detailed analyses of population trend. Little is known about the biology of black scoters, including delineation of subpopulations and links among annual cycle stages. This study integrates three elements (population surveys, satellite telemetry, and genetics) into a multi-pronged approach to determine population status and trends and provide the information necessary to make scientifically sound management decisions. These elements are complementary and benefit from being conducted simultaneously.

Objectives:

a. Provide precise annual estimates of the size of the Pacific breeding population that will serve as a long-term monitoring tool.
b. Estimate observer detection rates.
c. Identify breeding, molting and wintering locations used by black scoters across the annual cycle.
d. Use mtDNA sequence data to infer levels of site fidelity by testing for genetic differentiation among breeding and among wintering areas.
e. Assess timing of movements in relation to population surveys and subsistence harvest.

Preliminary Results*:*

Population Surveys We have now completed the fourth year of survey observations with the same pilot and observers using an amphibious Cessna 206 with the exception of several lines near Izembek NWR, where a super cub was used. The surveys covered about 28,000 linear km flown on 36 days between 12 and 25 of June, 2004-07. The aerial index averaged 86,562 black scoters with an average standard error of 11,419 (CV=0.132) based on observations from front- and rear-seat observers in 4 years. Another 3,688 were white-winged or surf scoters. The aerial indices indicated 137,407 scaup (SE = 19,889, CV = 0.145). The 4-year average detection rate across all years and regions was 56% and 67% for black scoter for the front- and rear-seat observers, respectively. The aerial index divided by estimated detection rate gave an estimate of the actual population. Estimated population sizes were 142,148 black scoter, and 246,094 scaup. A more complete description of this survey and its results can be found at http://seaduckjv.org/studies/pro3/pr96.pdf .

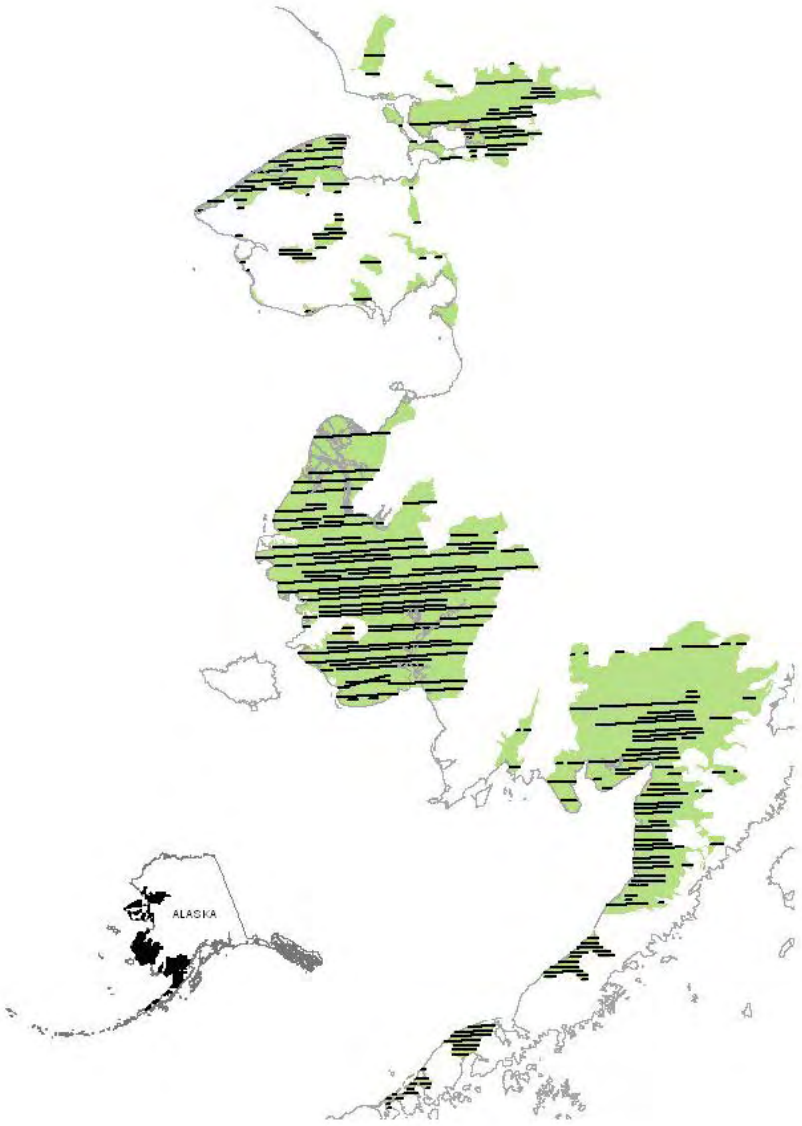


Figure 1. Aerial transects flown cumulatively, 2004-2006, for Pacific black scoter breeding survey

Satellite Telemetry

Current status of Black Scoter satellite transmitter deployments:

Location	2003-2004	2005	2006	2007*
	Numbers of transmitters deployed ((total) Ad Female/Ad Male/ Subadult Female) *that survived for > 2 months*			
Winter/staging				
Kodiak NWR, AK	(8) 2/4/0	(7) 3/3/1	(2) 1/0/1	
Nelson Lagoon, AK	(23) 0/22/1			
Strait of Georgia, BC	(5) 4/0/0	(10) 5/5/0		
Dutch Harbor, AK				(10) 2/0/8
Breeding				
Togiak NWR, Alaska				
Selawik NWR, AK				
Yukon Delta NWR, AK		(10) 3/0/7	(10) 5/0/5	

Cumulatively, 75 black scoters have been marked and have survived to provide excellent data on migration routes, timing of migration, and location of staging and molting areas. Post-surgery survival of radio-tagged black scoters has been excellent. Figures 2 and 3 summarize movement patterns for all birds. Links to partner maps depicting movements of individual birds from each marking location can be found at www.seaduckjv.org/ststoc.html.

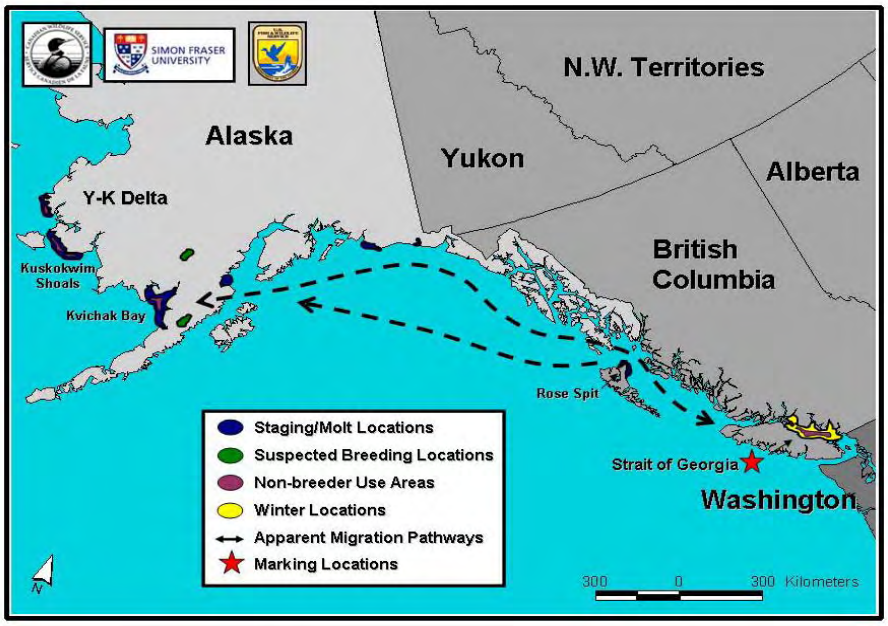


Figure 2. Annual movement patterns of black scoters marked with satellite transmitters in British Columbia.

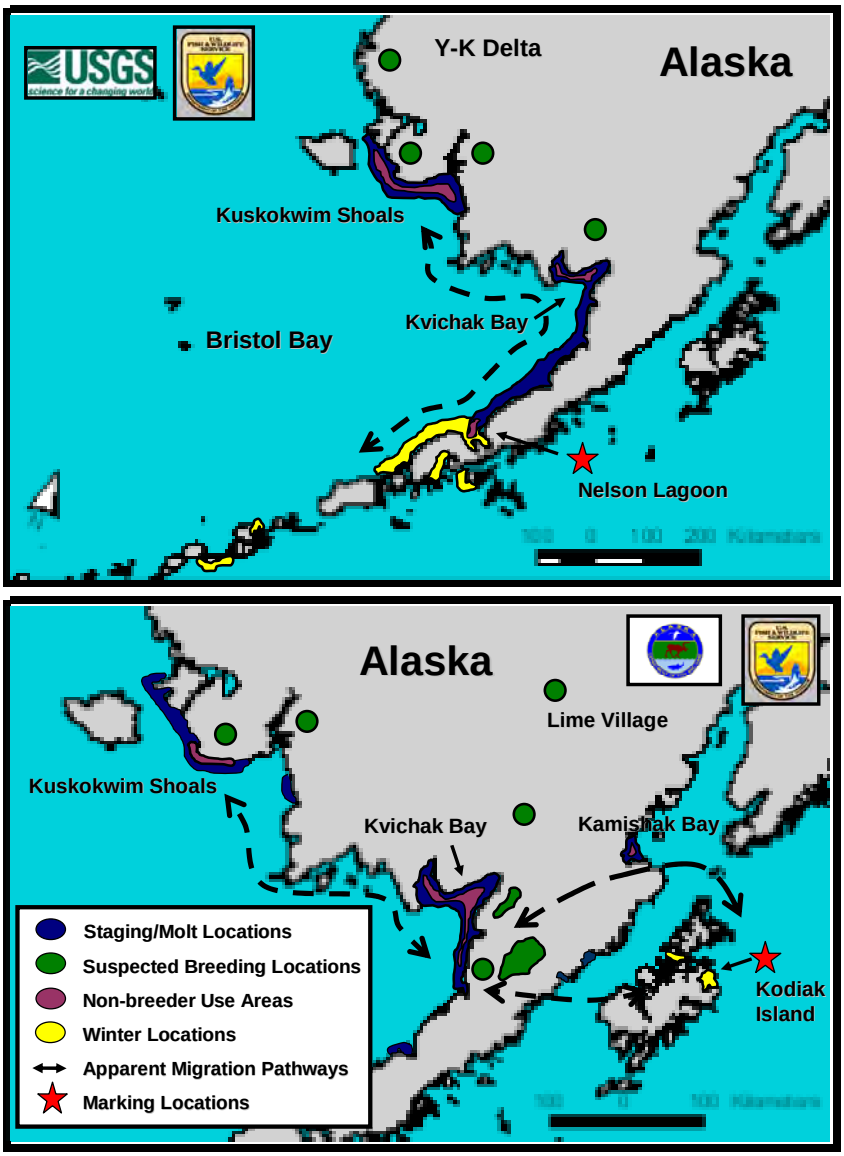


Figure 3. Annual movement patterns of black scoters marked with satellite transmitters in Alaska.

In Alaska, Black Scoters are known to breed primarily in three major areas: Bristol Bay Lowlands, Yukon-Kuskokwim Delta, and Seward Peninsula. Individuals marked in this study migrated exclusively to the Yukon-Kuskokwim Delta and Bristol Bay Lowlands. Not a single bird has gone north to Seward Peninsula / Selawik areas suggesting that that population may be independent from the other breeding populations in western Alaska.

Cross-seasonal movements of individuals were varied; appearing to follow coastlines, overland routes or more direct offshore pathways. Birds favored near-shore waters of Bristol Bay and the Kuskokwim Shoals throughout the breeding and molting periods. Specifically, Kvichak Bay was utilized by individuals from each marking location from spring through autumn; suggesting that this is a critical area for non-breeding, staging and molting Pacific Black Scoters.

Telemetry Results by Marking Site

Strait of Georgia, BC, Canada: CWS and Simon Fraser University implanted 10 black scoters (5 females, 5 males) in February 2005. British Columbia is near the southern extent of the wintering range of Black Scoters along the Pacific coast of North America. As such, capture and marking of black scoters from this area and deployment of satellite transmitters (PTTs) allows for population delineation and potential differentiation of subpopulations from different wintering areas.

Over two winters of marking, researchers from the Canadian Wildlife Service and Simon Fraser University have deployed 15 PTTs on Black Scoters wintering in British Columbia. In December 2003, they marked 5 adult females with PTTs, 4 of which generated useful data. In February 2005, they marked 10 adult Black Scoters, 5 of each sex. Of these 2005 markings, 8 (4 of each sex) have produced excellent data through spring migration and the breeding period.

A number of patterns emerge from a review of the data to date from Black Scoters marked in British Columbia. First, within-season winter site fidelity seems high; locations after marking but prior to migration indicated that individuals remained closely associated with the areas in which they were captured. Also, between-year fidelity to wintering sites is apparently high, based on the 4 females captured in December 2003; all 4 of these birds returned to the Strait of Georgia in fall 2004. Presumably, we will gain more insights into this phenomenon based on fall and winter locations of the birds we marked in February 2005.

Another key finding is the importance of the Rose Spit area off the NE corner of Haida Gwaii (Queen Charlotte Islands) as a staging area in both spring and fall. Nearly all of the Black Scoters marked in British Columbia stopped in this area during spring migration, for up to 4 weeks. Also, during fall migration in 2004, 2 of the 4 female Black Scoters staged at the Rose Spit area for at least 2 months, from late October to early January. Of note, this area is being considered for energy development, including oil and gas exploration and a large wind turbine farm.

Other important spring-staging areas included Kamishak Bay in southern Cook Inlet, Alaska and Kvichak Bay, Alaska, both of which were also important areas for Black Scoters marked on other wintering areas. To date, all birds marked in British Columbia have spent the breeding seasons in the Bristol lowlands or Yukon-Kuskokwim Delta areas; none have migrated to the Seward Peninsula, which is thought to be an important breeding area.

Kodiak Island, Alaska:
The Alaska Department of Fish and Game in cooperation with the USFWS Kodiak National Wildlife Refuge captured and banded 37 black scoters in Chiniak Bay, Kodiak Island from 1-6 March 2006. Five After Second Year (ASY) Females and 2 Second Year (SY) females were surgically implanted with 40g satellite transmitters. This augmented a sample of seven scoters (4 females, 3 males) marked in 2005 and eight scoters (4 females and 4 males) marked in 2004.

On 7 March, a winter storm lasting about 48 hours hit Kodiak with hurricane force winds gusting to over 170 kph. Three ASY and one SY female died between 8 and 14 March. At least some mortality was storm related. We lost satellite signals from a fourth ASY female on 2 April 2006 while she was still in Kodiak. We do not know if the transmitter failed or the bird died.

The remaining two birds, an adult female (AF) and a SY female, departed Kodiak between 28-30 April and 13-15 May respectively. The AF traveled to the area between Kvichak and Nushagak bays via Pilot Point. After spending a minimum of 8 days in Bristol Bay she staged

briefly at the Kuskokwim Shoals before arriving on the Yukon–Kuskokwim Delta (YKD) breeding area on 28 May. She remained there until 25 July, briefly staged in Hazen Bay, then returned to the Kuskokwim Shoals where she remained until late-September 2006 (time of this writing). From Kodiak, the SY female migrated to Kamishak Bay where she remained until early June before moving inland to wetlands in the headwaters of the Mulchatna River. She remained there until late-July when she returned to the coast of Bristol Bay between Kvichak and Nushagak bays. She remained there in late-September.

Update on 2005 Birds Marked at Kodiak

Three females and one male continued to transmit location data throughout the winter of 2005-2006. All left Kodiak between 17 and 24 April 2006 for Kvichak Bay. One female that potentially nested on the Alaska Peninsula in 2005 remained in Kvichak Bay until late-June 2006, the time of her last location. The one male returned to the Kuskokwim Shoals where it spent the summer of 2005 and was still there on 4 August 2006, when we received our last location. He never went to a breeding area. The two remaining females returned to their 2005 nesting sites on the Yukon-Kuskokwim Delta. In late-September 2006 one of these females was west of Jacksmith Bay (Kuskokwim Bay) in an area she used for staging in both the spring of 2005 and 2006 and molting in the fall of 2005. After leaving the YKD nesting area in early September, the second female moved offshore to Etolin Strait where she remained as of 23 September 2006.

Nelson Lagoon, Alaska: In April 2003, researchers from USGS/Alaska Science Center implanted 17 individuals (16 males and 1 female) with satellite transmitters. Two birds likely died and one transmitter failed (no signal) within two weeks of capture. Two transmitters failed in December 2003 and January 2004 and one bird likely died in December 2003. All other transmitters failed in April or May 2004. All individuals remained in Alaska and migrated within a narrow range between the Yukon-Kuskokwim Delta and near-Aleutian Islands. Eight individuals (7 males and the single female) moved inland to 2 major breeding areas, the Yukon-Kuskokwim Delta and Bristol Bay Lowlands, Alaska, and remained for a period (males: 10-30 days; female: >50 days) suggestive of breeding activity. Mean arrival date of males to breeding locations was May 18. Suspected non-breeding individuals remained in coastal near-shore waters of the Kuskokwim Shoals, Kuskokwim Bay or Kvichak Bay, Alaska, throughout the breeding period. Birds likely molted along the Kuskokwim Shoals, Kvichak Bay or Nelson Lagoon, Alaska. Birds wintered in near-shore waters along the Alaska Peninsula and near-Aleutian Islands.

Six adult males were implanted, out of the intended 15 transmitters, in April 2004 by researchers from the USGS/Alaska Science Center. Because of difficulties capturing females, transmitters were deployed only in males following the proposed sex ratio of 2:1, to complement the effort in 2003. Five individuals departed Nelson Lagoon in late-May and moved to near-shore waters along southwestern coastal Alaska. One male remained in Nelson Lagoon from April to present. We suspect that all individuals were non-breeding, as they resided in near-shore waters of the Kuskokwim Shoals, Kvichak Bay, or Nelson Lagoon, Alaska, throughout the breeding and molting periods. Two of the five individuals returned to and are currently in Nelson Lagoon, Alaska.

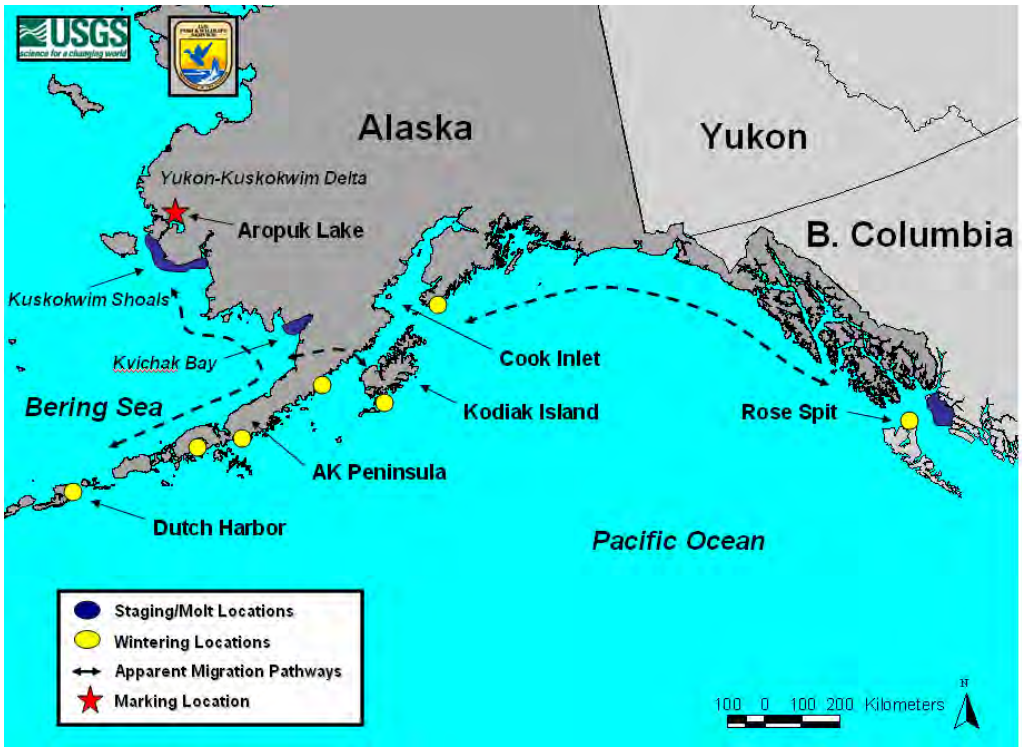
Yukon-Kuskokwim Delta, Alaska: Researchers from the USGS/Alaska Science Center implanted three adult females and seven juvenile (Second Year) females with satellite transmitters at Aropuk Lake in early June 2005. Aropuk Lake is a shallow freshwater lake complex approximately 50 miles inland from the Bering Sea coast. Adults departed Aropuk

Lake during the last week of July, remaining in the area for an average duration of 59 days. Subsequent movements were to marine waters of the Kuskokwim Shoals for the molting period. Two juveniles departed Aropuk immediately following surgery and moved to freshwater locations elsewhere on the Y-K Delta. In late July, these birds re-located to near-shore waters of the Y-K Delta in either Jack Smith Bay or Hazen Bay and remained until mid-October. Five juveniles remained at Aropuk Lake until mid to late-July before moving to the Kuskokwim Shoals or Kvichak Bay for the molting period.

Following the molting period birds migrated to terminal wintering locations ranging from the Alaska Peninsula to the Pacific coast of Oregon. Two adults and three juveniles settled in near-shore waters associated with the Alaska Peninsula (Puale Bay, Shelikof Strait, Stepovak Bay, Izembek Lagoon, and Sanak Islands). One adult and one juvenile wintered at Kodiak Island; while three juveniles migrated east to bays of the north Pacific coast. Specifically, one bird wintered at Cape Yakataga, Alaska, one juvenile wintered at the Strait of Georgia, Canada, and one bird migrated to the north Oregon coast. Four transmitters (2 adults and 2 juveniles) failed during the wintering period in either January or February 2006. The remaining six PTTs continued transmitting through the 2006 breeding season and are transmitting intermittently during the current molting period. Birds initiated spring migration from mid-April to mid-May. Five of six birds stopped-over at Kvichak Bay before continuing migration to summer areas; one juvenile remained at Cape Yakataga for the summer. One adult spent the breeding season in waters of the Kuskokwim Shoals. Three juveniles arrived at Aropuk Lake in early to mid-June and remained until late July before migrating to the Kuskokwim Shoals. One juvenile returned to a freshwater wetland on the Y-K Delta that it visited the previous summer. All individuals appeared to molt or stage at the Kuskokwim Shoals, indicating that this is critical habitat for key portions of the annual cycle of Black Scoters. Further, eight of 10 birds used Nelson Lagoon or Kvichak Bay during spring or autumn staging periods, signifying importance to migrating birds. Finally, four of five birds with functioning transmitters returned to previous summer locations, suggesting that fidelity is high.

Aropuk Lake 2006; Yukon-Kuskokwim Delta: In early June of 2006 researchers from the USGS/Alaska Science Center returned to Aropuk Lake and implanted five adult females (ASY) and five second-year (SY) females with satellite transmitters. All five SY birds and two ASY females departed Aropuk Lake in late-July or early August and moved to the Kuskokwim Shoals, Jack Smith Bay or Kvichak Bay for the current molting period. Three ASY birds stayed at Aropuk Lake until late-August, remaining in the area for an average duration of 80 days. Subsequent movements were to marine waters of the Kuskokwim Shoals for the present molting period. The Kuskokwim Shoals and Kvichak Bay appear critical to molting and staging black scoters.

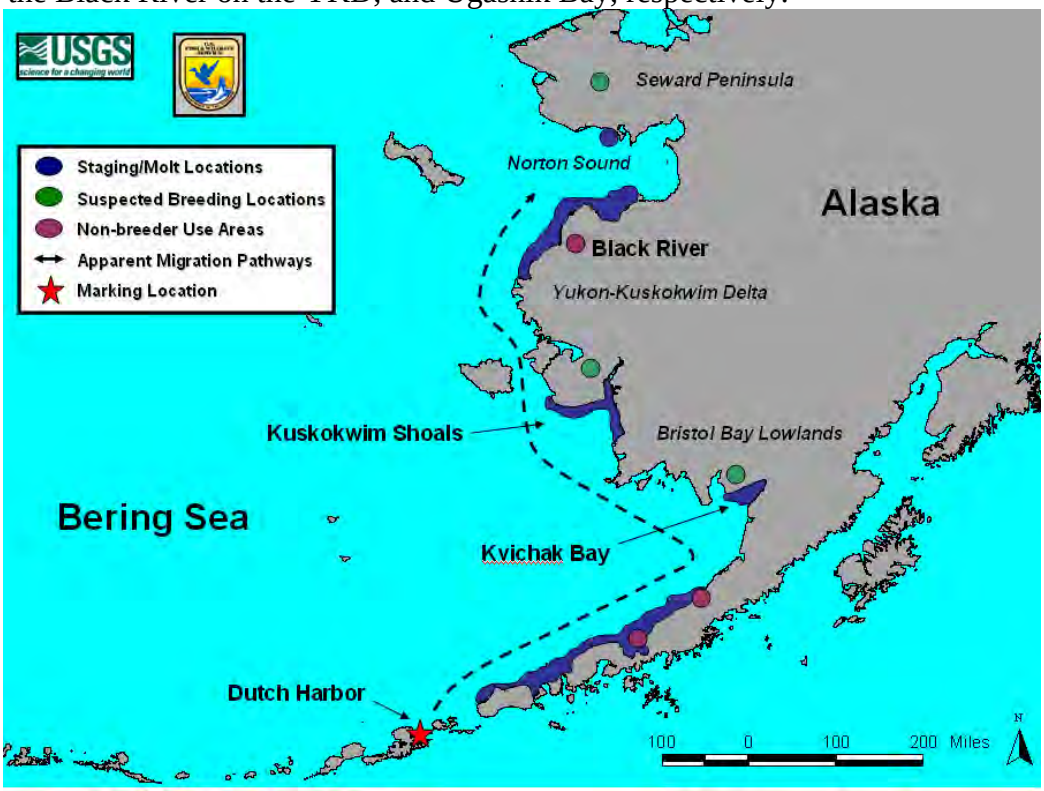
Following the molting period, five ASY and three SY individuals initiated migration to terminal winter locations in late-October or early-November; transmitters failed on two SY individuals in early-September at the Kuskokwim Shoals. Terminal winter locations were varied among individuals; ranging from the near Aleutian Islands, Alaska to the Hecate Strait, Canada. Two ASY and two SY females settled in various bays of the Alaska Peninsula (e.g., Ivanof Bay, Pavlof Bay, Wide Bay, and Stepovak Bay). One ASY female wintered in Dutch Harbor, Alaska. Three females moved to near-shore waters east of the Alaska Peninsula.



Specifically, one ASY female staged in bays of Hecate Strait, but wintered in Rose Spit on Queen Charlotte Island, Canada, another ASY female wintered in Windy Bay near Cook Inlet, Alaska, and the final SY female wintered in bays on the south-end of Kodiak Island. Two transmitters failed (2 ASY) during the winter months, one transmitter (SY) failed in May during spring migration at Kvichak Bay, and another transmitter (ASY) failed in June while the bird resided at Dutch Harbor. The remaining four PTTs (3 ASY, 1 SY) provided reliable data through the summer months and are presently transmitting. The four birds initiated spring migration in late-April or early-May and staged at either Kvichak Bay or the Kuskokwim Shoals. All four birds returned to Aropuk Lake and remained for a time-period suggestive of breeding; one ASY female is presently still at Aropuk Lake. Two (ASY, SY) of the three females departed in late-July for the Kuskokwim Shoals until present, and the other female also departed in late-July for Kvichak Bay until present. All individuals appeared to molt or stage in two consecutive years at either the Kuskokwim Shoals or Kvichak Bay, indicating that these are critical habitats for key portions of the annual cycle of black scoters. Further, winter locations were considerably variable, suggesting that a single breeding population may be subject to varying environmental conditions during the non-breeding season. Finally, all four birds with functioning transmitters returned to the previous summer's marking location, suggesting that fidelity to breeding areas is high.

Dutch Harbor, AK: Researchers from the USGS/Alaska Science Center and USFWS/Migratory Bird Management implanted two adult females (ASY), five second-year females (SY), and three first-year females (FY), with satellite transmitters at Dutch Harbor, AK in early February 2007. Dutch Harbor is located on the Bering Sea side of Unalaska Island in the eastern Aleutian Islands. A number of sea duck species select Dutch Harbor to over-winter, likely because of its abundant forage and ice-free bays that are protected from high-energy weather and wave-action. Of the 10 transmitters that we deployed, two transmitters failed to report data shortly after surgery: one bird likely died in late February and another transmitter failed in late-March. Additionally, two other transmitters failed in late-winter (late-March) and mid-summer (early July) while birds were in Dutch Harbor. Birds appeared to initiate spring migration from Dutch Harbor in an age-related manner. The two ASY birds

departed in early-April, followed by the departure of three SY birds in mid-April and lastly the single HY bird departed in late-April. Spring movements of all individuals were in a northward direction and primarily in near-shore waters. Specific locations visited in spring by ≥3 individuals included the Alaska Peninsula (e.g., Izembek Lagoon, Nelson Lagoon, Port Moller, and Port Heiden), Kvichak Bay, Jack Smith Bay and the Kuskokwim Shoals. Both ASY birds traveled inland in late-spring and remained for a significant time-period (i.e., a consistent pattern of location data) suggestive of breeding activity: one bird traveled to the Yukon-Kuskokwim Delta (YKD), and the other bird to the Seward Peninsula. For black scoters, this information is the first indication of connectivity between wintering/staging locations and the Seward Peninsula breeding area; unfortunately, the signal was lost in early-July for this bird. One SY female also traveled inland in early summer to the Bristol Bay Lowlands near the Nushagak River and remained for approximately two months. The likelihood that this bird attempted to breed was low, but it is likely an indication of natal philopatry. The other two SY birds and the HY bird spent the summer months in Norton Sound, the Black River on the YKD, and Ugashik Bay, respectively.



Individuals exhibited considerable variation in selection of apparent molting location, which included: south Norton Sound, Port Heiden, Kuskokwim Shoals, Kvichak Bay, and Jack Smith Bay. Our data indicates that black scoters from a single winter location utilize a wide-variety of habitats along the entire Bering Sea coastline during the annual cycle, and therefore, may be particularly sensitive to perturbations in the Bering Sea ecosystem.

Genetics

Tissue samples were collected from all marked birds, plus others that were captured and released, and are currently stored at the USGS Molecular Ecology Laboratory in Alaska. Mitochondrial DNA primers are currently being developed (SDJV project# 40). Genetic analyses will be done after completion of this study and acquisition of samples from all study areas.

Project Status: The survey data obtained satisfied the desired objectives of monitoring the size, distribution, and trend of the black scoter nesting population. We have demonstrated that

precise and unbiased estimates of visibility detection rates can be obtained, however these depend on collecting enough representative and independent front- and rear-seat observations, correctly identifying the matched observations, and meeting the assumptions of the simple mark-resight statistical model. Detection rates have differed, but not greatly, among years, regions, and observers. The process of determining detection rate remains difficult.

With completion of the first four-year rotation of transects lines, we plan to re-examine the stratified design. The scattered transects sampling the interior portion of the Seward Peninsula and the Alaska Peninsula are inefficient to fly. Rather than sampling ¼ of the transects each year, we flew these areas by covering all transects in a single year, and then we used the data obtained for those years not flown. The efficiency of coverage in low-density habitat can be further improved. In addition, sampling a smaller total area, for instance covering 80% of the population rather than 95%, may be adequate. We plan to modify the design to better allocate sampling effort in the future.

We have been unable to identify any promising capture sites at Togiak or Selawik areas and intend to use stable isotopes to identify general wintering locations (e.g., Russia versus Alaska versus BC) of black scoters in the Selawik area. This area is of particular interest because only one of the 85 black scoters we have marked has gone to the Selawik area, leading us to speculate that this population may winter primarily in Russia as do many other sea ducks in northern Alaska. Feathers were collected from 40 scoters harvested by subsistence hunters in local villages and stable isotope signatures will be compared with reference signatures from potential wintering areas and/or from wing feathers collected from sport-harvested black scoters of known age.

As a result of this study, we are developing methods for aging both male and female black scoters. In general, first-year birds are readily distinguished by body plumage, whereas second-year and older birds are distinguished using a combination of bill coloration, mottling patterns, and bill profile. Confirmation of age classes has been done by measuring bursal depth.

One of the original objectives in the proposal was to tap traditional knowledge about black scoter biology and harvest. Although we may continue to obtain information toward this objective opportunistically, the objective has been formally dropped due to significant political, bureaucratic, and financial obstacles. Local communities are kept abreast of this study through contacts with Refuge Information Technicians and distribution of a “Black Scoter Studies in Alaska” fact sheet. One local village prepared but then withdrew a Tribal Grants proposal to examine questions about the black scoter harvest in 2005. We hope to work with the communities to encourage submission of this proposal in the future.