Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2012 – (October 1, 2011 to Sept 30, 2012)

Project Title: SDJV PR96: Pacific Black Scoter Breeding Survey

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Fairbanks and Juneau Field Stations, MBM
Yukon Delta NWR, Tokiak NWR
Alaska Peninsula/Becharof NWR
Selawik NWR
Tokiak NWR

Project Description (*issue being addressed, location, general methodology)*:
We conducted an eighth year of aerial surveys to monitor Alaska's breeding population of Black Scoters. The 2012 survey was flown in a Quest Kodiak aircraft whereas a Cessna 206 aircraft was used in previous years. The left-seat pilot observer (EJM) and a right-seat observer (DJG) recorded all Black, White-winged, and Surf scoters (*Melanitta nigra*, *M. perspicillata, M. fusca*), and Greater or Lesser scaup (*Aythya marila, A. affinis)* within a 200m strip on each side of the aircraft using standard aerial survey protocol (USFWS and CWS 1987). Front- and rear-seat double-count observations allowing a mark-resight estimate of detection rate were not conducted in 2012. The timing of the survey was two to three weeks after the standard North American Waterfowl Breeding Pair and Habitat Survey and appropriate for late-nesting diving duck species. We designed the survey based on the distribution of scoters documented by extensive surveys of Alaskan wetlands flown 1989 to 1997. From 2004 to 2007, we flew systematic transects sampling 154,645 km^2 of tundra wetlands divided into 12 strata of high and low scoter density in various geographic regions. Using results of these four-years we redesigned the survey in 2008 to be more efficient by excluding some areas of low density and increasing sampling where variance was high. Transects flown 2008-2010 and 2012 sampled 113,732 km^2 of wetlands in six strata covering 74% of the original area and 84% of the 2004-07 average scoter population. All data were re-analyzed with the more efficient stratification.

Objectives ***(should identify how the project addresses SDJV priorities*):**
Our objectives were to monitor the breeding population size, determine population trend, and identify important scoter habitat. For scoters, the population parameter measured was the aerial index of indicated total birds, 2* n singles + 2* n pairs + birds in flocks, assuming a single male often indicated an undetected nesting female. Singles were not doubled for scaup due to excess males typically in the population (USFWS and CWS 1987). Survey precision was intended to allow detection of rapid population change within a 5-year period. The survey from 2004 to 2006 was part of SDJV Project #38 Black Scoter Integrated Study and it continues to complement

goals of that project as more data on population delineation, seasonal movement, and estimated harvest are compiled.

Preliminary Results *(include maps, photos, figures/tables as appropriate):*

The 2012 aerial survey transects were flown on 7 days between 20 June to 28 June with two days skipped due to weather. The number of observations and area sampled showed increase in the total number of birds recorded (Table 1). This included 294 unidentified species of scoters, 3.6% of scoters in all years. Of those identified to species, the proportions classified as White-winged scoter and Surf scoter, respectively, were 1.9% and 0.5% on Bristol Bay, 0.5% and 0.5% on YKD, 1.7% and 3.9% on Seward Peninsula, and 0.9% and 6.7% on Selawik transects. Of the unidentified scoters, 283 were recorded in 2012 because the observers used the observation protocol of Alaska-Yukon Waterfowl Breeding Population survey where scoters seen in the distant half of the transect width are usually not determined to species. Combined across all years and strata, 97.6% of the scoters were Black Scoters, 1.0% were White-winged Scoters, and 1.4% were Surf Scoters.

Table 1. Area observed and the sum of birds of each species recorded on aerial transects that sampled 113,732 km^2 of tundra wetland in six strata.

Year	2004	2005	2006	2007	2008	2009	2010	2012
Observed (km^2)	1113.1	1012.6	1253.9	1293.1	1342.9	1350.2	1379.3	1455.6
BLSC	732	617	984	1002	707	1131	1331	1140
WWSC	19	1	8	3	6	0	1	43
SUSC	4	1	18	28	3	7	19	29
Unidentified scoter	7	0	1	3	0	0	0	283
Scaup spp.	1156	1126	1437	1563	1121	1652	1888	2031

Combining data from both observers, the 2012 indicated total bird aerial indices were 116,657 scoters (SE = 9,948, CV = 8.5%) and 138,811 scaup (SE = 14,630, CV = 10.5%) (Fig. 1, Table 2). The relatively small numbers shown for Black Scoters in 1989-1997 and 2012 (Table 2) was the result of more frequent recording of unidentified scoters.

Table 2. Aerial population indices of scoters and scaup on western Alaska tundra wetlands analyzed using the 2008 redesign with 6 strata to sample a total area of 113,732 km^2. Data were pooled from both observers and no correction made for detection.

Year	Scoter species	Black Scoter	Scaup species	Long-tailed Duck	Tundra Swan	Jaeger species
1989-1997	121,158	87,935	147,026	27,503	78,453	3,752
2004	67,563	65,418	99,932	10,026		
2005	61,393	60,821	107,345	9,658		
2006	77,901	76,034	116,076	12,645		
2007	83,620	81,506	113,562	9,852		
2008	62,606	62,048	88,284		75,498	1,427
2009	92,772	92,366	117,399			
2010	105,274	102,687	133,855			
2012	116,657	89,138	138,811			

The trend of the 2004-2012 aerial index for scoters (Table 2) indicated an average annual population growth rate of 1.078 (90% confidence interval 1.043-1.114). The scaup aerial index indicated an increasing trend of 1.037 (1.008-1.066). In general, growth rates were similar in each stratum (Table 3). An exception was the relatively small populations in the

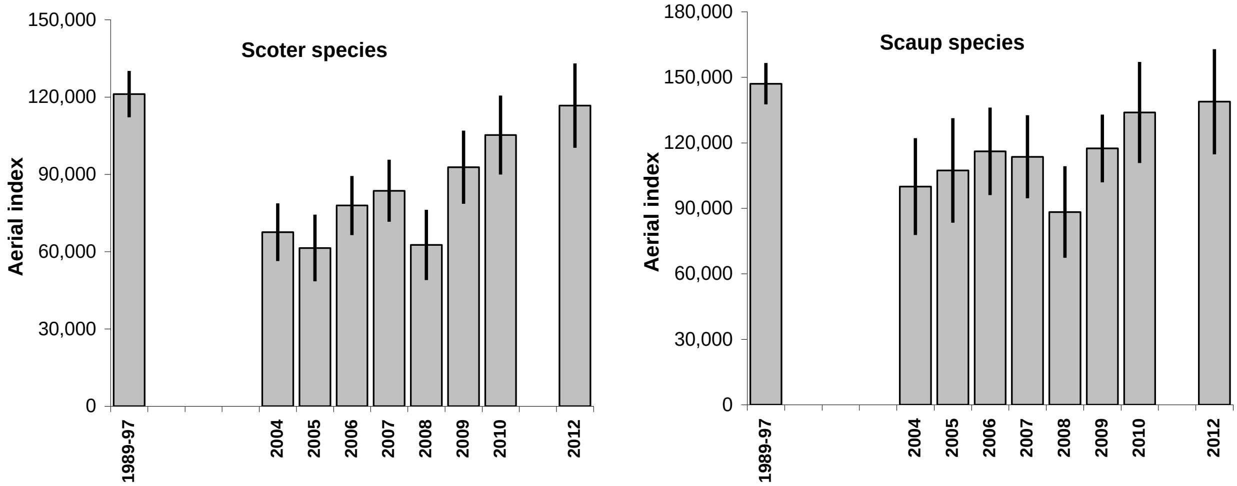

Figure 1. Aerial indices for combined scoter and combined scaup species totaled for the six survey strata.

Seward Peninsula stratum (Table 3) that showed higher growth rates caused by large increase in the 2010 and 2012 aerial indices.

From the independent front- and rear-seat observations recorded on transects when both observers observed from the left side, we matched sightings based on time (location), species, group size, and notes recorded on the observed bird's behavior (sitting, swimming, flying) and distance from the aircraft (near, mid, far, off transect). The accuracy of the resulting detection estimates required that mark-resight method assumptions held including independence, correct matching, and limited heterogeneity in actual detection rate among observations. We detected little change in detection rate among years 2004-2010 (Fig. 2) or among strata. The 7-year average detection rates for the front- and rear-seat observers, respectively, were 55% and 64% for black scoter and 52% and 57% for Scaup. This compares with detection rates of 86% for scoters and 52% for scaup based on the ratio of helicopter to fixed-wing aircraft counts recorded in 1989-1991 on the Yukon Delta (Smith 1995).

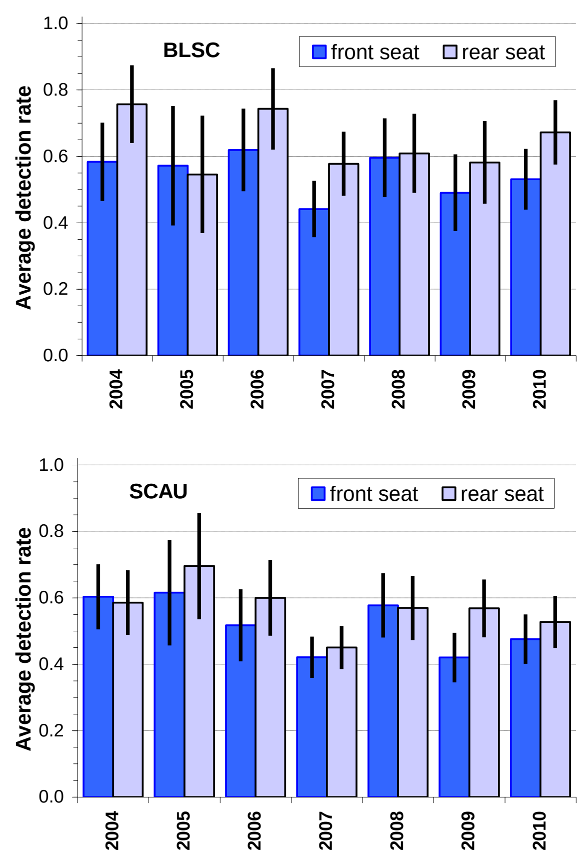

Figure 2. Average detection rate of Black Scoter and Scaup for front and rear-seat observers in each survey year based on the matching of independent double count observations. Data for each species and year were analyzed separately while region, crew, day, and group sizes were pooled.

We estimated the population size each year using the aerial index divided by the unweighted average detection rate of 0.594 (0.554-0.634) for scoters and 0.545 (0.499-0.590) for scaup. These detection rates were calculated by pooling data across strata and then averaging detection rates for front and rear-seat observers and seven years. The 2004-2012 average aerial index of 83,473 estimated the average population size for scoters at 140,528 indicated total birds with an increasing trend of 7.8% per year. Restricting the aerial index to only singles and pairs (indicated breeding birds) resulted in a 5% smaller population size for scoters and little change in the growth rate (Table 3). The 2012 total aerial index was 116,657 scoters and the population estimate was 196,393. For scaup, the average 2004-2012 index was 114,408 and estimated average population size was 210,035 total birds with an increasing trend of 3.7% per year. The 2012 aerial index was 138,811 with a population estimate of 254,699. Excluding observations of flocks for scaup, the growth rate was reduced to 1.025 and the average breeding bird index was reduced by 19% (Table 3).

Table 3. Estimated growth rates, average aerial indices and population sizes with 90% confidence intervals for combined scoter and combined scaup species surveyed 2004-2012. The average detection rates of 0.594 (0.554-0.634) for scoters and 0.545 (0.499-0.590) for scaup were used to estimate population size from the aerial indices.

Stratum	area km^2	Growth rate (90%ci)	Average aerial index	Average population size
Scoter				
Bristol Bay high	14,605	1.097 (1.066-1.129)	17,069 (14,148-19,991)	28,736 (23,444-34,028)
Bristol Bay low	13,611	1.127 (1.009-1.259)	6,716 (4,615-8,817)	11,307 (7,687-14,927)
YKD high	31,642	1.067 (1.038-1.096)	31,902 (27,822-35,982)	53,708 (45,929-61,487)
YKD low	40,142	1.063 (1.004-1.125)	14,860 (12,536-17,183)	25,016 (20,751-29,281)
Seward Peninsula	8,825	1.107 (1.050-1.167)	7,807 (6,176-9,437)	13,143 (10,255-16,030)
Selawik	4,907	1.074 (0.918-1.256)	5,119 (3,431-6,808)	8,618 (5,716-11,521)
Indicated total birds	113,732	1.078 (1.043-1.114)	83,473 (71,697-95,250)	140,528 (118,520-162,536)
Indicated breeding birds		1.075 (1.040-1.110)	79,016 (68,469-89,563)	133,024 (113,097-152,951)
Scaup				
Bristol Bay high	14,605	1.021 (0.948-1.101)	9,977 (7,990-11,963)	18,315 (14,360-22,270)
Bristol Bay low	13,611	1.048 (0.907-1.210)	4,344 (2,949-5,738)	7,974 (5,328-10,620)
YKD high	31,642	1.025 (0.976-1.076)	51,062 (45,377-56,746)	93,741 (80,696-106,787)
YKD low	40,142	1.013 (0.956-1.073)	30,198 (26,180-34,215)	55,439 (46,730-64,147)
Seward Peninsula	8,825	1.167 (1.052-1.294)	8,681 (6,057-11,305)	15,937 (10,939-20,935)
Selawik	4,907	1.109 (1.005-1.224)	10,147 (7,896-12,398)	18,629 (14,213-23,045)
Total birds	113,732	1.037 (1.008-1.066)	114,408 (104,756-124,060)	210,035 (185,102-234,968)
Breeding birds		1.025 (0.990-1.062)	92,774 (84,564-100,983)	170,318 (149,595-191,041)

Project Status ***(e.g., did you accomplish objectives, encounter any obstacles, what are your plans for the future?)***

The survey successfully monitored the size, distribution, and trend of Black scoter and scaup nesting populations. Aerial survey indices and population estimates showed consistent and positive growth rates for both species.

Estimated detection rates were not strongly or consistently influenced by observer, stratum, or year, therefore using average detection rates for each species seemed a reasonable method to estimate population size. In any case, for years without an estimate of detection rate, we must use some averaged detection parameter.

For scoters, the coefficient of variation (CV) of the estimated sampling errors of annual indices ranged from 9% to 13% and averaged 10.3% over 7 years from 2004 to 2010. The CVs of the detection rates determined in individual years ranged from 6% to 14% and averaged 9.1%. If the index and detection rates are independent, the expected CV of the quotient of the average index divided by average detection would be 13.7%, (= [0.103^2 +0.091^2]^0.5). The average of annually calculated sampling and detection errors for the population estimates (= aerial index/detection rate) had CVs ranging from 11% to 18% and averaged 13.9%, supporting the assumption of independence. If not independent (e.g., years with lower counts might also have lower detection rates), the year-specific population estimates would have different variability with time. Deviation around the smooth loglinear regression fit of the 2004-2010 aerial index or population estimate data is another way to assess variability of the measured parameters, although this depends on the assumption that the actual population growth was exactly loglinear, i.e. with a constant growth rate. The deviates (residuals after regression) for the aerial index had an average CV of 13.4% and the regression residuals of the population estimates had an average CV of 16.7%. Thus, we observed a small increase in variation and a decrease in the ability to monitor the population size with annually estimated visibility correction. (Such a conclusion depends entirely on the assumption that growth rate was constant. Because true population change may have varied, perhaps the actual variability was closer to the larger CV. We have no data to determine which was true.) We used Gerrodette's (1987) equation 20 to solve for number of years needed to obtain significance with probability <0.10 and 80% power for detecting a growth rate of 0.9659 (equal to a 50% decline in 20 years). A sampling error CV of 16.7% would require 12 years of data, a CV of 13.4% indicates 10 years, and a CV of 10.3% indicates 9 years to obtain significance. In practical terms, all these estimates of survey precision were essentially equivalent.

The estimated detection rate from 2004-10 was almost constant with the same pilot, different observers, similar timing, and a variety of weather conditions. The 11% increase in scoters and the 4% increase in scaup indexed in 2012 compared to 2010 were consistent with (but slightly below) the numbers expected as based on previous population trend. In spite of a new aircraft, pilot, observer, slightly later timing, and perhaps other changes in conditions in the 2012 survey, we found no evidence to suggest a marked change in visibility rate. Even with variation in aircraft, observers, and conditions, the relatively consistent aerial index estimates among years suggests that less frequent monitoring (2 to 5 year intervals) may suffice to detect a 50% change in population in 20 years.

The increasing trend for both scoter and scaup populations in western Alaskan nesting areas reduced the earlier concerns about declining populations. At least since 2004, the possibility of overharvest by subsistence hunters, or a decline in foods in near-shore marine staging or wintering areas, seemed unlikely. Perhaps the subsistence estimates were overestimates due to bias or other problems with the harvest survey, or harvest has diminished since 2004. The original suggestion that a 50% decline had occurred since the 1950s, as was stated on the Black Scoter fact sheet, has not been confirmed. Informal re-examination of early survey data from Alaska shows no basis for either a decline or a subsequent recovery of the population of scoters in Alaskan tundra wetlands.

Efforts to conduct paired sampling were not conducted in 2012 due to operational concerns of the aircrew. Plans for continuing the survey in 2013 with base USFWS funding is contingent upon federal funds available.

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