Sea Duck Joint Venture
Annual Project Summary for Endorsed Projects
FY 2005 – (October 1, 2004 to September 30, 2005)

Project Title: Project #20- Breeding Ecology of Scoters Nesting in the Lower Mackenzie River Watershed, NWT. YEAR 3 of 5+ YEAR STUDY. Year 3 of multi-year SDJV funding.

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Partners: Sea Duck Joint Venture/USFWS, Ducks Unlimited Canada, Gwich'in Renewable Resource Board, Environment Canada

Project Description: The continental population of scoters (all three species combined) has declined by over 58% since 1978, from about 1.75 million to about 700,000 birds.
We cannot reliably predict where limitations on these taxa have occurred or where they might be most responsive to management because we lack basic data on population dynamics. However, retrospective analyses examining correlations between declining scaup and scoter populations suggest that these birds share limiting factors in the NWT. We are using a combination of mark-recapture techniques (including radio-marking prenesting females), nest searching, and brood observations to estimate demographic parameters and habitat use of scoters nesting in the Lower Mackenzie River watershed. This region is within the NWT, where over 65% of the scoter breeding population historically occurred, and declines approach 70% over the past 24 years. The project is also a sister study to our scaup breeding ecology work at the same site and will permit comparisons of demographic rates without confounding effects of spatial and temporal variation between studies.

Objectives: The primary objective of this study is to address a high priority SDJV information need by estimating vital rates associated with breeding in white-winged scoters, particularly breeding propensity, clutch size, nest success, annual and breeding survival of adult females, and duckling survival. Such information will help us develop population models to identify what demographic rate(s) constraints may be acting on, develop more advanced hypotheses about limiting factors, and assess sensitivity of population trajectory to changes in different vital rates as a way to evaluate potential targets for management actions. Another objective is to test for effects of handling on prenesting female scoters using multi-year radios to better understand researcher-induced impacts on nesting effort. Multi-year radios should also allow us to assess return rates and increase annual sample size to obtain tighter estimates of demographic rates. Finally, we have tested effects of mock satellite transmitters on survival of scoters marked in the breeding season to help interpret results of the Alaskan scoter marking program, and are continuing collaborations to examine contaminants, reproductive energetics, and population delineation of white-winged scoters.

Preliminary Results:
Marking: We captured 37 female and 60 male White-winged Scoters from May 31st (~ice out) to June 17th 2005, using floating mist nets. Back-dated ages of scoter broods indicated that mean

(sd) nest initiation was June 16th (+7 days, n=69 broods), so this trapping period included both the pre-nesting and early nesting periods. All female WWSC were marked with an intra-abdominal radio transmitter with an external antenna and 18 month battery life, an aluminum leg band, and nasal markers. These were the same model radios used in 2004 and were more powerful and yielded far better resolution of bird movements than those used prior to 2004. Unfortunately, 3 radios malfunctioned prior to deployment and so we did not reach our objective of 40 marked females. Cumulative catch during the 2002-2005 pre and early nesting periods (% female) is: 353 White-winged Scoters (34%), 21 Long-tailed Ducks (14%), 7 Surf Scoters (14%), 2 Greater Scaup (0%), 2 Lesser Scaup (0%).

Adult female survival: We observed 11 unique nasal marker codes deployed in 2002 and 2003. Of the 40 birds marked in 2004 with 18 month radios, we heard 12 and observed nasal markers of another 5 with failed radios. About half these radio-marked females were egg producers in 2004, based on blood lipid results (see below). No previously marked males or females were recaptured in floating mist nets. Encounter rates (# females encountered/# marked) were 13%, 33% and 42% for birds marked in 2002 (n = 15 females marked), 2003 (n = 27) and 2004 (n = 40), respectively. We will continue observing marked females in subsequent years and use these data to obtain an estimate of annual adult female survival. Two females marked in 2004 were predated during the 2005 breeding season. No females marked in 2005 died during the study.

Prenesting body condition: We indexed body condition as mass corrected for structural size (PC1) and computed size and condition with all sexes and years combined. Body condition and mass of captured females was highly variable across years of this study (Figure 1, GLM test for year effect on condition: $r^2 = 0.23$, P = <0.0001, and mass: $r^2 = 0.22$, P = <0.0001), with 2004 body mass being 207g and ~120g lower than in 2002 and 2003/2005, respectively. There were no year effects on male body condition or mass (P > 0.80). Females were numerically heavier for their structural size, i.e. in “better” body condition, than were males in 2002, 2003, and 2005 but lighter in 2004 (Figure 1). Arrival weights in 2004 were also 90g lighter than those recorded in 1985 for white-winged scoters by Dobush at Redberry Lake, Saskatchewan. There was no effect of social status (paired vs. unpaired) in either sex (P > 0.05), although samples sizes for unpaired females lacked statistical power. The cause of this intersexual difference in patterns of annual variation is unknown. However, we could not find evidence of sampling bias and so think this result is representative of the population.

Egg Production Status: Vitellogenin, a yolk precursor found in the blood, was used to assess follicular development/egg production status at time of capture. About 35% and 86% of the marked females were developing follicles at capture in 2004 and 2005, respectively, and this status did not change appreciably with capture date (P > 0.1, Figure 2), as might be predicted closer to peak nest initiation. We are investigating this vitellogenin approach as a measure of breeding propensity. Morphometric measurements were analyzed for egg production status, year, and interaction effects using Proc GLM in SAS. The interaction and year effects were non-significant and were subsequently dropped from analyses. Mass and condition differed between egg producing (EP) and non-egg producing (NEP) females, varying by nearly 250 g on average (Table 1), and with 93% of EP above and 87% of NEP below ~1380g (Figure 2). We don’t know if this value represents a threshold for breeding or simply a difference correlated with some other factor, i.e. female age. However, in 2005, we recorded bursal depths of females, and

19% of the EP birds had bursal depths >3 mm, including 3 birds over 10 mm, suggest that in this year some young birds were egg producers. All NEP birds had bursal depths >5 mm (range 6 – 22 mm). In 2002, 2003, and 2005, most females were above 1380 g (Figure 1).

Over 95% of females were known to be paired at capture across all years, indicating that young/non-egg producing females can be observed on the breeding grounds in a pair, which might have implications for interpreting aerial survey results obtained from other programs, i.e. not all paired birds are breeders.

Table 1. Mass, condition, and size of egg (n = 46) and non-egg producing (n = 31) female White-winged Scoters.

	LS Mean (SE)		
	Mass (g)	Condition	Size (PC1)
Egg Producing	1530 (13)	94 (13)	-0.06 (.15)
Non- Egg Producing	1298 (16)	-140 (15)	0.09 (0.18)
r^2	0.62	0.64	0.01
P	<0.0001	<0.0001	0.500

Residency, nesting effort, and reproductive success: Birds were typically tracked multiple times per day during pre and early nesting, daily throughout the remaining nesting period, and then at least weekly until the 13th of August. Residency rate of birds marked this year (# birds remaining on the study area after the prenesting period/total marked) was 89% (n = 33). This rate was similar to 2002 (92%) and 2003 (100%) but much higher than 2004 (47%) when 65% of the marked sample were non-egg producing birds.

We found 14 scoter nests in 2005 and eight of those nests were from radio-marked females. Other nests were found by foot searching. We know there was an additional radio marked bird from 2004 which also nested, however her radio died before the nest was located; she was seen incidentally later in the season with a brood. Overall apparent nesting effort for resident radio birds from 2004 and 2005 was 22.5% (n = 40), including the nest that we did not find but know was successful. For birds marked in 2005 that stayed on the study area during pre and early nesting, 15.1% (n = 33 resident marked females) were known to have nested, numerically similar to 2004 (15.8%, n = 19), higher than that observed in 2003 (11%, n = 27), and lower than in 2002 (23.1%, n = 13), but all still less than 25%. Of the 2004 birds that returned with functioning radios and stayed on the study site through the pre-nesting period, 57.1% were known to have nested (n = 7 resident females). These results suggest a handling effect in the first year after marking, but, admittedly the contribution of NEP birds and potential migrants has not yet been fully taken into account. As well, telemetry data indicates that these scoters are extremely difficult to locate on the nest during egg laying, which might bias our estimate of nesting effort low. Typically we would have one to no locations of nesters on land throughout egg laying, then suddenly would locate them on land with a completed clutch and taking no detected incubation breaks. As well, nest failure of marked birds usually occurred in early incubation. Therefore, potential bias on estimates of nesting effort caused by high predation rates during early nesting, particularly as it might interact with year of marking also need to be considered. We have weekly observations of social status of marked birds that might yield insights into this issue and will further examine this possible researcher-induced bias in nesting effort.

Average (sd) clutch size was 6.7 eggs (2.0, n = 6 nests), which is numerically smaller than 9.24 eggs reported by Bellrose (1980) for scoters nesting on the prairies and is the numerically smallest yearly average clutch size observed at Cardinal Lake (2002 – 7, n = 3; 2003 – 8.5, n = 2; 2004 – 7.3, n = 8).

Mayfield-Green estimate of nest success was 13% (n = 13), with two of the eight nests of radio marked females surviving until hatch. Neither hen had a brood after one week. Mayfield-Green nest success was 25% (n = 4), 0% (n = 5), and 28% (n = 11) for 2002- 2004, respectively. Annual variation in scoter nest success is consistent with patterns seen for Lesser Scaup (Mayfield-Green nest success:2002- 66%, n = 26, 2003- 15%, n = 121, 2004- 28%, n = 138, 2005 – 13%, n=113), suggesting that the same factors might affect nest success of both species.

Habitat use: We conducted pair and brood counts on 37 wetlands for which we also sampled food availability during prenesting and brood rearing periods. These data will be combined with observations, water chemistry, and invertebrate sampling from previous years and our GIS habitat base map for the Lower Mackenzie region to better understand factors affecting pair and brood use of wetlands in this area of extensive oil and gas exploration.

Collaborative work: We continued monitoring small mammals as potential alternate prey for nest predators as a node in the NWT small mammal monitoring survey. We also obtained feathers to broadly identify wintering areas of birds in our marked sample (east coast/west coast/fresh water) as a potential explanation for variation in other parameters such as egg production status and body mass, blood samples for genetic analyses (taken while females were under anesthetic) to delineate subpopulations structure (collaboration with USGS AK Science Centre), and < 1 g lipid biopsy samples (also taken during surgery), plus invert samples to assess marine vs. fresh water sources of reproductive lipids (collaboration with CWS/Simon Fraser University/University of Wyoming SDJV project #45).

Project Status: We have obtained reliable data on annual variation in prenesting body mass/condition, particularly relative to egg production status, which might be a proxy for breeding propensity. The intersexual differences in patterns of annual variation we have observed may also be indicative of strong environmental effects on egg production in scoters, and will be investigated in the future, particularly after results from SDJV project #45 and isotopic analyses for winter origin are available later in the year. Given the potential researcher-induced bias in nesting effort, which might be consistent across all styles of radios deployed in this study, we also are evaluating whether we will mark prenesting scoters in 2006 and assessing future directions for this project, although we plan to continue reobservation efforts and track birds radio-marked in 2005. This past summer, we conducted exploratory work with capturing prefledging ducklings and believe that we can capture large numbers of broods, so we will explore options for obtaining estimates of age at first breeding and the role of body size near fledging on subsequent survival/observation on breeding grounds.

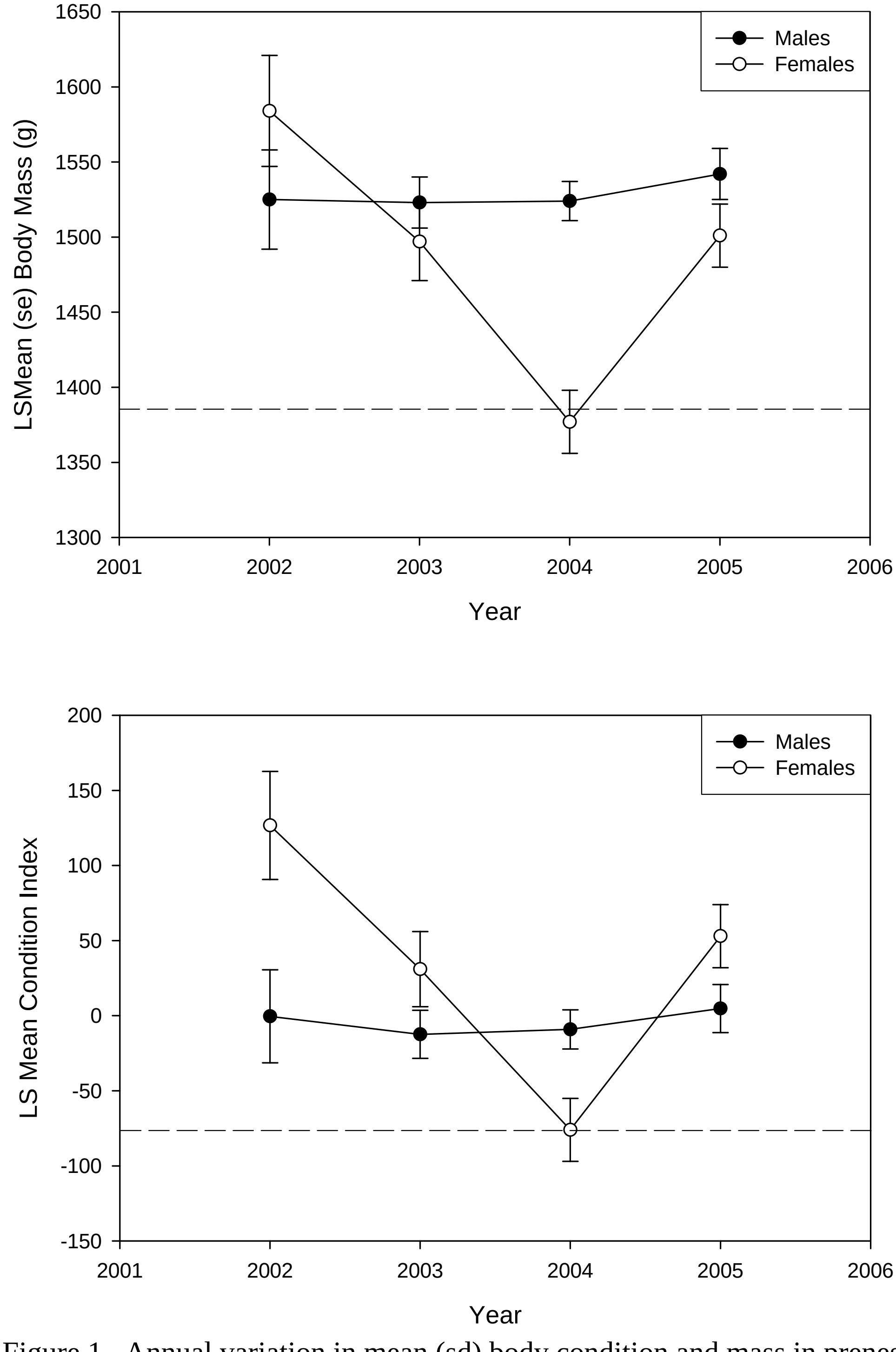

Figure 1. Annual variation in mean (sd) body condition and mass in prenesting white-winged scoters captured in the Cardinal Lake Region. Sample sizes: Females- n_{2002} = 13, n_{2003} = 27, n_{2004} = 40, n_{2005} = 37, Males- n_{2002} = 16, n_{2003} = 62, n_{2004} = 97, n_{2005} = 60. The dashed lines represent possible cut-off points in mass and condition for egg production (see Figure 2) and suggest the possible breeding effort in each year.

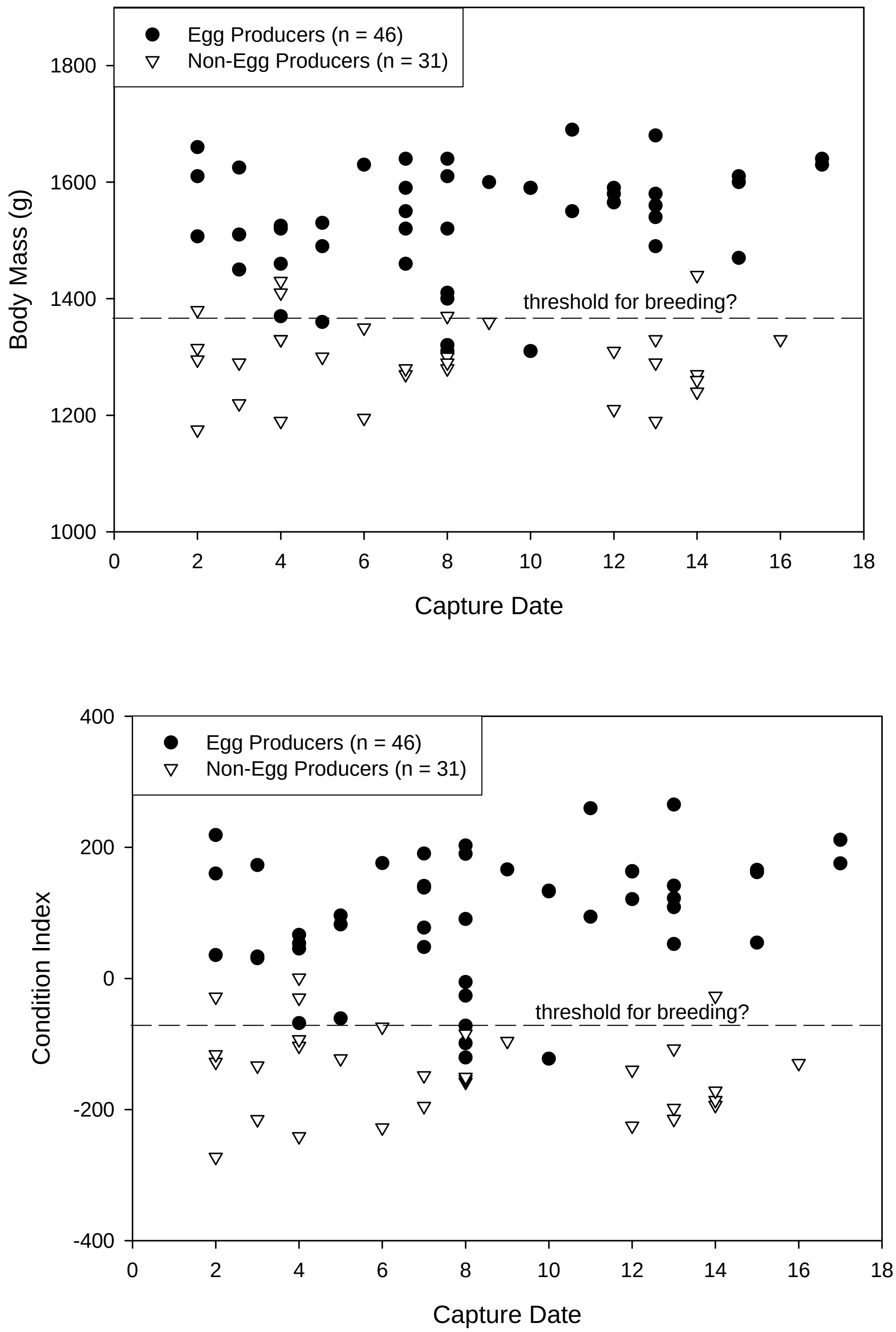

Figure 2. Relationship between body mass and condition with capture date, relative to egg production status in 2004 and 2005. Dotted lines indicate possible thresholds for egg production, although such cutoffs are speculative at this time. Years were pooled.