Sea Duck Joint Venture
Annual Project Summary
FINAL REPORT

SDJV Project #154: Integrating Fixed-Wing and Helicopter Survey Platforms to Improve Detection and Species Identification of North American Breeding Scoters

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Project Description:
Populations of North American breeding scoters appear to be declining although a large degree of uncertainty remains around estimates of population size and overall trends (Bordage and Savard 1995, Savard et al. 1998, Caithamer et al. 2000). We conducted experimental fixed-wing and helicopter integrated breeding surveys over portions of the core breeding range, in Québec-Labrador, northern Manitoba, and the Barrenlands of the Northwest Territories (fig 1), of all three North American scoter species. The overarching objective of the project was to produce recommendations for the development of breeding surveys for scoters and other Boreal/Arctic waterfowl.

Project Objectives:
There were 6 main objectives:

1. Identify the optimal timing for breeding scoter surveys
2. Develop and evaluate methodology to accurately assess species identification and composition from an integrated fixed-wing and helicopter survey
3. Develop and evaluate methodology for estimating detection probabilities from an integrated fixed-wing and helicopter survey. This will address the perception bias component in both fixed-wing and helicopter components as well as availability bias and species miss-classifications errors from the fixed-wing component, allowing the estimation of visibility correction factors
4. Evaluate annual and geographic variation in species composition and detection probabilities to determine whether these components would need to be measured annually and/or across the range in an operational survey
5. Derive baseline abundance estimates for the experimental survey areas for all three populations of eastern scoters
6. Develop habitat selection models and test hypotheses about factors influencing scoter distribution across the survey area
7. Develop monitoring recommendations with partners based on study results.

Results
The study sites (fig 1) encompassed a variety of habitats ranging from tundra to treeline to boreal which resulted in a diverse assemblage of sea ducks observed on plots: all sites had all 3 species of scoters, Long-tailed ducks, 3 species of Mergansers, as well as Lesser and Greater scaup. The Ramparts River and Yellowknife sites were predominantly boreal and had a much higher proportion of scaup than the other sites. The Lynx Lake North site was predominantly above the treeline and allowed us to obtain important information on the extent of the breeding range for all three scoter species as well as other waterfowl. The George River site had much lower densities of waterfowl than other sites surveyed over the course of this project, typical of the less productive eastern Canadian boreal landscapes. We surveyed the Lynx Lake site for three consecutive years, which allowed for the quantification of annual variation in species composition, detection probabilities, breeding densities and habitat selection. The variety of habitats across the six sites resulted in a robust analysis of habitat selection for all three species of scoters, Long-tailed duck, mergansers and scaup and allow for better planning of future survey efforts in the region.

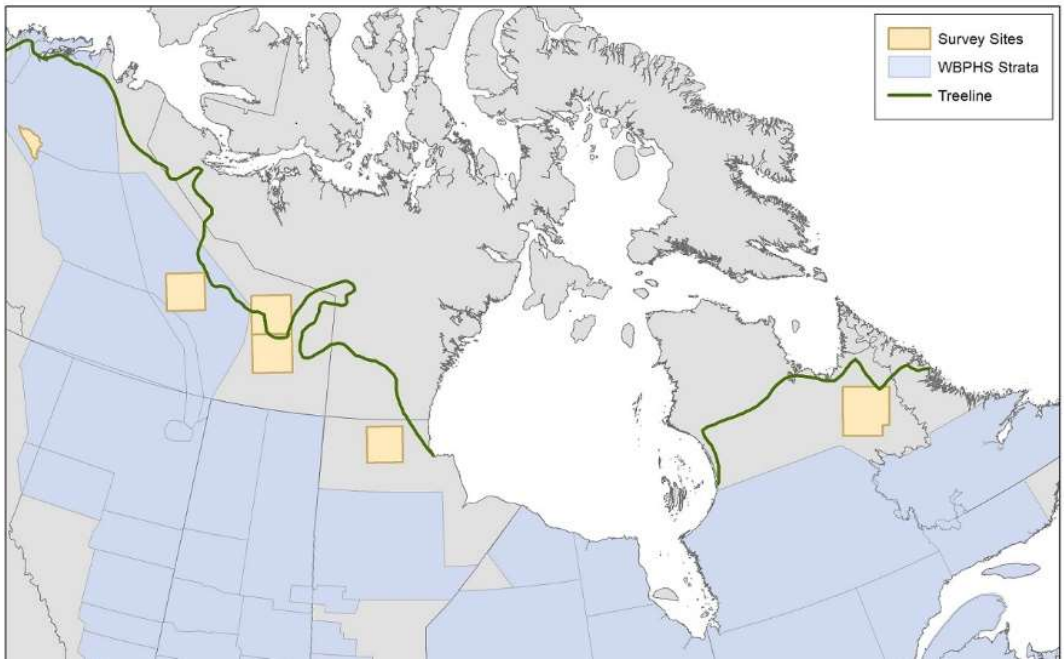

Figure 1. Locations of experimental surveys, 2017-2019 (Yellow areas). From east to west: George River QC, Little Duck Lake MB, Lynx Lake south NT, Lynx Lake north NT, Yellowknife NT, Ramparts River NT.

Objective 1: Identify the optimal timing for breeding scoter surveys

We integrated satellite telemetry tracking data from scoters marked at multiple molting, staging, breeding, and wintering areas along the Atlantic and Pacific coasts, and observations of known-age broods to quantify continent-wide breeding chronology and distribution. We examined possible drivers of variation in timing of arrival, length of stay, and departure at nesting locations. We documented a northwest to southeast distribution of estimated breeding sites across Alaska and Canada. On average, scoters arrived at nest sites on 1 June. Surf scoters and Pacific black scoters arrived earliest and departed earliest. Pacific-wintering black and white-winged scoters began breeding earlier than Atlantic-wintering birds. Additionally, birds arrived at nesting locations earlier in years with earlier snowmelt, and later snowmelt reduced lengths of stay for males. Breeding chronology also varied by age group, with adults arriving earlier than subadults. Our results increase our understanding of how current surveys enumerate scoters and will inform possible supplemental efforts to improve continental monitoring of scoter populations. Detailed results are described in Bianchini et al. 2023.

Objective 2: Develop and evaluate methodology to accurately assess species identification and composition from an integrated fixed-wing and helicopter survey

We collected data using both fixed-wing and helicopter over the same areas in 2018 and 2019 to compare species composition determined from the different survey platforms and identified potential species identification issues. Helicopters are highly maneuverable, can fly at very low altitude and speeds, and with their ability to dwell in areas allows precise species identifications.

Species composition varied by survey platform for study sites that were surveyed by both fixed-wing and helicopter Our results suggests that diving duck species were difficult to speciate from the fixed-wing. The three species of scoters and two species of scaups appear to pose the biggest issues to observers in a fixed-wing aircraft. Additionally, mergansers and goldeneyes cannot be identified at the species level from a fixed-wing aircraft. There are signals in the data that suggest there maybe miss-classifications between scoters and scaups, and mergansers and goldeneyes from the fixed-wing. A model to address identification error or non-identification is in development and will be submitted to a peer-reviewed journal when finalized (Cox et al., in prep).

Objective 3: Develop and evaluate methodology for estimating detection probabilities from an integrated fixed-wing and helicopter survey. This will address the perception bias component in both fixed-wing and helicopter components as well as availability bias and species miss-classifications errors from the fixed-wing component, allowing the estimation of visibility correction factors

Using data collected from the developmental scoter surveys in Labrador (SDJV # 115) we developed an approach and derived estimates of species-specific detection probabilities from the helicopter using dependent double-counting procedures (see Roy et al. 2022) and fixed-wing using distance sampling (see Cox et al. 2022). We have successfully applied the helicopter detection models to all study sites to document variation in detection within crews across years, and among crews and across the six study sites. We also collected information to estimate detection from fixed-wing aircraft in two years at three sites. However, we used independent double counting procedures. A major challenge of independent double counting procedures is post-survey reconciliation of observations between observers. We developed procedures to reconcile encounters between observers and provide species specific estimates of detection from fixed-wing aircraft.

Objective 4: Evaluate annual and geographic variation in species composition and detection probabilities to determine whether these components would need to be measured annually and/or across the range in an operational survey

We collected data from six sites over three years spanning the transition zone from tundra to taiga across northern Canada. We quantified variation in species composition, density and detection across central and eastern North America. The site at Lynx Lake, NT was surveyed for three consecutive years allowing for a robust evaluation of short-term variation in species composition and detection probabilities. A manuscript is in the final stages of write-up and will be submitted for publication in winter 2025 (see below)

Objective 5: Derive baseline abundance estimates for the experimental survey areas for all three populations of eastern scoters

We derived baseline population estimates for all surveyed areas, using helicopter data. These estimates indicated that the areas surveyed were core breeding areas which harboured significant proportions of the continental populations of all three scoter species.

Objective 6: Develop habitat selection models and test hypotheses about factors influencing scoter distribution across the survey area

We developed habitat models for scoters, scaups and Long-tail Ducks and expanded our models to include other species of interest including mergansers, Bufflehead, Canada Geese, Common Loons, Red-throated Loons, Ring-necked Ducks, Northern Pintails, Mallards, and Green-winged Teals based on 2017-2019 surveys. Results show consistent patterns in habitat selection across years. We extracted habitat data across the Taiga Plains and Shield ecozones to make ecozone-wide density predictions. Analyses are completed and we are preparing a manuscript for publication, to be submitted in spring 2025.

Objective 7: Develop monitoring recommendations with partners based on study results.

A workshop was held in November 2023 in Montreal, Qué., which included experts from Canada and the U.S.. Workshop discussions focused on elaborating a strategy to develop monitoring recommendations for sea ducks, with an emphasis on the three scoter species. It was determined that a monitoring strategy for those species should be drafted and dovetailed with ongoing efforts to review the Waterfowl Breeding Population and Habitat Survey (WBPHS). A report was produced that outlines the vision and the path forward towards a continental breeding sea duck survey (SDJV 2023)

Manuscripts published or in preparation related to this project:

Bianchini, K., Gilliland, S.G., Berlin, A.M., Bowman, T.D., Sean Boyd, W., De La Cruz, S.E.W., Esler, D., Evenson, J.R., Flint, P.L., Lepage, C., McWilliams, S.R., Meattey, D.E., Osenkowski, J.E., Perry, M.C., Poulin, J.-F., Reed, E.T., Roy, C., Savard, J.-P.L., Savoy, L., Schamber, J.L., Spiegel, C.S., Takekawa, J., Ward, D.H. and Mallory, M.L. (2023), Evaluation of breeding distribution and chronology of North American scoters. Wildlife Biology: https://doi.org/10.1002/wlb3.01099

Bowman, T.D., S. G. Gilliland, J. L. Schamber, P. L. Flint, D. Esler, W. S. Boyd, D. H. Rosenberg, J.-P. Savard, M. C. Perry, and J. E. Osenkowski. 2021. Strong evidence for two disjunct populations of Black Scoters *Melanitta americana* in North America. Wildfowl 71:179-192.

Cox, A. R., S. G. Gilliland, E. T. Reed, and C. Roy. 2022. Comparing waterfowl densities detected through helicopter and airplane sea duck surveys in Labrador, Canada. Avian Conservation and Ecology 17(2):24. https://doi.org/10.5751/ACE-02260-170224

Cox, Roy, Gilliland, Reed et al. in prep. *Comparing species identification in fixed-wing and helicopter surveys*

Lamb, J., Cooper-Mullin, C., Gilliland, S., Berlin, A. , Bowman, T., Boyd, W, Cruz, S., Esler, D. Evenson, J., Flint, P, Lepage, C., Meattey, D., Osenkowski, J., Paton, P., Perry, M., Rosenberg, D., Savard, J.-P., Savoy, L. Schamber, J., Mcwilliams, S.. (2024). Evaluating conservation units using network analysis: a sea duck case study. Frontiers in Ecology and the Environment. 22. 2648. 10.1002/fee.2648.

Reed et al. in prep. Towards the development of a sea duck monitoring strategy: using helicopter plot surveys to estimate waterfowl abundance in northern boreal Canada

Reed et al. in prep. Habitat selection of breeding waterfowl in the Canadian Taiga

Roy, C., S. G. Gilliland and E. Reed. 2021. A hierarchical dependent double-observer method for estimating waterfowl breeding pairs abundance from helicopters. Wildlife Biology, 2022(1). http://dx.doi.org/10.1002/wlb3.01003

SDJV, 2023. Experimental scoter surveys in the Taiga Plains/Shield ecozones: summary of work planning meeting, Montreal, November 4 and 5, 2023. Unpublished report.

Project Status:

The project has been completed. Work continues to publish the remaining manuscripts in the scientific literature.

We continue to work towards the development of a monitoring program that exploits the precision of the helicopter, and the efficiency and range of the fixed-wing aircraft to produce species specific estimates for sea ducks and other waterbirds breeding the Taiga and Tundra regions of North America. The field component of the project was completed in 2019 and development of the detection models completed in 2022. However, the project is large and complex and there were information gaps that needed to be addressed to develop a survey that were not included in the original objectives.

For example, the North American breeding ranges for the three species of scoter are not well defined. This required additional work on delineation of the continental breeding ranges of the scoters. Towards that end, we've compiled the satellite telemetry data for all scoters tagged in North America and estimated their breeding locations. This information has been used to delineate the breeding range of Black Scoters in North America (Bowman et al. 2021) describe connectivity between the three species of scoters that winter in the Pacific and Atlantic (Lamb et al. 2024). In addition, we compiled a database all encounters of scoters from regional and continental breeding surveys that had a high reliability of species identifications. We are currently working on methodology to combine the survey and telemetry datasets to better delineate the breeding ranges of North American Scoters.

We continue to work towards completion of the habitat models and development of a monitoring program of habitats important for breeding sea ducks and diving ducks on the vast areas of taiga and tundra in North America. Delivery of this part of the project requires strong quantitative skills and a deep understanding of waterfowl monitoring programs across the continent. One of the challenges of a project of this nature is development and retention of the quantitative skills required to analyze the data. In 2023, we had a major setback when two of the projects quantitative ecologist took positions in other organizations.

Project Funding Sources (US$). Complete only if funded by SDJV in FY23. This is used to document: 1) how SDJV-appropriated funds are matched, and 2) how much partner resources are going into sea duck work. You may include approximate dollar value of in-kind contributions in costs. Add rows as needed for additional partners.

SDJV (USFWS) Contribution	Other U.S. federal contributions	U.S. non-federal contributions	Canadian federal contributions	Canadian non-federal contributions	Source of funding (name of agency or organization)
Not funded by SDJV in FY24					

Total Expenditures by Category (SDJV plus all partner contributions; US$). Complete only if project was funded by SDJV in FY23; total dollar amounts should match those in previous table.

ACTIVITY	BREEDING	MOLTING	MIGRATION	WINTERING	TOTAL
Banding (include only if this was a major element of study)					
Surveys (include only if this was a major element of study)					
Research					