Sea Duck Joint Venture
Annual Project Summary
FY2024 (October 1, 2023 – September 30, 2024)

Project Title:
Identifying demographic bottlenecks and habitat use to support the recovery and management of American common eider: a range-wide, full life-cycle telemetry project: 2023 (SDJV Project #162).

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Project Description:
The target population for this project is the American subspecies of the common eider (*Somateria mollissima dresseri*). The project will address elements of Science Need 1 (Improve understanding of population delineation, migratory connectivity, and key habitat use of sea ducks by targeting geographic gaps from previous satellite telemetry studies), Science Need 6 (breeding propensity) and Science Need 11 (evaluation of body condition documented shifts in species distributions). This study will also contribute to future harvest assessments for this population.

Project Objectives:
The primary objectives for this study are to document the current rates of non-breeding and pre-breeding body condition of American common eiders across their breeding range, and to establish a large geo-spatial database from tracking data with which we will examine multiple aspects of the movement ecology of *S. m. dresseri*, but particularly their current habitat use throughout the annual cycle. Specifically, our objectives are:

1. Deploy up to 184 PTTs on adult female common eiders.
2. Develop new methodology to assess the breeding status of common eiders.
3. Estimate relative levels of breeding propensity and body condition across the breeding range of American common eider.
4. Identify the periods in the annual cycle when mortality of adult females occurs.
5. Using telemetry data to identify marine habitat use, assess marine ecosystem changes in eastern North America and identify drivers of altered abundance and habitat use by American common eiders.
6. Identify inshore benthic habitat used by common eiders to inform impact assessment and marine spatial planning processes, as well as coastal and marine protected area planning and establishment.

Project Status:
Field Component
In 2023, we completed the field component of the project deploying 182 PTTs across the breeding range of American Common Eider (Fig. 1; Table 1). One of the main objectives of the study was to characterize habitat use across the annual range of American Common Eiders. An evaluation of the data in summer 2023 suggested there were significant gaps in our coverage for birds in the southern part of their wintering range in the New England States, and in their breeding range along the North Shore of the Gulf of St. Lawrence in Québec. Gutowsky et al. (2023) documented shifts in the distribution of American Common Eiders with their abundance in winter increasing south of Cape Cod in the New England States and in the Gulf of St. Lawrence. The abundance of eiders breeding along the Lower North Shore of Québec has been increasing rapidly since the beginning of the 21st Century (Rail 2022) and birds breeding in this area are a potential source for the increases observed in the Gulf of St. Lawrence.

With some savings in other areas of the project and funding from ECCC, we added an additional year of deployments to fill these gaps. This expanded the project's partnerships to include Scott McWilliams lab at the University of Rhode Island (URI), Jay Osenkowski at the Department of Environmental Management (DEM) in Rhode Island, and Parks Canada in the Mingan Archipelago, Québec.

Only a small number of eiders breed along Rhode Island's coast and there were concerns that a significant portion of them would have to be captured and tagged for the project so we decided to capture birds in early March before spring migration. Working with a large crew from URI, DEM and volunteers (see list of participants at: https://seaduckjv.org/where-have-all-the-eiders-gone/) we caught 36 eiders between 3 and 9 March 2024 and deployed 15 PTTs on adult females.

The deployments in Québec took place in the waters surrounding the Mingan Archipelago National Park Reserve and on the ancestral lands of the Innu Nation. Based on some work with Parks Canada in 2023, we estimated that nest initiation period for this area was the second week of May and field work took place between 25 April and 5 May. This period overlapped with the spring hunting activities by the Innu community of Ekuanitshit and prior to field work we consulted with the community. The community was interested in the project, but there were concerns that our activities might disturb local hunters. We offered to take an Innu observer with us in all field activities, and Parks Canada maintained daily updates of the project on social media that advertised the capture sites a day in advance so the community could notify us of potential conflicts. This system worked well, and we had an Innu observer accompany us on most days and no conflicts were reported. Between 27 April and 5 May, we captured 71 eiders. This is a major over-wintering area for Northern Common Eiders and 17 of the birds captured were *S. m. borealis* or *dresseri-borealis* hybrids. We deployed 26 PTTs on adult females of which three hens were *borealis* type birds.

To date, we've deployed 227 PTTs (Table 1) that have logged ~200,000 locations between New York and Nunavut (Fig. 2).

Breeding Propensity

A major objective of the study is to use the satellite telemetry data to estimate breeding status of female eiders. This is not a simple procedure as the location errors associated with the telemetry data are often larger than the islands eider nest on, and there can be gaps in coverage due to the duty-cycle of transmissions, and signals may be interrupted when eiders nest in heavy cover. This component of the project was assigned to Asha Grewal as a MSc student under the supervision of Sarah Gutowsky and Mark Mallory at Acadia University.

Using the R package *momentuHMM* (McClintock and Michelot 2018), Asha has been able develop a model from which breeding status could be estimated. The model uses a decision tree to assign one of four breeding status categories for each breeding seasons (i.e. successful nesting attempt, failed nesting attempt, potential prospecting, and skipped breeding). An example of the model results is provided in Figure 3.

Asha presented her results at the 2024 Sea Duck Conference. Since the conference Asha has refined updated the model with 2024 data. She will present her results to the SDJV in Fall 2024 and defend her thesis in winter 2025.

Communications

In 2023, we hired Emile David to document the field component of the study and Emile produced five short videos on the project. The videos debuted at the Sea Duck Conference in January 2024 and have since been posted on Ducks Unlimited's YouTube channel and are now hosted on a special landing page on the SDJV's Website (https://seaduckjv.org/where-have-all-the-eiders-gone/) that is available in English and French. In 2024, we had enough funds to collect video of the use of the over-water mist for catching sea ducks, and some French language interviews with Jean-Francois Giroux, Francis St- Pierre and Manon Sorais. An article on the project will feature in the 2024 edition of DU Canada's Conservator magazine.

Future Work

In 2024, we partnered with ECCC to fund a post-doc to work with Marie Auger-Methé at University of British Columbia to summarize migratory connectivity, year-round habitat use, year-round annual movement

and connectivity and provide industrial overlap/risk assessments. The project will be funded thought a 200,000 (CAD) Grants and Contributions agreement with ECCC and a 70,000 CAD MITACs internship.

In 2025, we will work with Scott McWillilams (URI) and Jay Osenkowski (RIDEM) to fund a post-doc/PhD that will focus on winter/non-breeding season movement resource selection and possibly risk assessments.

References:

Gutowsky, S., Robertson, G.J., Mallory, M.L., McLellan, N.R. & Gilliland, S.G. (2023). Redistribution of wintering American Common Eiders (*Somateria mollisima dresseri*). *Avian Conservation and Ecology* 18(2):8. https://doi.org/10.5751/ACE-02510-180208

McClintock BT, Michelot T. 2018. momentuHMM: R package for generalized hidden Markov models of animal movement. Methods in Ecol Evol. 9(6):1518-1530.

Rail, Jean-François. 2022. Eighteenth census of seabirds breeding in the sanctuaries of the North Shore of the Gulf of St. Lawrence, 2015. The Canadian Field-Naturalist. 135. 221-233. 10.22621/cfn.v135i3.2675.

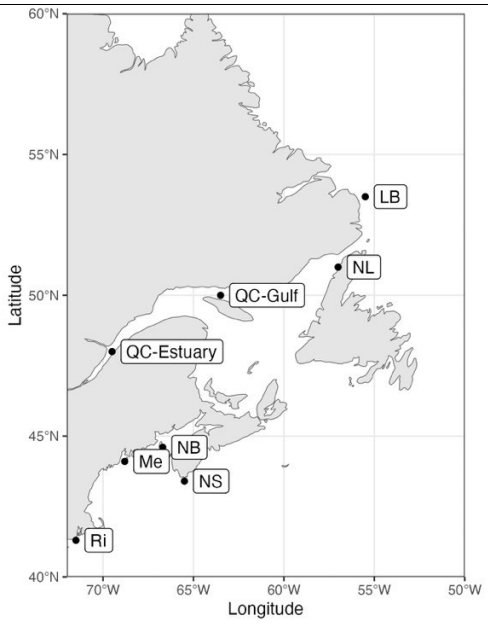

Figure 1. Deployment locations for satellite tags on Common Eiders, 2021 to 2024.

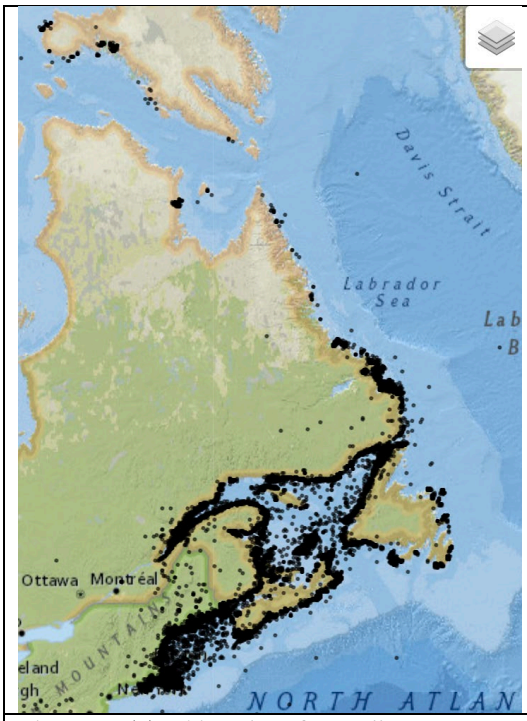

Figure 2. Tracking data from all Common Eiders tagged with PTTs from 1 May 2021 to 30 September 2024.

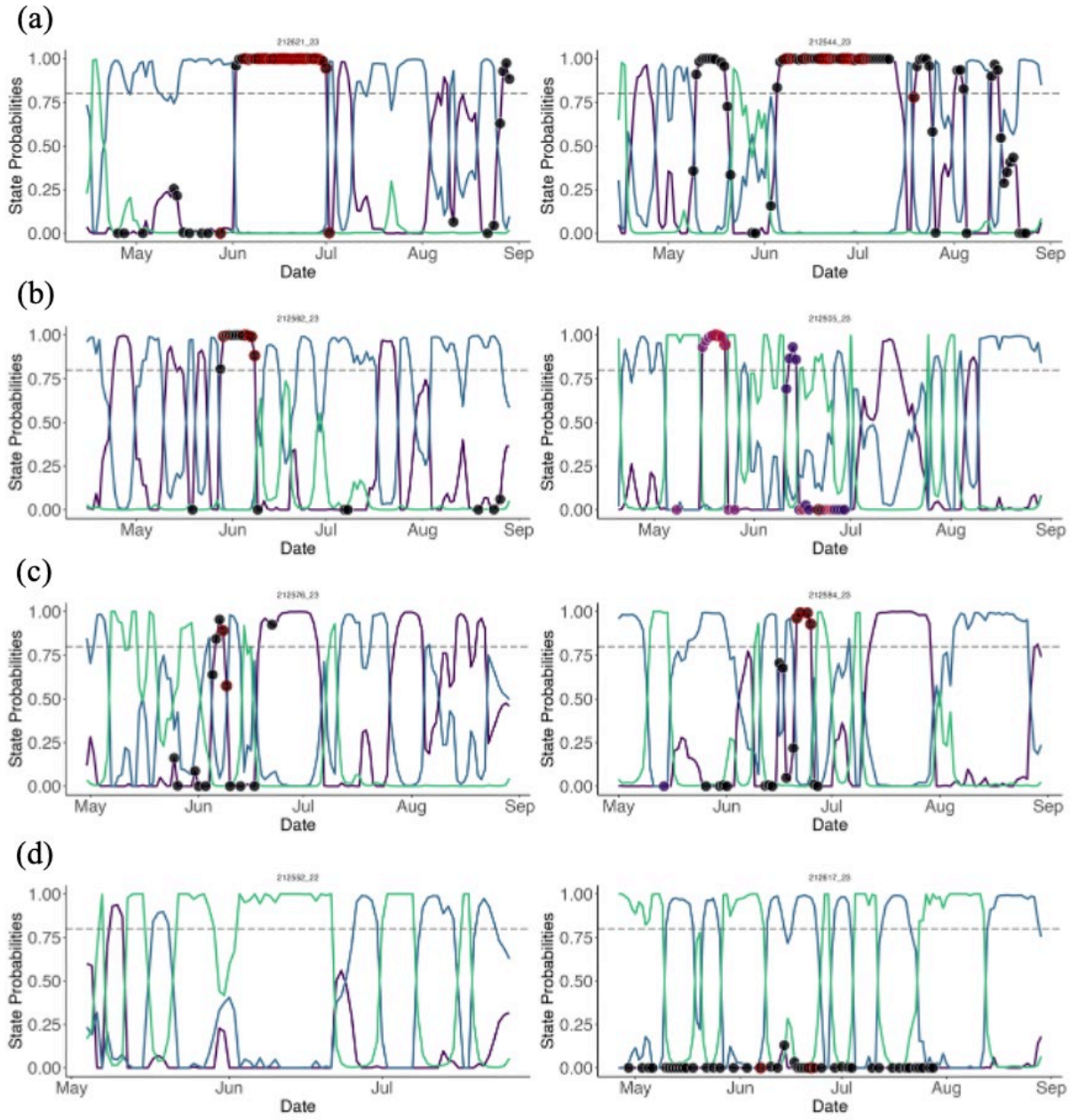

Figure 3 Example state probability time series generated from the Hidden Markov Model output were used to assign nesting status to PTT-equipped American Common Eider hens (*Somateria mollissima dresseri*), including two individuals each that had (a) a successful nesting attempt, (b) a failed nesting attempt, (c) a potential prospect, and (d) skipped breeding (individual hen ID and breeding season year at the top of each plot). The three behavioural movement states (i.e. limited = purple, localized = blue, mobile = green) are indicated by colour and daily positional error polygons that overlap a colony are uniquely coloured by colony (red cross markers indicate days where the mean position also overlaps a colony).

Table 1. Capture dates for each study area.

Area	Capture Period	Year	Deployments
ME	27 Apr to 7 May	2021	28
QC (Estuary)	27 Apr to 7 May	2021	40
NB	27 Apr to 7 May	2022	26
NS	22 Apr to 2 May	2022	25
NF	1 to 10 May	2023	40
LB	12 to 22 May	2023	26
RI	3 to 9 Mar	2024	15
QC (Gulf)	27 Apr to 5 May	2024	27