Continental-scale Analysis of Sea Duck Telemetry Data

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Target Species:
Black Scoter, Common Eider, Long-tailed Duck, Surf Scoter, White-winged Scoter
Project Summary

During a decade of telemetry data collection, the Atlantic and Great Lakes Sea Duck Migration Study has dramatically expanded our understanding of sea duck ecology in eastern North America. Although the study has resulted in a number of reports and publications, we have only scratched the surface of the analyses that can be accomplished with this data, and much work remains to be done mining the scientific information contained in this expansive dataset. We propose to use this multi-species dataset, in combination with other telemetry data, to conduct additional analyses of sea duck movements, behavior, and habitat use. This work will build and expand on previous work by the PIs to generate comprehensive annual-cycle models of sea duck movements from telemetry data. We propose to address three major questions of importance to sea duck management and conservation that have not yet been answered using this dataset: 1) How and when do sub-populations of sea ducks wintering in Eastern and Western North America overlap in shared habitat areas?; 2) What are the short- and long-term behavioral effects of transmitter attachment, and how do they differ among study species?; and 3) How do annual-cycle movement patterns differ among sea duck species and individuals? This work will result in the completion of at least three peer-reviewed manuscripts, which we will publish in journals focused on applied ecology and conservation. The analyses will also contribute to ongoing projects and priorities of the SDJV, including the Key Sites Atlas, population delineation, identification of habitat requirements, and improvement of monitoring regimes for North American sea ducks.
Project Narrative

A. Statement of Need

The Sea Duck Joint Venture’s decade-long Atlantic and Great Lakes Sea Duck Migration Study (AGLSDMS) represents a major effort to use coordinated bird-borne telemetry to expand our understanding of sea duck distributions in Eastern North America. To date, the study has resulted in the collection of over 600 individual tracks, representing annual movements of four sea duck species. The information gathered from the project has filled crucial gaps in ecological knowledge for the target species, including elucidating habitat preferences during both breeding and wintering seasons, and has been used to inform conservation and development initiatives. However, the vast amount of data generated by the project has yet to be fully explored. Questions remain regarding annual-cycle connectivity, population delineation, habitat partitioning among species, and single-species movement and habitat selection for some of the target species.

The University of Rhode Island (URI) and RI Department of Environmental Management (RIDEM) has been involved in AGLSDMS data collection from the start of the project, and has produced a variety of related publications (see Lit Cited). For the past year, Dr. Juliet Lamb, a post-doc with URI and RIDEM, has been engaged in analyzing the full multi-species telemetry dataset. Juliet has led efforts to complete two major manuscripts: 1) a collaborative network analysis of annual-cycle movement patterns (recently accepted in Ecological Applications), and 2) a manuscript on habitat selection and partitioning (nearing submission). While these manuscripts represent major contributions to sea duck ecology and conservation, there are still questions of interest to the SDJV and project participants that remain to be answered. Dr. Lamb’s familiarity with the dataset, analytical experience, and existing collaborative relationships with the AGLSDMS PIs places her in a strong position to rapidly complete further analysis of the multi-species dataset and incorporate additional data.

B. Project Goals and Objectives

The overarching goal of our work is to use telemetry data to better define population structure, delineate key sites, understand habitat requirements, and inform monitoring efforts for North American sea ducks.

An additional year of funding would allow us to achieve the following objectives:

1. Support completion of single-species annual-cycle movement analyses (~4 months). As part of the completion phase of the AGLSDMS, manuscript(s) focusing on single-species annual-cycle movement patterns and habitat use are currently in preparation. Such analyses could be similar to a collaborative effort on White-winged Scoter by Meattey et al. (2018). Our goal would be to work with PIs as needed to help advance these manuscripts to completion. The supplemental analytical capacity provided by a dedicated post-doc familiar with the data would help to insure that these manuscripts are completed in a timely manner and to a high scientific standard. Target analyses might
include assessments of seasonal habitat use, migratory connectivity, phenology, and population structure, according to the priorities of individual PIs and the SJDV.

2. **Extend and expand network models and habitat analyses (~6 months).** Our first priority would be to integrate telemetry data from Western populations of focal species, where available, with existing data for Eastern populations of the same species to assess network use and modularity on a continental scale. These analyses would complement ongoing work by the Sea Duck Joint Venture focused on using genetic and spatial tools to delineate population structure, particularly in areas of spatial overlap (e.g., high-arctic breeding ranges). Additional analyses could include relating within- and between-species variation in phenology with interannual climate variation and assessing changes in network use across the study period, both of which would contribute to our understanding of the effects of climate on sea duck movement decisions. Finally, if time allows, we would explore the possibility of bringing together the two major products of the first phase of analysis (network and habitat models) into a single assessment of multi-species habitat partitioning in a network context.

3. **Assess transmitter effects using state-space models of behavior (~2 months).** Previous assessments of the effects of capture and transmitter attachment on sea ducks have frequently relied on captive individuals, with limited evaluation of effects on free-ranging populations. State-space models, which allow inference of underlying behavioral patterns from sequential telemetry locations, represent a potential untapped technique to assess the immediate behavioral effects of transmitters. Having already used these models as a starting point for network and habitat analyses, we would be able to mine additional data on individual responses to capture and transmitter implantation. These data would provide species-specific estimates of the amount of time required to return to normal movement following transmitter implantation, as well as patterns of breeding and behavior in the year of implantation compared to subsequent years.

**C. Project activities, methods, and timetable.**

Much of the initial data analysis required to achieve our objectives (data screening, state-space modeling, network and habitat analyses) have already been completed (see Recently Submitted/In Prep). Additional activities over the following year would include obtaining and incorporating data from Western sea duck populations, focused analyses of results to answer questions related to transmitter effects on behavior, and species-specific analyses as recommended by collaborating PIs.

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<tr>
<th>Time Period</th>
<th>Activities</th>
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<tr>
<td>July – October 2019</td>
<td>Complete Objective 1:</td>
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<td></td>
<td>• Discuss additional single-species objectives and analyses with AGLSDMS PIs</td>
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<td>• Obtain additional data from collaborators as required</td>
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<td>• Complete writing and submission of relevant manuscripts</td>
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<td>Begin Objective 2:</td>
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D. Stakeholder Involvement

Given their long associations with the project, URI and RIDEM have strong collaborative relationships with the researchers and organizations involved in collecting data. Dr. Lamb has already worked with the Principal Investigators of the AGLSDMS to obtain data permission, including drafting a memorandum of understanding (MOU) for data use (Appendix A), and all PIs participated in production of the submitted manuscripts and are co-authors. Any future collaborators will be integrated into the project under the terms outlined in the MOU, and will have the option of either signing on officially, or proceeding unofficially without officially signing the document under the assumption that the same terms will apply.

E. Project Monitoring and Evaluation

An initial meeting of the collaborator group to discuss data sharing and project objectives will be organized during the North American Duck Symposium in Summer 2019. Progress of the project will be monitored through quarterly updates (via written report and optional conference call) to the full collaborator group, and regular presentations to the stakeholders and broader scientific community including at SDJV annual meetings. The project will ultimately result in at least three scientific manuscripts published in peer-reviewed journals. Dr. Lamb has previously presented at two SDJV annual meetings, two professional conferences (International Ornithological Conference, Pacific Seabird Group), a US Fish and Wildlife Service webinar, and several internal collaborator meetings.

F. Entities Undertaking the Project

Dr. Juliet Lamb (University of Rhode Island) will coordinate with stakeholders, conduct all analyses, and write and present results. Drs. Scott McWilliams and Peter Paton (University of Rhode Island) will provide institutional supervision and office space, and oversee disbursement of project funds. Jay Osenkowski (Rhode Island Department of Environmental Management) will provide additional supervision and act as the project liaison to the Sea Duck Joint Venture.

G. Sustainability

Not applicable
H. Literature Cited

Recent publications from SDJV- and RIDEM/URI-sponsored Sea duck research:


Recently submitted or in prep SDJV- and RIDEM/URI-sponsored Sea duck research:
