

**Sea Duck Joint Venture
Annual Project Summary
FY2021 (October 1, 2020 – September 30, 2021)**

Project Title: Monitoring of Non-breeding Sea Ducks on the Great Lakes, Project 161

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Partners: Currently, the two datasets we are using are from individuals listed as co-PIs.

Project Description:

Sea duck use of the Great Lakes, particularly the Lower Great Lakes (Lakes St Clair, Erie and Ontario), during spring migration, fall migration and winter has increased considerably over the past few decades. Limited information about sea duck abundance and distribution in the Great Lakes region, as well as the connectivity of the Great Lakes population to other populations hampers harvest and habitat management and conservation. Commercial and energy development on the lake shore and on the lakes themselves along with changes in water quality, contaminants, and outbreaks of diseases all threaten sea ducks and require sound baseline knowledge about responses to environmental and habitat changes. Moreover, climate change will increase extreme weather events, precipitation, and temperature, resulting in large shifts in habitat availability for sea ducks. We are developing species distribution models to inform stakeholders about habitat use of sea ducks on the Lower Great Lakes. We are collating existing datasets by combining data (e.g., aerial and ground count surveys) into integrated species distribution models for multiple species or species groups of interest. Our model will link underlying population abundance with habitat and environmental covariates in the Great Lakes region. We will then use the model to simulate future population abundance under different

climate change scenarios, such as reduced ice coverage, increased water temperature, and more variable ice conditions. These models will also allow us, through sensitivity analyses, to identify the factors that contribute most to uncertainty in these models, and which could be addressed through a formal adaptive management program whereby changes in where and when surveys take place are made and tested to determine if uncertainty has indeed been reduced in the model output in locations where reductions in uncertainty are most needed. Additionally, we will work with stakeholders to develop monitoring designs using output from the integrated species distribution model to build a framework for future potential survey approaches. The outcomes and products we anticipate from this work include species-specific maps of past/current distribution/abundance as well as maps for future climate scenarios, evaluation of stakeholder feedback based on potential monitoring designs, and information to contribute to the Sea Duck Key Habitat Sites Atlas. Any potential future monitoring efforts will have important information on key habitat and areas in the Lower Great Lakes for sea ducks as well as information about the greatest data uncertainties for populations of non-breeding sea ducks.

Project Objectives:

Goal 1 - Identify key habitats and regions by season (spring migration, fall migration, winter) for sea ducks in the Lower Great Lakes (Lakes St Clair, Erie and Ontario).

Objective 1.1 - Collect relevant environmental data to include in modeling effort.

Objective 1.2 - Construct Integrated Species Distribution Model for survey data for sea ducks using the Lower Great Lakes. Will begin with long-tailed duck and expand to develop species-specific models.

Objective 1.3 – Use the ISDM to simulate changes in climate (e.g., ice cover or temperature) in the Lower Great Lakes.

Goal 2 - Use optimal sampling design to highlight areas for potential future surveys

Objective 2.1 - Engage stakeholders for their input into potential future sampling designs to compare, use the principles of structured decision making to determine what objectives (cost, complexity, estimates produced) are most important so we can evaluate each based on those objectives.

Objective 2.2 - Develop potential future sampling designs based on previous surveys and cost of effort for survey methods.

Objective 2.3 - Use sensitivity analyses to identify key uncertainties in the ISDMs that limit inference/decision making for future adaptive management program.

Preliminary Results:

Data	Collection Method	Geographic Coverage	Years Covered	Species Included	Data Source
Lower Great Lakes Midwinter Survey	Aerial Inventory	Lake St. Clair Lake Erie Lake Ontario Niagara River St. Lawrence River Detroit River	1971-2020	BLSC, BUFF, COGO, COME, HOME, KIEL, LTDU, RBME, SUSC, WWSC	CWS and LPW
Lower Great Lakes Migrant Waterfowl Survey	Aerial Inventory	Lake St. Clair Lake Erie Lake Ontario Niagara River St. Lawrence River Detroit River	1968-2020	BLSC, BUFF, COGO, COME, HOME, LTDU, RBME, SUSC, WWSC	CWS

We currently have acquired two data sets of Sea Duck counts for our analysis. The first is the Lower Great Lakes Midwinter Aerial Survey gathered by the Canada Wildlife Service (CWS) and Long Point Waterfowl (LPW). Data were gathered in the months of January and February 1971–2020. There are 5,073 records Sea Duck count records collected during that time period that include eight species across six waterbodies. The second data set is the Lower Great Lakes Migrant Waterfowl Aerial Survey from the CWS. This data set includes count data collected in the Spring, Summer, and Fall from 1968-2020. There are 13,318 records that include seven species from six waterbodies. We are in the process of securing access to an additional data set that will provide additional coverage for Sea Ducks on Lake St. Clair. During our data acquisition process, we were in touch with relevant state, provincial, and federal agencies (WI DNR, MI DNR, OMNRF, USGS, USFWS), universities (Michigan State University) and NGOs (Biodiversity Research Institute, Michigan Natural Features Inventory).

Project Status:

We are still in the initial phase of our project development and have been focusing on data acquisition so far. We are now shifting to data cleaning and processing and will begin analyzing the data in the next two months. We have completed Objective 1.1 as well as identified key stakeholders for future participation relative to Objective 2.1. We are on track to complete our objectives based on the revised timeline (ending in March 2022) coinciding with the change in award date.