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

Project Title: Evaluating Sea Duck Detectability in the Puget Sound Winter Ambient Monitoring Program SDJV #136

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Project Description: Monitoring the abundance and density of wintering sea ducks in the U.S. portion of the Salish Sea is achieved annually through aerial surveys conducted by the Washington Department of Fish and Wildlife (WDFD). These surveys provide information regarding the wintering population status and trends of several sea duck species, information which is necessary for population and habitat management. The Sea Duck Joint Venture recognizes the Salish Sea as a Key Habitat Site, and accurate sea duck abundance estimates are essential to understand how threats both inside and outside the Salish Sea are impacting sea duck populations. However, raw counts from WDFW aerial surveys tend to underestimate the number of individuals due to imperfect detection (Samuel and Pollock 1981, Pollock and Kendall 1987) and movement away from the aircraft.

Model-based approaches for correcting for imperfect detection are widely applied but are most useful when specifically developed for the study area, species, environmental conditions, and set of observers, as these variables can affect detection (Pearse et al. 2008). As raw counts from the WDFW aerial surveys do not provide any information regarding the detection process, we seek to develop a correction factor for aerial survey counts of sea ducks by species. Comparing detected animals to known numbers of animals can serve as a useful method for developing a correction factor that can be used to account for imperfect detection and adjust estimates for better accuracy of abundances (Caughley et al. 1976, Bayliss and Yeomans 1990, Pearse et al. 2008). Photographs can capture all animals available for detection along a transect with no time limit to identify and count species. However, long-term collection and analysis of photographs tends to be more costly and time-intensive (Bayliss and Yeomans 1990). Therefore, using photographs to calculate a correction factor for imperfect observer detection can serve as a cost-effective and accurate approach for sea duck survey estimates. The correction factor can be retroactively applied to previous surveys and will be a useful component for analyses of future sea duck surveys in the Salish Sea.

We are using aerial survey data collected by WDFW to compare sea duck detection rates from two observers with known numbers of sea ducks available for detection, as recorded by plane-mounted cameras. Data collection occurred during March 2012 in the Salish Sea. The aircraft flew along transect lines, and rear-seated observers counted all sea ducks observed along the transect while the forward-facing camera photographed sea ducks ahead of the plane, and a point-of-view camera photographed sea ducks available to the observers. We are developing a set of models that will result in species-specific correction factors for aerial surveys of sea ducks.

Project Objectives: 1) Evaluate whether there is a need for further digital image processing of the 2012 data, 2) Complete data analyses based on imagery to estimate correction factors that will provide quantitative information on availability and detection of sea ducks by the Puget Sound Ambient Monitoring Program (PSAMP) observers, 3) Incorporate species-specific correction factors into winter estimates of sea duck species monitored through PSAMP

Preliminary Results: The forward-facing camera captured 3182 individuals of 9 sea duck species (black scoter, white-winged scoter, surf scoter, Barrow's goldeneye, common goldeneye, bufflehead, harlequin duck, common merganser, and red-breasted merganser) across 389 transects over 5 sampling days. The sea ducks were organized into 675 groups with a range of group sizes from 1 to 168 ducks and a mean of 4 ducks (Figure 1). Group sizes varied across species (Figure 2). Under-counting occurred more often than over-counting with some variation across species and between observers (Figure 3). When groups included 54 or more individuals, observers tended to under-count the number of individuals but never over-counted them.

Project Status: A postdoctoral scientist began working on the project part time during summer 2021 and, starting September 1, 2021, is working full time on the project. The project team met in September 2021 and will be meeting regularly going forward. Thus, we expect rapid progress in the coming months. Objective 1 – All necessary image processing has been completed. Objective 2 – We are in the process of building models to estimate correction factors for the detection of sea ducks by PSAMP observers. We anticipate that our final model set will take the form of hierarchical repeat count or binomial regression models. We currently have built simple versions of these models and are working to add complexity. We are working to incorporate species-specific detection data into our models. We will also examine multiple environmental covariates that might affect sightability of sea ducks. In particular, we are planning to investigate how group size might affect detection. We also will be evaluating misidentification of birds.

Objective 3 – After models are complete, we will evaluate the effect of accounting for detection retrospectively on historical sea duck monitoring data.

Project Funding Sources (US$).
NA – not funded by SDJV in FY2021

Total Expenditures by Category (SDJV plus all partner contributions; US$).
NA – not funded by SDJV in FY2021

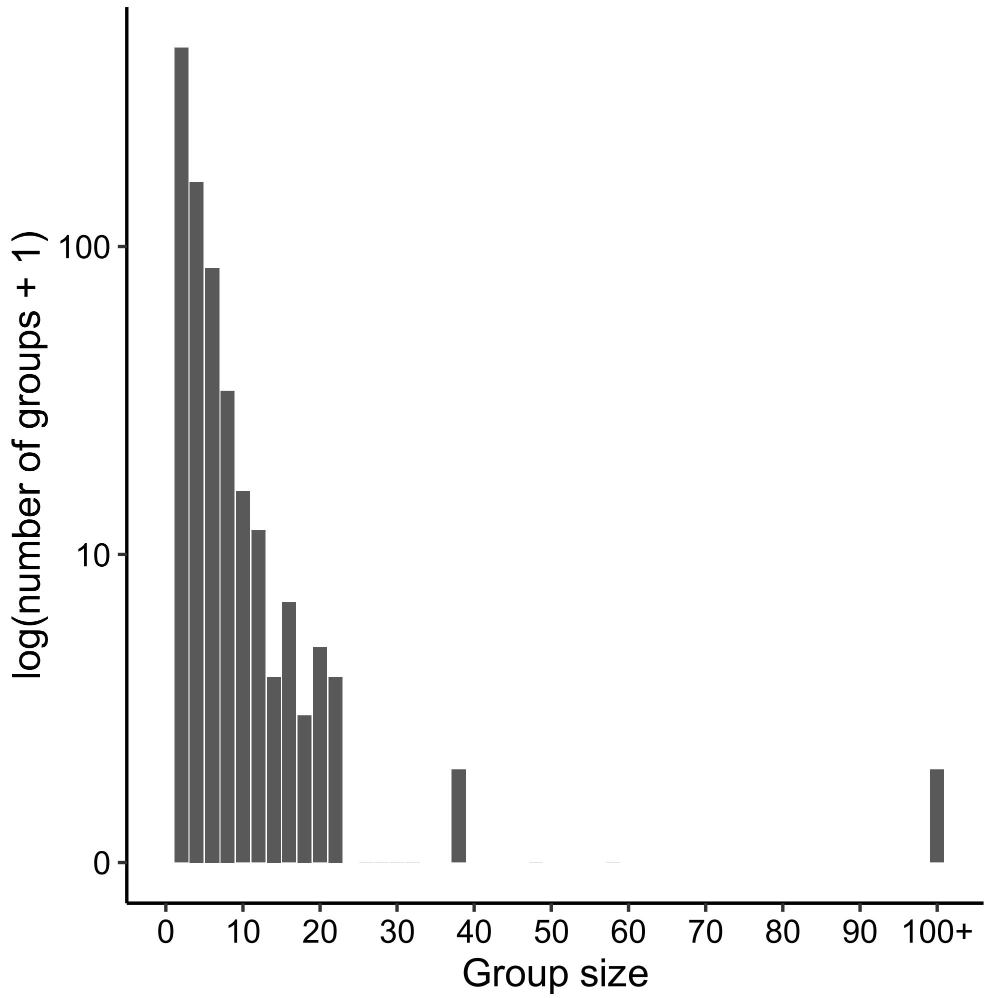

Figure 1. Distribution of sea duck group sizes. Histograms were constructed using combined data from all transects on all five survey days, and groups sizes were from the forward-facing camera mounted on the survey aircraft. Groups could consist of one or multiple species.

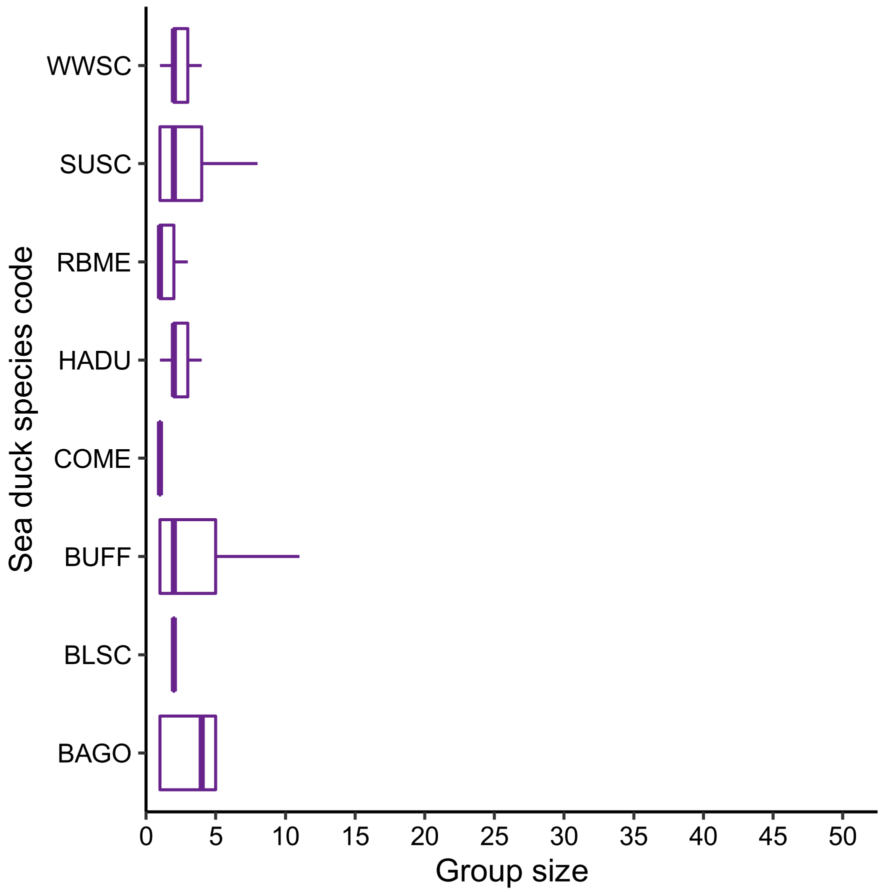

Figure 2. Group size per species. Boxes represent the 25% quantile, median group size, and 75% quantile.

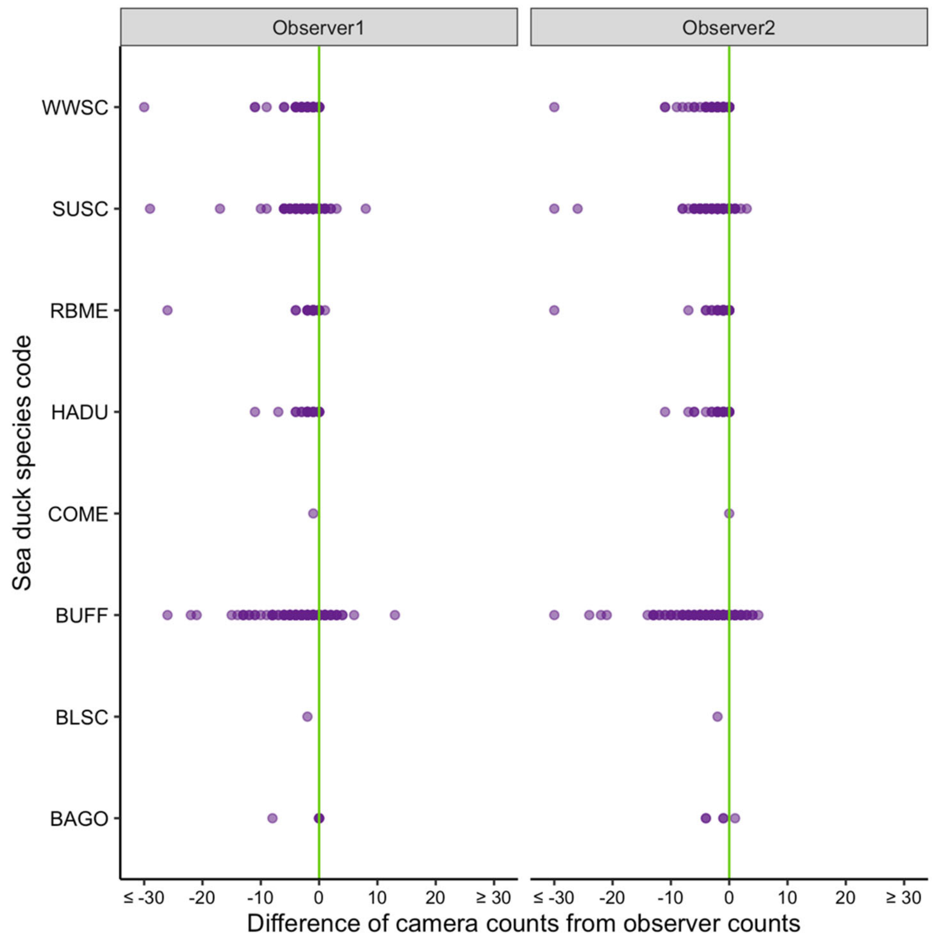

Figure 3. Observer count accuracy per species. Purple points display the difference of the count captured by the forward-facing camera mounted on the survey aircraft subtracted from each observer's count for each species per observed group. Only groups that were captured by the forward-facing camera were included.