Sea Duck Sample Size Evaluation

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Objective: Determine the sample size of sea duck individuals needed to delineate spatially independent sub-units during breeding and wintering seasons for BAGO, BLSC, and SUSC.

We obtained location data from six researchers.

Data Summary

Species	F	M	Total	Source	Notes
BAGO	111	204	315	Jenn Barrett	
BLSC	54	57	111	Scott Gilliland / Andrew Gilbert	
SUSC	(20)	(10)	9	Jenn Barrett	Tag loss or mortality
SUSC	26	9	35	Joe Evanson	
SUSC			19	David Ward	Need metadata
SUSC			30	Susan De La Cruz / Eric Palm	Need metadata

Since our ultimate objective is sample size determination, we decided to start with the largest data set. We will first determine methods and analyze BAGO data and then repeat the methods using data for the remaining two species.

Behavioral and biological criteria and published season dates were ineffective at defining seasons for our purposes. Data separated using these criteria included long movements (>600 km) and high mean point distances to seasonal centroids, particularly during breeding seasons. We calculated net displacement (Bunnefeld et al. 2011) from starting locations for each BAGO individual. Migratory and relatively stationary periods are apparent from visual inspection (Figure 1). Dates of these relatively stationary periods will be determined and used to select location data for analysis of wintering and breeding areas.

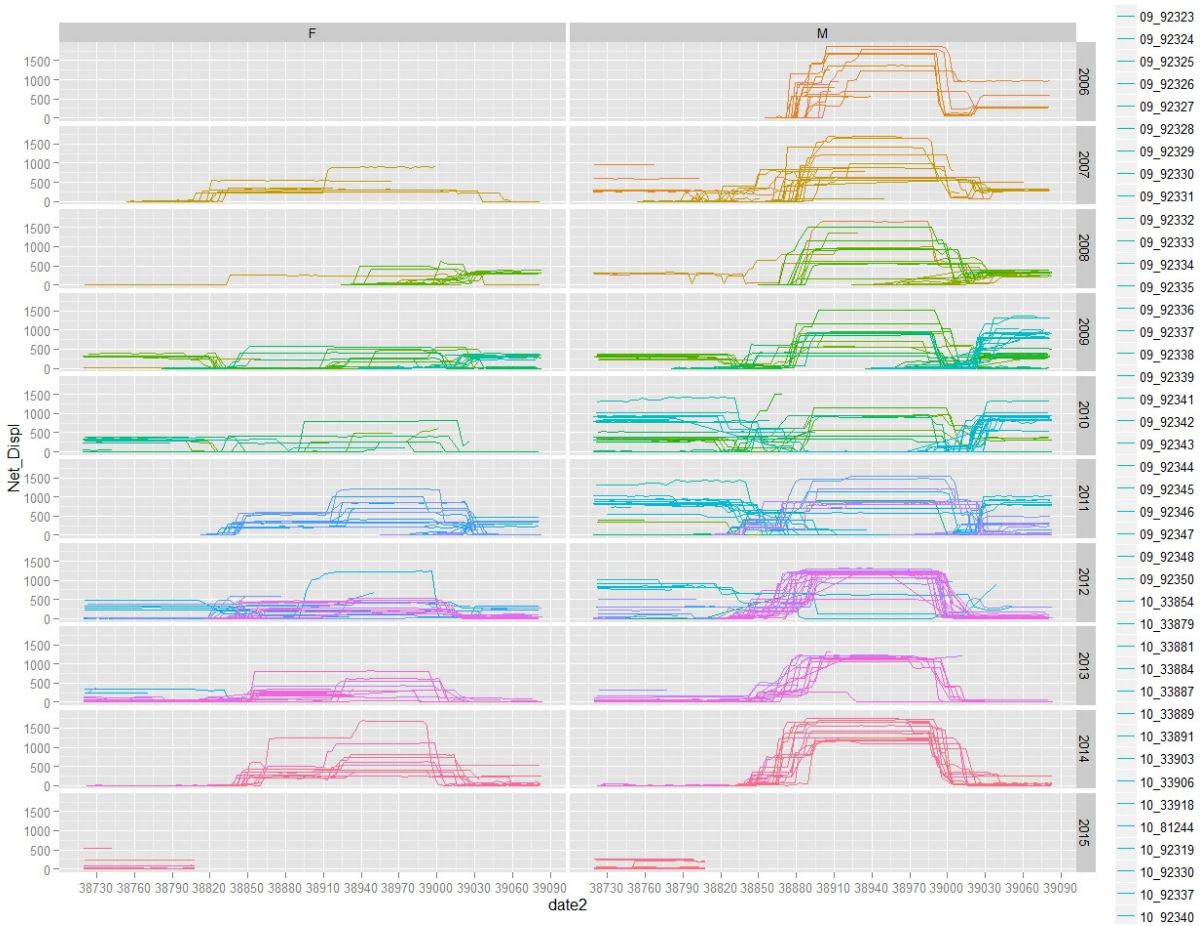

Figure 1. Net displacement (km) of female (F) and male (M) BAGO by year, 2006-2015.

We will calculate a centroid for each individual for each season (breeding, wintering for each year), and perform a cluster analysis to delineate breeding and wintering ranges. We will calculate the transition probabilities of individuals moving between the ranges, defined as the proportion of individuals moving from each breeding area to each wintering area, and each wintering area to each breeding area. We will repeat the range determination and transition probability evaluation using bootstrap samples of birds beginning with n = 10 and continuing until the number of identified populations at each stage reaches an asymptote.

Literature

Bunnefeld, N., L. Borger, B. Van Moorter, C. M. Rolandsen, H. Dettki, E. J. Solberg, and G. Ericsson. A model-driven approach to quantify migration patterns: individual, regional and yearly differences. Journal of Animal Ecology 80: 466-476.