GBHE 2015 and 2023 Dual-Frame Survey Estimation

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## Introduction

The Great Blue Heron (Ardea herodias) is still a species of Special Concern in the State of Maine, USA, as it continues its decline beginning in 1995 (D’Auria 2010). We follow D’Auria and Otto (2018). Deviations will be noted. We estimate both years of the survey together, re-estimating the 2015 survey. We expect differing results, but not greatly, for the 2015 survey. We expect declines in the number of colonies and numbers per colony.

## Data and Program Set-Up

The original data is in the ori directory in the GBHE.2015 and GBHE.2023 directories. I pull the data and spatial shape files from them. The lists and counts are in the data directory and the spatial files are stored in the gis directory in .kml files. The GBHE R project has both years of data. Quarto documents are in the doc directory. All the data can be loaded for analysis from GBHE.RData in the output directory.

## Study Area

As in 2015, the study area is the state of Maine divided in the same 10 km x 10 km grid interected by the same strata.

# Sample Size Determination

The same nest list as the new colonies found in the 2015 survey. The list frame is all the plots with at least one colony. The area frame consists of all the plots intersected by strata. The survey was designed to optimally allocate strata and frame sample sizes to obtain an 80 percent chance of detecting a 25 percent decline at a 10 percent significance level between two survey periods. We used prior information on occupancy, colony densities, and observer detection. This requires an 8.3 percent CV.

## Field Methods

(Check with Danielle D’Auria and add stratum-plot-known nest map)

Summary of the stratum areas, number of known colonies, colonies for strata, and the Maine totals.

## Analytical Methods

The same model was used for the estimation for both years. Different occupancies, colony sizes, and proportions active were estimated for each year and strata. We estimated only a common rear observer detection rate because of the low number of capture histories, especially in 2023. Also, there were no observer detections unless the front observer detected them (no 01 capture histories).

## Notes and Results

Get the new sample observations. In 2023, there were duplicate observations of nests. 0822 at least had different observers.

We need to remove the training flight of DD and DK on ME.0822.

## References

D’Auria, Danielle E., and Mark C. Otto. 2018. “Estimating the Breeding Population of Great Blue Herons (Ardea herodias) in Maine, USA, Using Dual-Frame Sampling.” *Waterbirds* 41 (4): 365–75. <https://doi.org/10.1675/063.041.0413>.