

Assignment 2: Testing Additive Models and Annual Covariates in Program MARK

Objective: To learn to use PIMs and design matrices of dummy variables to fit models and external covariates to mark-recapture data.

Background: In this analysis, you will use the same dataset on Semipalmated Sandpipers that you examined in Assignment 2. You have already calculated many of the necessary models, here you will go back to fill in some of the gaps and to see if you can obtain a model with a better fit.

You are interested in asking three additional questions of biological relevance. First, is there any evidence that local survival after first capture is less than subsequent transitions? Second, does annual variation in local survival in both sexes follow the same pattern? This might be the case if both sexes were subject to the same environmental conditions, but if one sex was at greater risk to predators during incubation or was more likely to disperse after breeding failure. Third, is the local survival of adult sandpipers related to delays before nesting on the breeding ground? If early arriving birds discover their nesting sites covered in snow, they may disperse to find better areas, or they may suffer high mortality because food supplies are unavailable. Snow melt may vary but could affect both sexes in the same way.

How can you measure annual snow cover on the study area? In the course of the five-year study, your colleague recorded “Boot Day” each year in their daily journal as an index of snow melt. Boot Day was the first day that more than half of the field crew could wear rubber boots instead of snowshoes to get around on the study site.

Year	Days after 1 May
1	23
2	42
3	13
4	45
5	27

Assignment: Devise models to test these questions with the Semipalmated Sandpiper data. Here are a few hints to get started. Some of these models can be developed with Parameter Index Matrices (PIMs), others require design matrices of dummy variables. Looking at the parameter estimates of the global starting model may give you some hints to what is going on. Some models may include interactions, others may be main effects or additive models. Use the past modeling that you have done to select the best parameter structure for recapture rates. Read the class notes for guidance if you are uncertain how to proceed, also refer to Chapter 7 of the MARK manual in your reader.

Hand-in: It is not necessary to revise your Results section from last week. Instead, prepare a short paragraph and Table that compares the new models to the models of your previous analyses. Use the tools of model comparison to quantify differences: Akaike’s Information Criterion (AICc) and Likelihood Ratio Tests (LRT). Are any of the new models a better fit to the sandpiper data?