

Assignment 1: Testing Group and Time Effects in Program MARK

Objectives: To learn to use Program MARK for fitting statistical models to mark-recapture data. To learn how to present the results of mark-recapture analyses in a clear and concise manner.

Background: Semipalmated Sandpipers are long distance migrants that breed throughout arctic regions of North America. In some areas, the foraging activities of increasing populations of Lesser Snow Geese have led to considerable habitat degradation. There have been associated declines in the populations of sandpipers and several other arctic-breeding birds. To develop a population model for this sandpiper species, it would be helpful to have reliable estimates of survivorship.

A colleague has been studying Semipalmated Sandpipers at a site in northern Manitoba for the past 5 years and has generously provided you with the following data set. Both parents incubate in this monogamous species and ca. 300 adult sandpipers were captured in traps at nests in each year of the study. The capture histories of these birds are summarized in the computer file lab03_semi.txt, which is available at the course website: www.ksu.edu/bsanderc/biol823.

Assignment: Analyse this mark-recapture data set by using Program MARK to fit a range of models. Use the Parameter Index Matrices in Program MARK to fit a starting model with time- and sex-dependence in local survival and recapture rates (ϕ_{t*sex}, p_{t*sex}). Take a look at the point estimates of local survival and recapture rates for this model. Would you have a first guess whether the sex or time effects are likely to be important. Continue to calculate a series of models without time and or sex in ϕ and p , and use the AICc values to guide your model selection. As you are working thorough the analyses, keep the following considerations in mind. Does there appear to be significant annual or sexual variation in local survival or recapture rates? What are the possible biological explanations for differences or similarities in rates? What additional information could help our understanding of this system? Using the tools of model selection (AICc, and w_i if you like), find the model(s) that best fit the data.

Hand-in: One of the greatest challenges in working with new quantitative methods is being able to express the complex statistics in readable language. For this assignment, you will write up your analyses as a short Results section (1-3 pages) with 1-2 tables or figures as appropriate. Present the criteria by which you selected the best-fit model, and give the point estimates of local survival and recapture for this model. Model testing can be presented in a variety of formats, devise a method that clearly indicates your comparisons. You may wish to refer to papers in the course pack to see how other authors have presented mark-recapture analyses. I encourage you to work in groups to complete the analyses but writing up the results should be completed individually. You have two weeks to complete this assignment.

Semipalmated Sandpiper Capture Histories

To save retyping, the file is available on the web at: www.ksu.edu/bsanderc/biol823 The format of this file is identical to what might be saved if you had created the capture histories in Program Access. Here, the total numbers of individuals of sandpipers per capture history are presented for females are on the left, males on the right. You will need to make some changes to import this file into Program MARK. Refer to the snowy plover input file or the on-line manual for Program MARK if you run into difficulties.

00010	205	179
00011	95	121
00100	120	93
00101	19	29
00110	106	101
00111	55	76
01000	169	133
01001	8	3
01010	12	14
01011	9	12
01100	48	44
01101	9	20
01110	33	43
01111	12	31
10000	154	126
10001	0	1
10010	2	4
10011	1	3
10100	9	9
10101	1	2
10110	5	5
10111	4	6
11000	87	75
11001	0	1
11010	9	10
11011	3	6
11100	12	15
11101	0	6
11110	8	18
11111	5	13