**Preliminary Exam Questions: Dr. Dinsmore**

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March 27, 2020

4. Please complete a short analysis of the seasonal survival of a fish (species is irrelevant) in a hypothetical lake system. I have attached two files (.dbf and .ftp) that are formatted for Program MARK. I am interested in seeing your approach to this type of analysis, with less emphasis on a “right” answer. Also realize that this is a “real” analysis in the sense that the data might not be perfect, all parameters might not be estimable, etc. Please begin by providing a *brief* justification for the factors that you considered in your analyses, and your general approach to building models for consideration. Then run an appropriate set of models to answer the questions below. I’ll want to see both of your MARK files, so please include them with your response to this question. Please also label the columns in the design matrix and model names in a way that I can understand them.

Here is a little background about the (fake) dataset. First, carefully read the documentation at the top of the input file. Note that there are 20 occasions (corresponding to April and September sampling periods in each of 10 years) and four individual covariates in the input file. The fish were tagged and recaptured during two 1-month-long (April and September) periods using standard sampling techniques. There are no missing data. Assume that all recaptures were measured without error. Here is a little more information about the covariates:

* **Sex** codes for whether the fish was a male (1), of unknown sex (0), or a female (-1). There is zero chance that they switch sexes during the study.
* **Length** is measured at capture as the total length from snout to tip of folded caudal fin in cm.
* **Mass** is measured at capture in kilograms.
* **Scaled white color** is measured from a digital photo of each fish, and is essentially a proportion of the skin (ranging from 0 to 1) that was white. It has been suggested that paler fish may be more susceptible to harvest.
* In addition, the annual harvest of this fish (in metric tons) is 300, 330, 400, 440, 600, 525, 540, 510, 575, and 560 for the 10 years. Harvest is in fall.

When you open the .dbf file in MARK, you will get the message “No output is stored in this Results Database”; click o.k. and you will be directed to an empty results browser where you can begin building models. You are free to email me if any of this is unclear. **And to keep the analysis on track, do not consider (or even run) the fully time-dependent model.**

After you complete your analysis, please answer the following questions:

* 1. What is your best estimate of the seasonal survival of fish (April to September, and September to April)? Be sure to show your work.
  2. Is there any evidence that sex, length, mass, or scaled white color is an important predictor of survival or capture probability in this population? If so, then how and under what conditions? (1-2 pages)
  3. What problems, if any, did you encounter in your analysis and how might they be resolved? (1 page)
  4. Summarize all of the findings from your analysis in a short (<400 words) paragraph, just as you would write for an abstract of a manuscript.