

ST 506 Sampling Animal Populations  
Exam 1. Due Tuesday October 7, 2008

You may use any notes or books but must not talk to anyone except me about this test. This is very important.

My exams are meant to help you learn the material. Please ask me when you have any need for clarification on what questions mean.

With this signature I verify that I did not accept any help whatsoever on this take home exam.

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

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1. A scientist has carried out a 9 period removal study on an insect population. The numbers removed were 72, 63, 44, 32, 31, 23, 17, 18, and 11. Use three estimates for the population size:
  - the regression estimate (no need for a SE),
  - Model  $M_b$  estimate with SE,
  - Model  $M_{bh}$  estimate with SE.
2. One way of establishing the approximate precision of an estimator is to input data to the appropriate software based on the expected values for a hypothetical set of parameters. Use this approach to answer the following questions about the Lincoln Petersen estimator. If  $N=200$  approximately what values of  $p_1 = p_2$  are required for the proportional standard error to be 10%? Repeat the question for  $N=1000$ , and  $N=10,000$ .
3. One can also use the same approach of inputting expected values to evaluate assumption violations and establish the approximate model induced bias. Let us consider trap response in a 3 sample closed capture-recapture problem and suppose  $N=500$ ,  $p_1 = p_2 = p_3 = 0.3$  and in the first case let  $c = 0.6$  and then in the second case let  $c = 0.2$ . What is the approximate model induced bias in each case and does it agree with the general discussion of bias that we had in class? Note that I will show you in class how we could also obtain estimates under a heterogeneity model.
4. Once I get hold of an idea I won't let it go (☺) so now I would like you to use the same approach to answer a comparison of estimators question. I told you in class that removal sampling is not as good as capture-recapture sampling in terms of precision. Let us check that out. When designing an electro-fishing study on a section of stream the precision of a simple three sample mark-recapture study versus removal studies might be of interest. I would like you to compare the precision of the  $M_t$  estimator for  $N=200$ ,  $p_1 = p_2 = p_3 = 0.25$  with the precision of a 3 period removal study ( $M_b$  not  $M_{bh}$ ) for  $N=200$  and  $p = 0.25$ .

5. Using information in Table 14.9 P313 in the text, verify using appropriate software that the two estimators 65 (SE=5.7) (the jackknife estimator) and 63 (SE not given) (the Chao estimator) are correct. Also provide the SE of the Chao estimate.
6. We have not focused much on tag loss in our class although it is an assumption of all tagging methods that tag loss is 0 or that the tag loss rate can be estimated. Pick a particular animal of interest to you and discuss briefly different methods of tagging the animal and how they might relate to this assumption (1/2 page).
7. Now a few short questions on distance sampling.
  - One of the most important assumptions of distance sampling is to assume a particular value for  $g(0)$ . What is the value and what are some possible reasons this assumption may be violated?
  - In class we briefly discussed the use of distance sampling for point counts of birds. What are some of the reasons that this approach may be problematic? (Note that for the house wren example none of the models fitted the data very well whereas for the line transect example they did). I realize that some of you may never have sampled birds so just a reminder that they may be detected and identified by sight or by sound based on calls.
  - Distance sampling using both line transects and point counts have sometimes been applied to sampling fish on coral reefs using snorkeling or scuba divers. Such studies can be very important to the community and population ecology of reef fish populations and communities because tagging studies are much more expensive and logistically very challenging. There is not a right answer here at least as far as I know but what do you think would be better: to do point counts or to run line transects? Briefly give some advantages and disadvantages of each approach.