

ST 506 Sampling Animal Populations

Homework Set 1.

Due Tuesday Sept 9, 2008.

You may work together on homeworks and also consult me if you have questions.

1. Please outline why you are taking this class and also what sections you think might be relevant to your own research. (Not graded but useful for me to know).
2. To illustrate and reinforce some of the ideas of properties of estimators I would like you to do a small mark-recapture simulation to compare the bias of the Lincoln-Petersen and Chapman mark-recapture estimators when you have a population of 100 animals. Suppose you mark $n_1 = 40$ and then draw a sample of $n_2 = 5$ animals. (We used these estimators for the multiple independent observer method). Carry out at least 50 replicate studies using either: a) two different colors of pieces of paper placed in a bag and drawn out one at a time; or b) write a computer program to do the simulation for you.
Calculate the approximate Expected Value, Bias, SE, and MSE of the Chapman estimator using your simulation replicate values. Also calculate the expected value and bias of the Lincoln-Petersen Estimates if you ignore the infinite values. Comment on why this shows the value of the Chapman modification.
3. In an aerial survey of 10 plots or sampling units, selected by simple random sampling without replacement, the numbers of elk detected were 62, 22, 88, 43, 69, 88, 93, 75, 13, and 17. The study area consists of 50 plots. A random sub-sample of 4 plots was then selected for a complete ground count. The plots selected were 2, 4, 5, and 10 and they had 2- 27, 4-43, 5-87, and 10-21 elk counted.
 - (i) Estimate the probability of detection of an elk in the aerial survey.
 - (ii) What assumption is being made about the ground count?
 - (iii) Estimate the total number of elk in the study area unadjusted for visibility bias and then adjusted for visibility bias.
4. In an aerial survey of manatees, the two observers method was used to estimate detection probability. There were 75 animals seen by observer 1, 90 seen by observer 2, and 45 seen by both observers.
 - (i) Calculate the population size estimate and its SE (see p. 292. for variance equation and then take sqrt to get SE)
 - (ii) Calculate the detection probability estimate for observer 1 and also for observer 2.
5. When one is interested in conducting an aerial survey of a population of objects (say eagle nests to make it simple) there are several approaches available for accounting for visibility bias (i.e., non-detection of all animals from the air). Discuss the advantages and disadvantages of the following methods:
 - Aerial count plus complete ground counts on a sub-sample of plots
 - Ground and air by 2 observers with mapping objects seen in common.
 - Two (independent) observers in the same plane with mapping of objects seen in common, and
 - Line transects (distance sampling) (Postpone until Home work 2).

Note: Give about 1/2-1 page or so on each one.