ST 506 Sampling Animal Populations
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Homework Set 5
Due Tuesday September 23, 2008

Q1. Let us consider an animal population subject only to mortality. Suppose we carry out a short duration complete Lincoln Petersen study in month 1 and find n_{11}=101,n_{21}=202,m_{21}=21 whereas a few weeks later in month 2 we run another quick complete Lincoln-Petersen study and find n_{21}=152, n_{22}=242,m_{22}=61. (Note here we ignore any recaptures between months. We will discuss better ways to deal with this kind of data later). Calculate the population sizes in months 1 and 2.
Also calculate the survival rate between months 1 and 2.

Q2. Attached is some of the voluminous CAPTURE output for the Edinborough taxi cab data (N = 420, k = 10) using another sampling scheme called B. (We will see scheme A output in class). I would like you to write a one-two page report on this analysis. Among other things answer the following questions. What does it tell you about the precision and bias for the different models? What is the best model to use? Does that model do a good job on estimation of N? What does Test 1 tell you? Test 6? Test 7?

Tests

1. Test for heterogeneity of trapping probabilities in population.
   Null hypothesis of model M(o) vs. alternate hypothesis of model M(h)
      Chi-square value = 7.898 degrees of freedom = 3
         Probability of larger value = 0.04816.

Tests 2-5 not shown

6. Goodness of fit test of model M(t)
   Null hypothesis of model M(t) vs. alternate hypothesis of not model M(t)
      Chi-square value = 188.341 degrees of freedom = 168
         Probability of larger value = 0.13452

7. Test for behavioral response in presence of heterogeneity.
   Null hypothesis of model M(h) vs. alternate hypothesis of model M(bh)
      Chi-square value = 13.624 degrees of freedom = 24
         Probability of larger value = 0.95470

Model selection criteria. (based on combining all the tests into a linear discriminant function, Otis et al.(1978))

Model	M(o)	M(h)	M(b)	M(bh)	M(t)	M(th)	M(tb)	M(tbh)
Criteria	0.88	1.00	0.34	0.49	0.00	0.43	0.34	0.56

Individual Model Estimates and SEs for many Models

M(0)
Popn est 288 (se 9.66)
p-hat = 0.1649

M(h)
Jacknife Popn est 365 (se 27.76)
Av p-hat = 0.1301
Chao Popn est 322 (se 20.70)
Av p-hat = 0.1475

M(t)
Popn est 288 (se 9.57)
p-hat(j)= 0.17 0.18 0.16 0.15 0.17 0.16 0.17 0.15 0.16 0.18

M(b)
Popn est 292 (se 17.07)
p-hat = 0.1592
c-hat = 0.1661

M(bh)
Popn est 292 (se 17.07)

M(th)
Popn est 311 (se 17.00)
Av p-hat(j) = 0.15 0.17 0.15 0.14 0.15 0.14 0.15 0.14 0.15 0.17

M(tb)
Popn est 317 (se 46.17)

Note- While Capture is a very old program there are still some things it can do that MARK cant directly. One can access CAPTURE from MARK and I will show you how to do that.

Q3. To help you understand the structure of capture histories and expected values suppose we have a population of N=1000 animals that we wish to sample k = 3 times following the closed capture recapture protocol. Write an excel spreadsheet to do the calculations (or do them on a calculator) and write down the expected values of each possible capture history under:

a. Model M_o when p1=p2=p3 = 0.2
b. Model M_t when p1=0.2, p2=0.3 and p3=0.1.
c. Model M_b when p = 0.4 and c = 0.1.

If you are correct the sum of all the expected values in each case should add up to 1000.