Leslie Model HW

Maceina *et al.* (1995) examined the population of harvestable largemouth bass (*Micropterus salmoides*) in Connor Cove of Lake Guntersville, Alabama, a 28,000-ha impoundment of the Tennessee River in March, 1992. Their objective was to estimate the abundance of harvestable bass through the depletion of catches due to electrofishing. In their study, they electrofished for 15 minutes at each of four depth strata. The total number of bass captured, and removed, from the population from the full hour of electrofishing in the four depths was recorded. Thus, a total of one hour of electrofishing constituted one unit of effort. Six one-hour periods were used to deplete the population of bass in this cove. The number of bass caught in each period was 23, 12, 13, 14, 9, and 7. Use these data to answer the following questions.

a. Enter the catch and effort data into separate vectors in R using `c()`. Then calculate a vector that represents the CPE for these data. Carefully interpret the first CPE value.

```
> ct <- c(23,12,13,14,9,7)
> ft <- rep(1,6)
> ( cpe <- ct/ft )
[1] 23 12 13 14  9  7
```

The first CPE value shows that an average of 23 fish were captured in one unit of effort (one hour of electrofishing).

b. What is the best estimate and 95% confidence interval for the catchability coefficient? Very carefully interpret what this (the best estimate) means relative to Connor Cover largemouth bass. How does your estimate compare to the estimate published in Maceina *et al.* (1995)?

```
> dep <- depletion(ct,ft)
> coef(dep)
         No       q
[1,] 108.4 0.1896
> confint(dep)
      95% LCI  95% UCI
No 57.85374 158.9372
q   0.05762   0.3216
```

The catchability coefficient (q) is estimated to be 0.190 with a 95% confidence interval between 0.058 and 0.322. This catchability indicates that 19.0% of the population is captured with one unit of effort (one hour of electrofishing). This estimate matches the published estimate.

c. What is the best estimate and 95% confidence interval for the population size? How does your estimate compare to the estimate published in Maceina *et al.* (1995)?
The initial population size (N_0) is estimated to be 108.4 with a 95% confidence interval between 57.9 and 158.9. This estimate matches the published estimate.

d. Given the best estimates of q and N_0 and the amount of effort used in one period/sample, estimate how many bass you would expect to catch in the first period/sample?

```
> cf <- coef(dep)
> 1*cf[,"q"]*cf[,"No"]
    q
20.55
```

The first unit of fishing effort is estimated to have caught 20.6 fish.

e. With the same assumptions as the previous question, estimate how many bass you would expect to catch in the second period/sample?

```
> 1*cf[,"q"]*(1-cf[,"q"])*cf[,"No"]
      q
16.66
```

The second unit of fishing effort is estimated to have caught 16.7 fish.