FW663 -- Laboratory Exercise

Program RELEASE to Design Experiments

Stromborg et al. (1988) studied postfledgling survival of European starlings (*Sturnus vulgaris*) deliberately exposed to an organophosphate pesticide. In this starling experiment, relatively small numbers of birds were released ($R_{t1} = 60$; $R_{c1} = 61$), but capture probabilities were high (~0.78). The study was conducted on about 2,000 hectares of the Patuxent Wildlife Research Center near Laurel, Maryland. The experiment is also discussed by Burnham et al. (1987:343-348).

On the CNR microcomputer network is an input file to Program RELEASE named J:\CLASSES\FW663\EXERCISE.10\STARLING.INP. This file will generate a complete analysis of the starling data with Program RELEASE. The m-arrays are shown on page 344 of Burnham et al. (1987), so you might consider entering the data into Program RELEASE to try the interactive user interface. As you can see from your output, the study was inconclusive about the impact of the organophosphate pesticide on the survival of treated birds.

Your problem today is to design a more powerful study to detect the impact of the pesticide on survival. Use the simulation procedure of RELEASE to generate Monte Carlo simulations, and compare these results to the EXPECT option. Evaluate the effect of greater sample sizes, higher capture probabilities, and a stronger treatment effect. You might start with a treatment effect of $S = 0.9$, and decrease this value to 0.8. Other possibilities are to increase the number of occasions, and use more than one treatment level. Use the output from STARLING.INP as base line data for the design of this experiment. You will probably want to build the input files for this output with the interactive interface of RELEASE.

Questions for Discussion

1. Do results from 1,000 Monte Carlo simulations compare well with results obtained with the EXPECT option?

2. What are the biological implications if model H_{2p} fits the data better than model $H_{1\phi}$? Stated differently, what are the biological implications if model H_{2p} approximates the data better than model $H_{1\phi}$? Are these statements equivalent?

3. Is power greater for designs with high survival of controls, or lower survival?

4. Four methods to increase the power of an experiment are to increase sample size, decrease variation, increase the treatment effect and develop more controlled manipulations (such

as blocking and paired designs). How do each of the variables you manipulated in your RELEASE simulations fit into these categories?

5. How would you use cost functions to optimize the design? As an example, consider that the cost of a person in the field to sight starlings for one day might be $100. Sighting probabilities on a single occasion might be 0.5 for one person, 0.75 for two persons, and 0.875 for 3 people. Would you get better precision of your estimates if you designed the experiment with 2 people working 3 occasions, or 3 people working 2 occasions? The cost of both these experiments would be $600 for manpower.

6. What would happen to your proposed experiment if the dispersal of the juvenile starlings was impacted by the pesticide?

Literature Cited

Burnham, K. P., D. R. Anderson, G. C. White, C. Brownie, and K. H. Pollock. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph 5:1-437.

Stromborg, K. L., C. E. Grue, J. D. Nichols, G. R. Hepp, J. E. Hines, and H. C. Bourne. 1988. Postfledging survival of European starlings exposed as nestlings to an organophosphorus insecticide. Ecology 69:590-601.