FW663 -- Laboratory Exercise

Point Transect Estimation

Estimation of the density of a savannah sparrow (*Passerculus sandwichensis*) population is the problem of this exercise. We use data supplied by F. L. Knopf from extensive songbird surveys of parts of the Arapaho national Wildlife Refuge, Colorado (Knopf et al. 1988). We will consider the counts carried out in June of 1980 and 1981. In 1980, three pastures, 1, 2, and 3, were surveyed. In 1981, 4 pastures were surveyed, with pasture 0 added. Although pastures varied in size, we assume that each is the same size for this example. A summary of detections per pasture follows.

Year	Pasture	Points Surveyed	Detections
1980	1	124	60
	2	126	122
	3	123	94
1981	0	100	35
	1	100	37
	2	100	63
	3	100	51

Surveys were conducted from 30 minutes before sunrise until approximately 1000 hours daily. A motionless observer waited for 1 minute at each station and then recorded all perched birds seen within a 10-minute period. Birds heard, but not seen, were not recorded to minimize the likelihood of recording an individual twice, and to avoid potential biases due to variable vocalization rates among species, variability in estimation of distances to a vocalizing bird, and differences in observer ability to identify vocalizations. Knopf et al. (1988) felt confident that all individuals that vocalized within the species-specific range of visibility were also seen. After each counting period, the investigator flagged the bushes that birds were in, or the bushes nearest to the point where birds were seen on the ground. Each afternoon, observers returned to those stations where birds were seen and measured station-to-bird distances to the nearest 0.1 m.

Use Program DISTANCE to estimate density for these data. Input for Program DISTANCE are stored in the files J:\CLASSES\FW663\EXERCISE.27\SASP80.PT and J:\CLASSES\FW663\EXERCISE.27\SASP81.PT. Your assignment is to develop a defensible estimate of density from these data. Consider whether data need to be truncated, and which models are appropriate (i.e., key function and adjustments). Compute estimates for each pasture. Develop a defensible variance estimate of $\hat{D}$ as well. Compare your results with Table 8.19 of Buckland et al. (1993:407).

Other procedures to consider for this data are 1) can the detection functions be pooled across years, and 2) can the detection functions be pooled across pastures? Explore the use of the following DISTANCE statements:

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DETECTION ALL
DETECTION BY STRATUM

DENSITY ALL
DENSITY BY STRATUM
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Finally, consider use of the bootstrap procedure to incorporate model selection variance. Beware, however, that using all the data at once can result in a lengthy computer run.

Questions for Discussion

1. Should the data be truncated to improve the estimator? Why or why not?

2. Which of the approximating models in DISTANCE fit the data the best? Do any fit the data adequately? Why? Are you able to reject any of the estimators as being inappropriate based on the data? What about theoretical grounds for rejecting an estimator?

3. How close are your estimates and your neighbor's estimates? To the estimates in Buckland et al. (1993)?

4. How does the bootstrap procedure incorporate model selection variance into confidence intervals on *D*?

Literature Cited

Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman & Hall, London. 446pp.

Knopf, F. L., J. A. Sedgwick, and R. W. Cannon. 1988. Guild structure of a riparian avifauna relative to seasonal cattle grazing. Journal of Wildlife Management 52:280-290.