PROGRESS REPORT 2008
SPOT MAPPING, OCCUPANCY METHODS, AND MONITORING GOLDEN-CHEEKED WARBLER POPULATIONS

Floyd W. Weckerly and James R. Ott
Department of Biology, Texas State University – San Marcos, Texas 78666

INTRODUCTION

Biologists with the Balcones Canyonlands Preserve spot map breeding territories of Golden-cheeked warblers (GCWA, *Dendroica chrysoparia*) in eight 100 acre plots. Six plots are in habitat that is considered optimal or prime and two plots are in habitat that is viewed as suboptimal or transitional for GCWA. The data gathered from spot mapping is used to measure GCWA density (e.g., number of territories per 100 acres) and productivity (e.g., number of fledglings per territory). This information has been gathered annually since 1998 and is used to determine trends in GCWA populations throughout Balcones Canyonlands Preserve. Possible trends are GCWA populations have declined, increased, or remained stable.

With the objectives in the Habitat Conservation Plan of achieving 800 – 1200 GCWA's and 10,000 – 12,000 acres of GCWA habitat by 2024, it may be useful to pursue alternatives to spot mapping for purposes of monitoring GCWA. Spot mapping is labor intensive; consequently, GCWA density can only be measured in a very small part of the preserve. Extrapolating densities measured in 100 acre plots to areas of similar habitat where birds have not been monitored may be misleading. Weckerly and Ott (2008), for example, showed that the amount of variation from plot-to-plot in territory densities was about twice as much as the variation in territory density from year-to-year within plots. Also, some measures of productivity gathered during spot mapping, such as number of fledglings per territory, may provide inaccurate data. Some fledgling may not be detected because nests in territories may not be located or the fledglings themselves may be difficult to spot in densely vegetated habitat. An issue called imperfect detection.

To provide data needed to achieve goals for the Habitat Conservation Plan, we initiated a study in 2008 to explore alternative monitoring methods. The alternative monitoring methods were selected to achieve three objectives. *One, the data collected from another method should interface with existing spot mapping data*. The alternative methods should be calibrated with spot mapping to maintain the integrity of the long-term data series on GCWA population trends in the preserve. *Two, the method has to be cost effective*. A larger part of the preserve should be monitored then can be monitored at the present time given the time, money, and personnel allotted. *Three, the data should be reliable*. Data on GCWA density and productivity should account for imperfect detection or the possibility of missing birds during surveys.

METHODS

The alternative methods for estimating abundance are occupancy and binomial mixture models (MacKenzie et al. 2006). Using these models requires that data on abundance is collected in such a way that areas are surveyed systematically and that surveys are conducted repeatedly in areas. In 2008 we plotted a 'grid' of detection stations over five 100 acre plots (Fig. 1, 2). Detection grids have 36 detection stations (sampling points) that are 200 meters apart. Detection stations are 200 meters apart to

minimize the potential to detect the same bird at multiple detection stations. At detection stations observers record the number of distinct GCWA seen or heard, regardless of distance from the detection station, in a 5 min survey period. A survey was sampling every station in a detection grid in one day. Also, surveys were conducted on days when weather conditions allow for songbird activities (calling and moving) that facilitate detection (Robbins 1981). Each grid was surveyed 4 times between 15 March and 15 April which was during the GCWA breeding season. Surveys began at dawn and the sequence that detection stations were sampled changed each survey so that stations were sampled at different times during the morning and early afternoon. Surveys of detection grids are conducted by biologists with Texas State University.

In each 100 acre plot, the standard spot mapping technique (Bibby et al. 1992) was conducted by biologist with the City of Austin. Every 100 acre plot was surveyed 10 times throughout the GCWA breeding season from mid-March to the end of May. A spot mapping survey of a 100 acre plot lasts 6 hours and was initiated at dawn.

At the conclusion of data collection in the second year (2009), we will estimate abundance using the two alternative techniques (Occupancy and Binomial mixture models). Estimates obtained from these techniques will be compared to estimates of territory density obtained from spot mapping to assess interface, cost-effectiveness, and reliability (see Introduction).

In May we established 35 belt transects (50 X 200 m) on each grid to measure number of fledglings. Each belt transect in a grid was sampled twice in May, again, surveys began at dawn. We collected data using the double observer design (Nichols et al. 2000). In each belt transect, two observers surveyed at the same time and kept separate records of the number of fledglings and adult GCWA sighted. By conducting surveys in this manner we can estimate detection probabilities of fledglings and estimate the extent to which fledglings are missed or imperfect detection (Nichols et al. 2000).

PRELIMINARY FINDINGS

The formal analysis of data will occur after the data collection in 2009. Number of detections among surveys and number of GCWA detected at detection stations (per grid) is summarized in Table 1. For fledgling surveys the number of GCWA groups ($\geq$ 1 fledgling or adult in a group) detected per survey ranged from 0 to 13.

Table 1. Summary of detections (stations where $\geq$1 GCWA detected) and number of GCWA detected (when at least 1 GCWA was detected) at grids among the four surveys.

	Number of detections per a survey of 36 detection stations		Number of GCWA detected		
Grid	Minimum	Maximum	Median	Minimum	Maximum
Bohls	4	14	1	1	2
Emma Long	21	28	1	1	5
Forest Ridge	12	22	1	1	4
Ivanhoe	22	34	1	1	4
3M/St. Edwards	15	30	1	1	4

FIELD WORK NEXT YEAR

We expect to survey the same four grids as last year and two additional grids (Double J&T and Barton Creek) in the upcoming 2009 breeding season. As in 2008, the 100 acre plots at each grid will also be surveyed by City of Austin biologists to estimate territory density. Like in 2008, surveys will be conducted to collect data to estimate abundance (Occupancy and binomial mixture models) and number of fledglings (Double observer estimator).

REFERENCES

Bibby, C. J., N. D. Burgess, and D. A. Hill. 1992. Bird census techniques. Harcourt Brace Co., New York.

MacKenzie, D. I., J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey, and J. E. Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Academic Press, New York.

Nichols, J. D., J. E. Hines, J. R. Sauer, F. W. Fallon, J. E. Fallon, and P. J. Heglund. 2000. A double-observer approach for estimating detection probability and abundance from point counts. Auk 117:393-408.

Robbins, C. S. 1981. Bird activity levels related to weather. Studies in Avian Biology 6:301-310.

Weckerly, F. W., and J. R. Ott. 2008. Statistical trends of golden-cheeked warblers on Balcones Canyonlands Preserve, City of Austin, Texas. City of Austin, Final Report.

Fig. 1. A map illustrating the location of detection stations in relation to the location of the 100 acre plot on one site, Forest Ridge. The Forest Ridge 100 acre plot is delineated in red and the grid of the 36 detection stations is denoted by black dots.

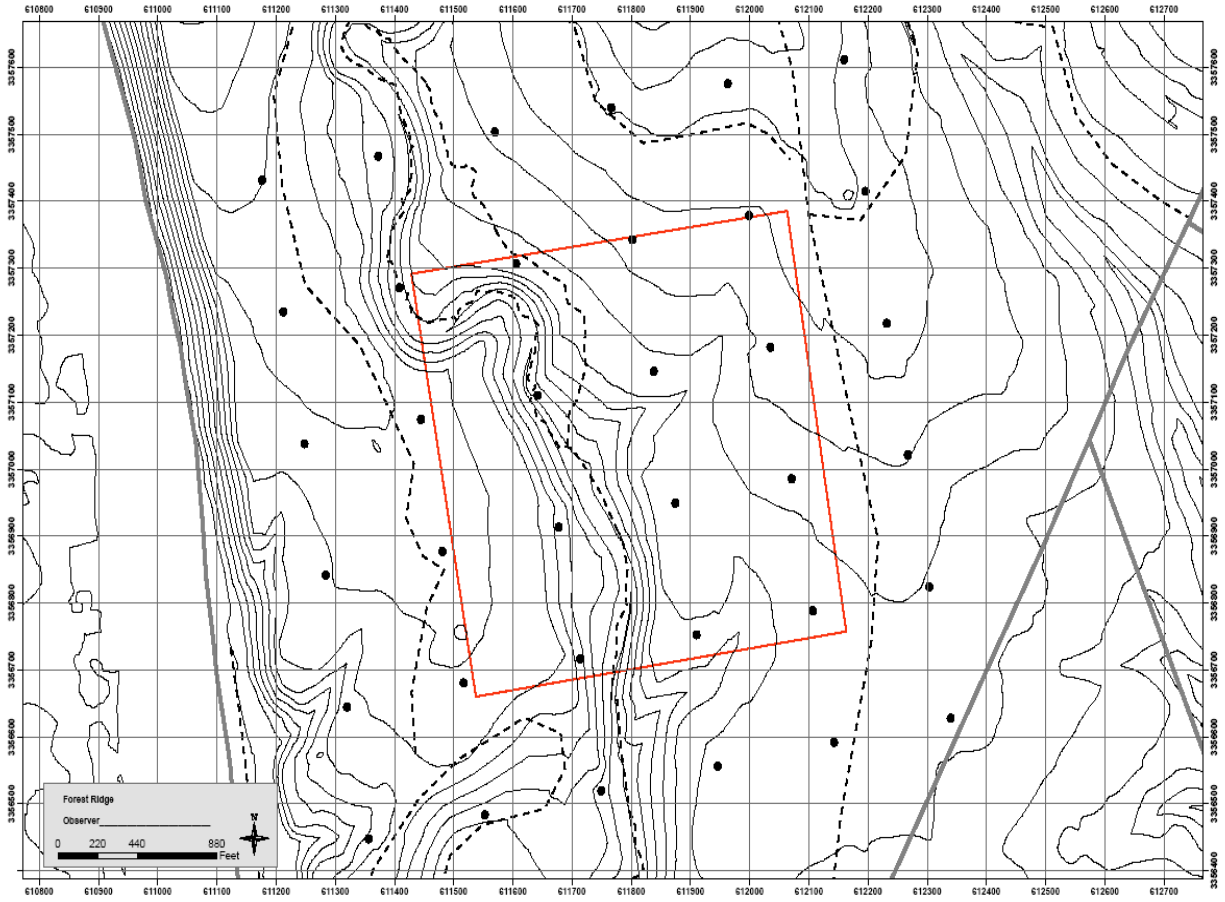

Fig. 2. Map of Balcones Canyonland Preserve showing locations of 8-100 acre plots where golden-cheeked warbler densities are measured by biologists with the City of Austin. In 2008 we collected data on detection grids overlaid on 5 of the 100 acre plots; Bohls, Emma Long, Ivanhoe, 3M/St. Edwards, and Forest Ridge.

