Abundance of Black-capped Vireos at Balcones Canyonlands National Wildlife Refuge in 2015

Balcones Canyonlands National Wildlife Refuge (BCNWR) was established in 1992 primarily to protect habitat for the golden-cheeked warbler (Setophaga chrysoparia) and black-capped vireo (Vireo atricapilla). The black-capped vireo was listed as endangered in 1987 due to declines caused by nest parasitism by brown-headed cowbirds (Molothrus ater) and loss of habitat (Ratzlaff 1987). Recovery criteria for the species include establishment of at least 1 viable population (750 breeding pairs) in each of 6 regions (U.S. Fish and Wildlife Service 1991). The BCNWR black-capped vireo population is within the Lampasas Cut Plains region. The largest black-capped vireo population within this region is found on Fort Hood Military Reservation (Cimprich and Kostecke 2006). In 2014, the population estimate for this population was 7478 territorial males (95% confidence interval 6523–8573; Cimprich and Cimprich 2014). Dispersal of 2 males and 1 female from that population to BCNWR has been documented (Cimprich et al. 2009), and it is likely that black-capped vireo breeding populations throughout this region are demographically connected.

Initially, black-capped vireos on the refuge were inventoried by spot mapping territories. In 1993, refuge staff estimated that about 50 black-capped vireo males occupied 140 ha on 3 refuge tracts. By 2002, this number had increased to between 90 and 100; 4 new sites had been occupied following habitat management, some areas that may have had black-capped vireo all along were searched and populations “discovered,” and the original surveyed populations generally increased. In 2012, various researchers documented 83 black-capped vireo territorial males (71 by TAMU [+10 on Hickory Ridge], 12 by Seckel) on BCNWR. However, not all known populations were surveyed and was therefore not considered a complete survey. In 2013 and 2014 these entities continued their territory monitoring and Refuge staff surveyed most remaining populations. Combining all documentation of black-capped vireo territories in 2013 and 2014 for BCNWR, Hickory Ridge, and Peaceful Springs, researchers and staff documented 158 territories (130 on BCNWR, 11 on Hickory ridge, and 17 Peaceful Springs). However, these historic estimates were all influenced by effort and area searched.

In 2015, a pilot study was conducted for a new survey protocol designed for estimating the black-capped vireo population at BCNWR. This protocol was based on the methods used at Fort Hood (Cimprich 2015). The objective of this pilot study was to evaluate protocols for estimating the density and abundance of territorial male black-capped vireo with a COV of 20% in a target area. The target area at BCNWR was the area managed specifically for black-capped vireo habitat and other areas where territorial male black-capped vireo have been found during any of the preceding 4 breeding seasons.

Methods

The study area was BCNWR, and the adjacent Hickory Ridge and Peaceful Springs ranches that are anticipated to become part of the refuge via future acquisitions of conservation easements or ownership in fee title. The target area for sampling was based on areas identified in the 2015
Draft Habitat Management Plan for BCNWR as management areas for either black-capped vireo or both black-capped vireo and golden-cheeked warbler (Figure 1) and areas within 100 m of any black-capped vireo detections from 2011 to 2014 (Figure 2). Using ArcGIS, a 100-m buffer was placed around these detections, dissolved, clipped to the study area, and then merged (ArcGIS tool Union) with the black-capped vireo management areas to create a target area. Next, a uniform grid of points spaced 250 meters apart was placed randomly across the refuge acquisition boundary and then clipped to the survey target area. This resulted in a grid of 210 survey points (Figure 3).

The sample unit was an unlimited variable-radius point (i.e., all detections of singing black-capped vireo were recorded). Surveys were conducted from 13-20 April 2015 and were preceded by 1 day of training; all surveyors were experienced with identifying black-capped vireos and the layout of the refuge, and thus training was much shorter than required for surveyors new to the area or species. Surveys were conducted from 15 min before sunrise until 4 hours after sunrise. Surveys lasted 3 min (Cimprich 2009). During each survey, distances and times to the initial detection of each black-capped vireo were recorded. The locations of singing black-capped vireos were plotted on a bull’s-eye diagram superimposed on 2014 aerial imagery (NAIP) (Figure 4). Distance estimates were improved by using a range finder to measure distances to objects near where a bird was singing and by walking to black-capped vireos still singing at the end of a survey and measuring the distance with GPS.

Data were analyzed using the distance sampling model of Royle et al. (2004) implemented through package unmarked of Program R version 3.2.1. Covariates were developed from the 2012 data used in Sesnie et al. (In press), and the methods for model selection and density estimation followed the steps outlined in that paper.

**Results**

Effort – Approximately 3 person days were required for 1 person with GIS proficiency to create the maps and data forms for the survey. Only 1 day was spent training surveyors, but it would likely require 3 days for this training for persons new to the refuge or to surveying black-capped vireos (3 persons @ 3 days = 9 person days). Three surveyors completed the 210 point count surveys in 17 person days (mean = 12 surveys per day). Weather was excellent during the scheduled surveys days. No surveys were cancelled due to weather and only 1 survey was delayed for 15 minutes 1 morning due to fog reducing visibility to <100 m. For future planning purposes, the amount of time scheduled to complete the surveys should account for about a 20% loss of survey time/days due to weather (e.g., reduce field survey daily rate to approximately 10 surveys per person per day). Data entry and verification took 1 person day. Analysis for this study took several weeks due to development of proper methodology. Methods of analysis for future surveys will be well documented as will contents of the report and should require far less time. For purposes of estimating future labor, it is recommended to estimate needing 30% of the total survey effort for data management, analysis, and reporting.

Field surveys –No black-capped vireos were detected at 150 points, a single black-capped vireo was detected at 46 points, and 2 black-capped vireos were detected at 14 points, for a total of 74 detections at 60 points. Data were truncated to 155 m, resulting in 68 detections at 55 points.
Mean density of black-capped vireos was 0.172 males/ha (SE = 0.007, COV = 3.9%). The target area was 1,307 ha, and the estimated abundance was 224 males (95% CI, 207 – 241). However, Cimprich (2009) found that a 3-minute point count estimate was 26% greater than the number of enumerated territories. Reducing the estimate by 26% resulted in an estimate of 166 males, which is very close to the combined 2013 and 2014 population estimate mentioned above.

Efficiency and accuracy of surveys – The survey met the objective of estimating the population with a COV of ≤20%. To conduct this survey in the future is expected to require approximately 45 person-days. If additional accuracy is required and survey effort is doubled, the survey would require 80 person days. This protocol may be appropriate to survey areas where at least 60-80 detections are expected.

**Literature Cited**


Figure 1. Balcones Canyonlands National Wildlife Refuge tract boundaries with yellow depicting areas managed for black-capped vireos or both black-capped vireos and golden-cheeked warblers in the 2015 draft Habitat Management Plan.
Figure 2. Balcones Canyonlands National Wildlife Refuge tract boundaries with fuschia depicting areas with black-capped vireo detections in 2011-2014.
Figure 3. Balcones Canyonlands National Wildlife Refuge tract boundaries with yellow depicting target survey area for black-capped vireos overlaid by the grid of 210 survey points.
Figure 4. Example black-capped vireo point count datasheet and 2014 aerial photograph with distance bullseye for point count location number 1.