Testing an assumption of the double-sampling method using riparian birds of the Lower Colorado River

Monitoring Riparian Obligate Avian Species for the Lower Colorado River Multi-Species Conservation Plan

Amy Leist and Dawn M. Fletcher, *Great Basin Bird Observatory, Reno NV 89502*

INTRODUCTION

We used the double-sampling method [1] to estimate density and population trends in riparian birds distributed in the lower Colorado River, USA (Fig. 1). Our goals were to provide system-wide monitoring of avian species and to make recommendations for riparian habitat restoration in the region with emphasis placed on six species covered under the Lower Colorado Multiple Species Conservation Plan (Gilded Flicker, Sonoran Yellow Warbler, Arizona Bell's Vireo, Vermilion Flycatcher, Summer Tanager, and Gila Woodpecker) [2].This project was initiated in 2007, and from 2011-2013 we collected additional data to test an assumption of the double-sampling method [3].

TESTING ASSUMPTIONS OF THE DOUBLE-SAMPLING METHOD

We evaluated the assumption of the double-sampling method that assumes unbiased estimates of territory numbers by performing triple-sampling (*extra intensive*: 16x, 8x, and 2x/season).

If double-sampling provides an unbiased estimate of territory numbers then intensive (I) and extra-intensive (EI) should yield similar results

STUDY AREA

Figure 1.

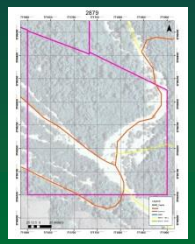
Historical floodplain of the Colorado River from Separation Point (above Lake Mead) to the Southerly International Boundary with Mexico

Habitats include the riparian corridor with native (cottonwood, willow, mesquite) and non-native (tamarisk) species as well as Mohave and Sonoran desert

METHODS

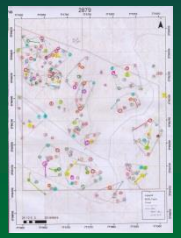
We surveyed 300 x 300m+ randomly selected plots using the area search method and double-sampling.

- Plots were systematically surveyed by passing within 50m of all points within the plot
- Surveyors spot mapped all breeding species (also recording species, age, sex, location, and breeding behavior on an aerial image of the plot (Fig. 2)) and tallied migrants and fly-overs
- 160 plots were surveyed rapidly (2 visits/season) each year
- A subset of 12 plots were double-sampled intensively (8 visits/season) each year
- A subset of 12 plots were triple-sampled (16 visits/season) each year
- Estimated detection ratios from territory numbers calculated from rapid and intensive surveys



Survey map

Visit map



End-of-season species map

ANALYSIS

- Used summary statistics to the estimate the bias or difference between estimates (I-EI) (Table…)
- Used program DS to calculate detection ratios (DR) for each sampling effort over all three years for common riparian obligate species and an all-species average
- Examined DR and errors by species and compared them with the overall DRs and errors (Table…)
- Examined the change in detected territories through the course of the survey season for all three survey types (Fig. 2)

RESULTS

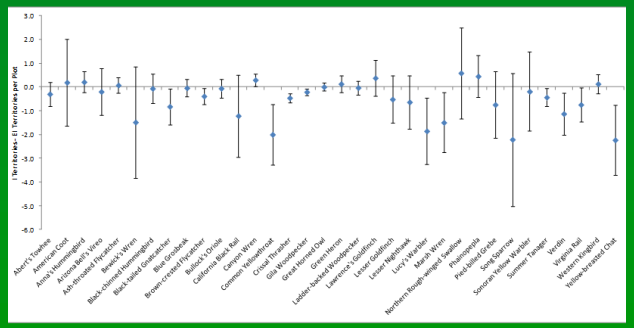


Figure 2 . Differences between I and EI sampling within a plot reported for relatively common species. Data below zero line shows that the EI surveyor had more territories than the Intensive surveyor. Error bars denote 90% confidence intervals.

RESULTS

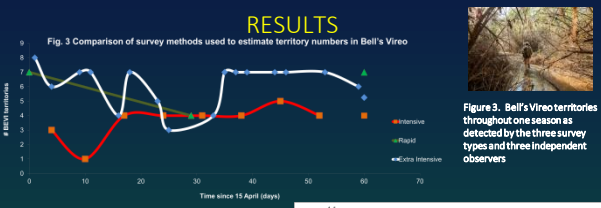


Figure 3. Bell's Vireo territories throughout one season as detected by the three survey types and three independent observers

Comparison of the detection ratios of EI and rapid (blue bars) vs. intensive and rapid (red bars) 2011-2013

Figure 4. DR was close to 1.0 and the EI and I DRs were similar.

Figure 5. EI and I surveyors were detecting similar numbers of territories but DRs were below 1.0 meaning rapid surveyors were underestimating the number of territories compared to I and EI.

Figure 6 . DR was below 1.0 for EI and I but consistently lower for EI meaning the rapid and the I efforts both underestimated the actual number of territories on the plot.

Figure 7. The DR was above 1.0 for EI and I, and rapid surveys overestimate birds relative to both EI and I.

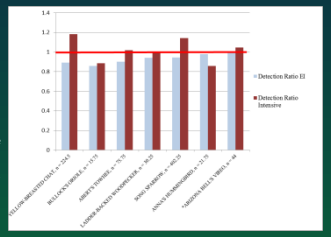


Figure 4.

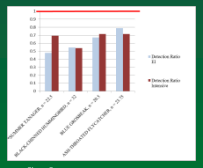


Figure 5.

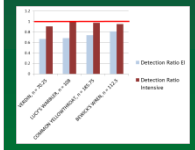


Figure 6.

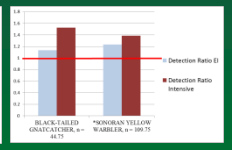


Figure 7.

DISCUSSION

The overall difference between the EI and I results was only 16%, and the species that contributed most to this difference differed in their natural history from most others. The species with the largest deviations from a detection ratio of 1 were those that breed early, arrive late, were challenging to detect, or have poorly defined territories. The EI and I surveys were also conducted in the most difficult-to-survey plots in the project area, making it likely that the actual detectability of most species is higher in many other areas that are easier to survey and have lower bird densities.

The *extra-intensive (EI)* surveys indicate that the double-sampling method can both overestimate and underestimate territory numbers (Figs. 2,5-7). These differences are mainly caused by the speciose avian community (n=142) with diverse ecologies, biases in the difficulty of the plots, surveyors incorrectly distinguishing between breeders and migrants in several species, and survey biases in estimating territory size.

We have improved our training for "difficult" species and adapted protocols and data collection methods to better fit individual species. This was an important reality check for the difficult process of monitoring many species across a large landscape and over a long period of time. Our study confirmed that the basic approach of the double-sampling method produced desirable long-term monitoring data, and it resulted in in-depth natural history, breeding, and migration information about birds on the Lower Colorado River (an under-studied area).
The natural history information gathered about the species will help future surveys produce more accurate results and thus continue to decrease bias.

Acknowledgments
B. Sabine and wildlife and GIS staff at BOR Boulder City, E. Ammon and GBBO staff, Amazing GBBO field crews 2011-2013, C. Vanier, lower Colorado river NWR and tribal partners

References
Cochran, W. G. 1977. Sampling Techniques, 3rd ed. John Wiley and Sons, New York
(USBR) U.S. Bureau of Reclamation. 2008. Species Accounts the lower Colorado River Multi-Species Conservation Program. http://www.lcrmscp.gov/technicalrepts.html
3. Bart, J., and S.L. Earnst. 2002. Double sampling to estimate density and population trends in birds. Auk 119:36-45.