An Appraisal of the Methodological Protocol for Avian Point-Counts: What is the Optimal Winter Strategy in a South African Private Game Reserve?

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Introduction

Avifauna are widely monitored using point-counts, as their susceptibility to environmental change makes them indicator species within their wider ecosystems (Butler *et al,* 2010). Population monitoring informs conservation strategies, based on bird's response to anthropogenic land alterations and climate change (Gregory *et al,* 2004). A prominent research focus has been the detriment of noise, vehicle density, habitat fragmentation and degradation associated with roads (Rheindt, 2003; Baudvin, 2004; Thinh *et al,* 2012). However, research has been confined to the Northern Hemisphere. Also, whilst point-counts remain ornithologist's preeminent method, contesting opinion surrounds the optimal time of day and sampling duration to adopt (Matsuoka *et al,* 2014). This Study aims to address this issue, evaluating point-counts within a South African private game reserve.

The study tested 2 hypotheses; the first assessing whether time of day significantly impacted avian species richness. The second measured (A); whether 5-minutes was sufficient to record most species detected in 10-minute point-counts, and (B); whether species detection rate differed significantly between the first and final 5-minutes of counts.

Materials and Method

Data was collected along 3 roads in Karongwe Private Game Reserve, within South Africa's Limpopo Province. Karongwe lies within Lowveld Savanna, predominantly Acacia Savanna and Broadleaf Woodland.

Transect locations were systematically chosen, based on their variable traffic disturbance and to achieve sampling coverage across the reserve (Gregory *et al,* 2004). Each was 1km with 6 point-count stations every 200m, based on travel between stations taking <15-minutes (Ralph *et al,* 1995). Mapping, measuring and recording transects utilised a laser rangefinder, Global Positioning System and white tape.

Data was collected over 3-days in July 2017, with each transect surveyed 3x throughout 1 day. Sampling initiated at 06:30am, 12:00pm and 16:30pm, lasting 10-miuntes at each station (Gregory *et al,* 2004). During each count, new bird species were recorded once, the time, station, range and whether aural or visual. Unlimited-distance sampling was adopted utilising a laser rangefinder pointed to the bird or reference point. This method is superior when surveying multiple species (Ralph *et al,* 1995).

ANOVA Type 2 with replication was used to measure whether survey time of day significantly impacted species abundance (Salkind, 2010). To assess count duration, overall detection events were categorised between whether they occurred during the first 3-minutes, following 2-minutes or final 5-minutes (Ralph *et al,* 1995). Also, mean species detection rate (per-minute) was measured, and a Type 1 T-TEST evaluated whether there was a significant difference between the first and final 5-mintes (Lynch, 1995).

Results

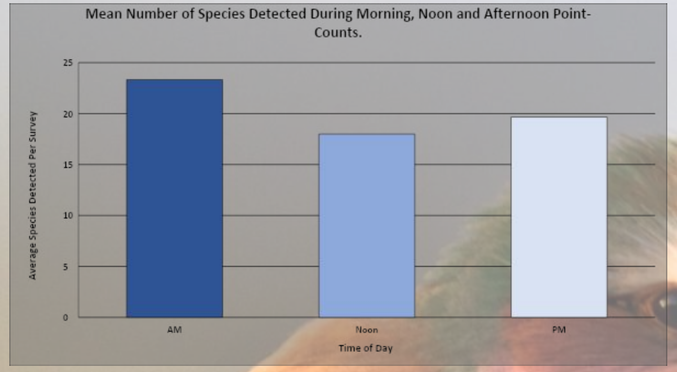

Figure 1. Illustrating survey time of day had a significant impact on bird species abundance (P = <0.05). Specifically, highest mean species abundance occurred during AM point-counts (23.3), compared to noon (18) or PM (19.6).

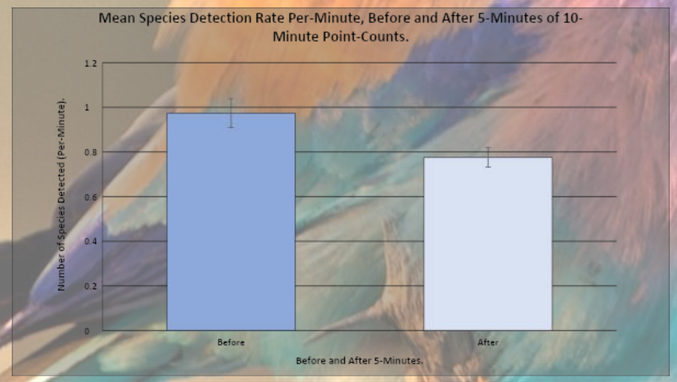

Figure 2. Shows species detection rate (per-minute) was significantly higher during the first 5-minutes of point counts (P = <0.05). Corroborating descriptive statistics which revealed 5-mintes sufficiently recorded >60% of bird species.

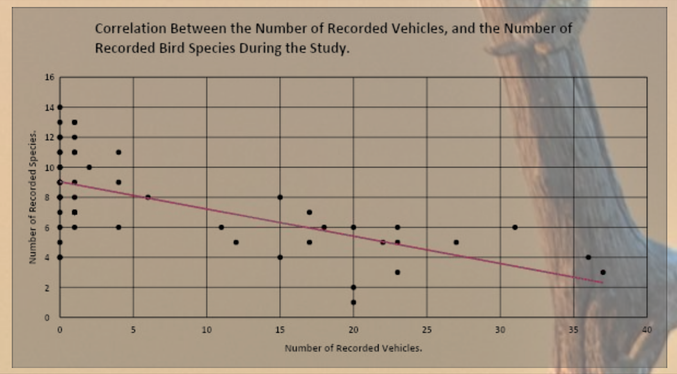

Figure 3. Highlights a significant negative correlation (-0.6), between increasing vehicle density and reduced species abundance during point-counts (P = <0.05).

Discussion

Results show species abundance was significantly higher during morning point-counts (P = <0.05) (see Figure 1). This corroborates many ornithologists, advocating morning counts when monitoring species richness to capitalise on emerging birds (Ralph *et al,* 1995; Kessler and Milne, 1982). Conversely, contrasts others documenting morning and afternoon abundance remains equivalent (O'Leske *et al,* 1997; Cavarzere *et al,* 2013). However, these investigations occurred during alternate seasons or adopted longer PM counts, modifying bird activity and prolonging data collection (Ralph *et al,* 1995). Additionally, as this study prioritised winter species richness, research factoring diversity or individual abundance during alternate seasons requires further investigation to determine whether results differ (Mallon, 2010).

Findings indicate species detection rate (per-minute) was significantly higher during the first 5-minutes of point-counts (P = <0.05), which was sufficient to record >60% of species (see Figure 2). This substantiates notable peers who state researchers quickly document most species, and 5-minute counts are superior when travel time between stations is <15-minutes (Ralph *et al,* 1995). Nevertheless, it must be reiterated that this study factored winter species abundance, and it remains unknown whether 5-minutes is optimal for research considering diversity and individual abundance during alternate seasons.

Finally, added calculations show a significantly negative correlation (-0.06) between increasing vehicle density and lower species abundance (P = <0.05) (see Figure 3). This demonstrates vehicle density detrimentally influences Karongwe avifauna or observer detection ability, reaffirming the necessity for an impact assessment to explore the contributing factors behind this discovery (Griffith *et al,* 2010).

Conclusion

Overwhelmingly, within the parameters of this study, findings show 5-minutes sampling during morning hours is optimal in Karongwe (Ralph *et al,* 1995). However, this provides a narrow framework for winter counts estimating species abundance, and further research is required during additional seasons considering diversity and individual aundance (Mallon, 2010). Nonetheless, the point-count protocol provided should be immediately utilised, to begin to evaluate the factors influencing the negative correlation between increasing vehicles and declining avian species richness in Karongwe. Thus, addressing the research gap surrounding the impacts of roads on birds in a Southern Hemisphere nation.

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