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CAN CITIZEN SCIENCE REPRESENT WILDLIFE ACTIVITY ALONG HIGHWAYS? VALIDATING A MONITORING PROGRAM

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Abstract

Using volunteers for scientific data collection is increasingly recognized as a method to gather management-relevant environmental information. Citizen scientists can provide an inexpensive and potentially large long-term labor force that can amass large datasets in a relatively short time while covering large geographical areas. Although there is a distinct need for large, long-term datasets in road ecology to address the numerous effects of roads on wildlife, few projects involving wildlife and highways have incorporated citizens in their research or conservation efforts. The spatially and temporally explicit data on wildlife movement near highways that is required to improve our understanding of wildlife movement along and across highways has the potential to be collected by highway users as citizen scientists. Yet, in order to be integrated meaningfully into decision-making processes, citizen science must be valid and reliable. It is therefore essential to examine whether these programs can provide robust, reliable data.

Study Area

In this study, we examined *Road Watch in the Pass* (RW), a citizen science monitoring program providing information on wildlife activity on Highway 3 in the Crowsnest Pass in Alberta, Canada, as a pioneering example in using citizens for wildlife crossing data collection by assessing its ability to represent unbiased visible live wildlife activity along Highway 3. As is sometimes the case with citizen science programs, this program is based on opportunistic observations rather than systematic monitoring, making it susceptible to problems related to sampling effort. We developed a rigorous driving survey sampling method for collecting data systematically. We assessed RW methodology in its capability of providing statistically robust data, and by comparing the RW dataset to the systematic dataset, we analyzed the accuracy of spatial distributions of opportunistic wildlife observations using two spatial statistic approaches. We assessed spatial agreement along 1-km segments of the highway between the citizen and researcher datasets using a permutation modeling process. We also demonstrated the use of Ripley's L and L_{12} statistics as tools to examine live wildlife spatial patterns along transportation corridors. Additionally, we assessed the threshold number of wildlife observations needed to provide representative highway wildlife data, insight potentially useful to other highway wildlife monitoring programs. To assess this numerical threshold, we undertook a simulation analysis that quantified and compared the strength of spatial similarity of the citizen and researcher data in a variety of settings, including different sample sizes for the two spatial processes.

Conclusion

Due to its unsystematic nature and lack of sampling effort documentation, this citizen science program is limited in its ability to make some statistical conclusions. Despite these problems, the spatial distribution of citizens' wildlife observations corresponded with the systematic dataset; the number of citizen-collected observations within a specified distance of a researcher-collected observation was significantly larger than would be expected if the citizens' observations were distributed independently. The wildlife observations from the two datasets also had similar spatial distributions; the differences in relative frequencies of citizen and researcher observations by kilometer were not significant. Spatial similarity of the two datasets was detected at sample sizes of a minimum of 150 observations. This minimum number of observations was needed for RW and possibly other highway wildlife monitoring programs to provide representative information of spatial highway wildlife activity.

We recommend several modifications to enhance the scientific rigor of RW and provide guidance for groups aiming to use a similar citizen science highway wildlife monitoring program. We particularly focus on the importance of including sampling effort, and discuss how the driving survey methodology may not be effective for all large wildlife species.

Biographical Sketches

Kylie Paul earned her M.S. in environmental studies in 2007 from the University of Montana. She is on the board of the Ninemile Wildlife Workgroup in Huson, MT, which focuses on wildlife connectivity conservation. She has worked with stakeholders in the Northern Rockies on issues ranging from wildlife connectivity, road ecology, citizen science, private and public land use issues, and human/wildlife conflict.

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Marcel Huijser received his M.S. in population ecology (1992) and his Ph.D. in road ecology (2000) at Wageningen University in Wageningen, The Netherlands. Currently Marcel works on wildlife-transportation issues for the Western Transportation Institute at Montana State University (2002-present). He is a member of the Transportation Research Board (TRB) Committee on Ecology and Transportation and co-chairs the TRB Subcommittee on Animal-Vehicle Collisions.