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Working

## Statistical methods to analyze the persistence of threatened birds using citizen science data: A systematic review

Version 2

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### ABSTRACT

#### Background

Due to certain risk factors such as climate change, habitat destruction, overhunting and pollution bird extinctions are now occurring at a rate that far exceeds their speciation rate. When a bird species is lost, the benefits it might have afforded are gone forever. There are no robust indicators of biodiversity conservation that can be used to complement existing national indicators of economic and social health. This study reviews the statistical methods that are used to model and evaluate the persistence or extinction risk of threatened bird species using citizen science data.

#### Methods

Adhering to PRISMA guidelines, this review systematically searched for relevant journal articles which were published between January 1900 and January 2019 in any of three databases (ProQuest Central, Scopus and Web of Science). Only the journal articles which used a statistical model, predictive model or trend analysis in analysing persistence or extinction risk (while considering risk factors) of threatened bird species developed using citizen science data were included in this study. The bird species that may be declining in population/range even in near threatened or least concern categories also included since these may be the next wave of species to be added to the endangered species lists. Citizen science data helps to increase the number of records and understanding of dynamics in declining bird species populations.

#### Results

This systematic review was able to identify 37 unique articles describing statistical models for this purpose. Generalised linear models and linear mixed/hierarchical models were the most popular methods used for analysis, followed by machine learning models. The review suggested several strategies to measure the persistence of threatened bird species, but there was no attempt to identify critical tipping points using methods such as change-point analysis.

#### Conclusion

Overall, it appears that the persistence of threatened bird species varies depending on various risk factors. Statistical models can provide a better understanding of the impact of these risk factors, which is expected to produce better immediate and long-term outcomes for the conservation of threatened birds. It is hoped that this review will identify the statistical methods which are most suitable for this purpose.



Systematic Review.pdf



Appendix 1 - Articles  
Description.pdf



Appendix 2 - Quality  
Assessment Checklist.pdf

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