A review of the survey design and analysis of waterfowl in Victoria

Reviewer: Dr Steven R. McLeod (SRS, NSW DPI)

About the reviewer: Dr Steve McLeod is a Senior Research Scientist for the NSW Department of Primary Industries. He is a qualitative ecologist with more than 30 years' experience and has worked on issues related to the sustainable harvesting of wildlife populations for 20 years. He is an expert on the design of large-scale wildlife surveys and analysis of aerial survey data. His current work involves the planning, design of the aerial surveys and analysis of the survey data for estimating kangaroo populations for the derivation of the commercial harvesting quota, in addition to the design and analysis of the waterfowl survey in NSW for derivation of the sustainable waterfowl harvest quota.

This report is a review of the 2020 waterfowl survey conducted in Victoria. The review is based on a critical appraisal of two documents that describe the design of the survey, and the analysis of the survey data, respectively. The two documents are:

1. Ramsey, D.S.L. (2020). Design of a Monitoring Program for Game Ducks in Victoria. Technical Report Series No. 314, Arthur Rylah Institute for Environmental Research, DELWP, Heidelberg, Victoria.
2. Ramsey, D.S.L. (2021). Preliminary results from the 2020 aerial survey of game ducks in Victoria. Arthur Rylah Institute, DELWP, Victoria.

Monitoring design

The monitoring design aimed to determine the optimal number of waterbodies to be surveyed using aerial survey methods to estimate the abundance of game duck species in Victoria. An addition aim was to the conduct an analysis of recreational harvest data to determine the relationship between bag limit and season length (i.e. harvest offtake).

The assessment of the optimal sampling strategy, one that balanced the trade-off between accuracy of the estimated population sizes and the cost of the survey, was done using simulation. Using spatial data, Ramsey was able to identify waterbodies that were suitable for survey and likely to be used by waterfowl. He also evaluated two scenarios that would form likely endpoints of a continuum between wet years—times of higher than average rainfall and water flow—and dry years—times of below average rainfall and low flow. He also stratified waterbody into three strata based on their size. Using historical count data, he was able to estimate the occupancy and number of ducks on each waterbody type. The analysis compared two different sampling strategies: stratified random sampling and multistage sampling.

The simulation model allowed for comparative assessment of the accuracy and cost of alternative sampling designs and effort. Uncertainty—which for most monitoring programs is discovered by trial-and-error—could be readily identified and used to distinguish superior sampling strategies. Confidence in decision making—using this type of analysis—would have been improved.

Although the author recognised the limitations of the simulation approach (simplifying assumptions are unavoidable in this type of analysis), he was also able to identify components of the models that would improve estimation of abundance, and how new data could be used to refine monitoring methods in the future.

The analysis of the relationship between waterfowl offtake and harvest regulations used a Bayesian generalised linear model approach. The analysis provided a reasonably good fit, and should provide robust predictions of changes to harvest regulations. However, the small sample size (noted by the author) hampered interpretation of the results. But this issue will be improved as more data become available (and highlights the continued need for monitoring of the consequences of harvest regulations).

The reported analysis represents a rigorous, sophisticated, and technically superior examination of alternative survey designs, and I am unaware of any superior efforts. The author should be commended on its comprehensiveness. It is a model that other surveys of wildlife populations should follow.

Data analysis

The objective of this study was to test the recommended survey methods identified by the analysis of alternative monitoring designs (presented earlier in this review), and estimate the abundance (including confidence level) of waterfowl that can be hunted in Victoria. The methods used to collect and analyse survey data are broadly similar to those used by NSW DPI to survey waterfowl in the Riverina region of NSW. While there are some minor differences between the methods collect and analyse the data, the largest difference is in the inclusion of confidence intervals around the estimates of abundance in Victoria, whereas there has been no attempt to estimate uncertainty in the estimates for NSW. Although the NSW analysis presents confidence intervals around mean group size on dams, it does not estimate confidence around the total abundance estimates for the Riverina. This is an important difference between the analyses and one which NSW should adopt.

The patterns in waterbody use are similar to the findings in NSW, with small waterbodies (< 6ha) having the majority of the population for most species. This result confirms the bias (also identified in the NSW DPI data) in the EAWS (Eastern Australian Waterbird Survey) data since it does not sample small waterbodies.

An additional analysis combines the estimate of population sizes with estimated harvest offtake, and should provide an additional level of confidence that harvest regulations do not result in over-harvesting of game waterfowl in Victoria, or at the least a more rigorous and justified basis on which management decisions are made.

Conclusions

The analysis of monitoring design is a benchmark for other wildlife monitoring studies. I have no reservation is commending the approach that Ramsey has taken, and the expertise demonstrated in the analysis and interpretation of results. The analysis of survey data adds some important improvements to the similar analysis currently used to estimate waterfowl abundance in the Riverina region of NSW.

I have no reservation in commending the design, analysis and interpretation of results presented in the reports.

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12/03/2021