



## **COLLABORATION FOR ENVIRONMENTAL EVIDENCE**

### **Is Predator Control an Effective Strategy for Enhancing Bird Populations?**

#### **REVIEW SUMMARY**

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## COVER SHEET

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## SYSTEMATIC REVIEW SUMMARY

### Background

The control of predators to protect populations of vulnerable bird species is an important nature conservation issue because in recent years predation pressure upon many populations has increased. Predator removal by culling or translocation is controversial, expensive, time-consuming and often temporary and so it is important that the effectiveness of the practice is assessed using available evidence. The aim of the current systematic review is to use explicit systematic review methodology to determine the impact of predator removal on bird breeding performance and population size. We also investigate whether nest predator exclusion using fences or nest-cages is an effective strategy for protecting bird populations, as although both exclusion techniques have been widely used, studies that have tested their effectiveness have shown mixed results.

### Objectives

- To assess whether predator control (removal or exclusion) is an effective strategy for enhancing bird populations.
- To assess whether factors relating to the prey species, predator species, location or operational level variables alter the efficacy of predator control programmes in enhancing bird populations.

### Search strategy

Multiple electronic databases and the internet were searched using a variety of keywords. Bibliographies, relevant experts and websites were also used to identify relevant studies. Foreign language searches were not carried out.

### Selection criteria

- **Subjects** - bird populations; all bird species were included.
- **Intervention** - any method of predator control including shooting, trapping, poison-baiting, exclusion fences and nest-cages.
- **Outcome** - the primary outcome was change in prey species breeding population size (density or count; counted in spring). Secondary outcomes were changes in prey species post-breeding population size (density or count; counts in autumn including the non-breeding young of the immediate past season), hatching success (%) and fledging success (number fledged/pair).
- **Types of Study** - any study providing measures before and after the control of potential predators or comparing predator-control areas to adjacent areas without predator control.

### Data collection and analysis

Data were extracted from the original studies and summarised in previously designed spreadsheets to minimise bias. We used DerSimonian and Laird random effects meta-analysis based on standardised mean difference to examine data on hatching success, fledging success, post-breeding population size and breeding population size. Sensitivity analyses were carried out to explore the impact of using two different effect size metrics, Hedges' standardised mean difference and log response ratios. Meta-regression and sub-group analyses were used to explore ecological and methodological heterogeneity between studies.

## **Main results**

Predator removal resulted in increased hatching success, fledging success and breeding populations. A significantly larger increase in breeding population was achieved by removing all predator species rather than just a subset. Overall, predator removal was not found to enhance post-breeding populations, but evidence indicated that although post-breeding population size was not improved on islands, it did increase on mainlands. Heterogeneity in effect sizes for each of the four population parameters was not explained by whether predators were native or introduced, the prey population was declining, the prey was migratory or a game species, or by study methodology. Effect sizes for fledging success were smaller for ground-nesting birds than those that nest elsewhere, but the difference was not significant.

Nest predator exclusion using either exclusion fences or nest-cages resulted in a significant increase in hatching success. Nest-cages had a larger effect on hatching success than exclusion fences, although this difference was not significant and the sample size for nest-cage studies was small. Heterogeneity in effect sizes was not explained by any of the covariates investigated. There was little evidence to determine whether increased hatching success following nest predator exclusion resulted in increased breeding populations.

## **Conclusions**

### ***Implications for management / policy / conservation***

The available evidence suggested that predator control is an effective strategy for the conservation of vulnerable bird populations. Predator removal tended to result in increased breeding populations, which is the main aim of conservation managers. Larger increases were achieved when all predators rather than just a subset were removed. Evidence also suggested that predator removal resulted in increased post-breeding populations on mainlands, but not on islands. Nest predator exclusion using either exclusion fences or nest-cages was found to be an effective conservation strategy for increasing the hatching success of bird populations, but little evidence was available to determine whether this resulted in increased breeding populations. Studies have shown that nest-cages can lead to increased levels of predation on incubating adults and so should be used with caution especially within small populations.

### ***Implications for research***

Additional studies are required investigating the effect of predator removal on post-breeding populations, particularly on islands. More evidence is also required on the effectiveness of nest predator exclusion methods, particularly using nest-cages as sample sizes are currently small. Future studies should include the use of independent treatment and controls, replication and ensure effective reporting of data. They should also be undertaken on a wider variety of bird groups in different regions of the world.

It is vital that further studies are carried out to determine whether nest-cages lead to increased mortality of incubating adults and whether the improved hatching success resulting from predator exclusion leads to increased breeding population size.