

ISSUES - DATA SET

Impact of Cowbird Brood Parasitism on an Avian Community

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Brown-headed Cowbird,
© Colorado Division of Wildlife
{[wildlife.state.co.us/
species_profiles/cowbird.asp](http://wildlife.state.co.us/species_profiles/cowbird.asp)}

THE ECOLOGICAL QUESTION:

Does cowbird brood parasitism reduce songbird numbers?

ECOLOGICAL CONTENT:

brood parasitism, bird community structure, species diversity, endangered species management.

WHAT STUDENTS DO:

Students use a spreadsheet to compare numbers of individuals of up to 40 bird species in sites with and without cowbirds.

SKILLS:

Using a spreadsheet to make figures.

ASSESSABLE OUTCOMES:

Figure from spreadsheet data, written interpretation of data, written analysis of the published paper.

SOURCE:

K. L. De Groot and J. N. M. Smith. 2001. Community-wide impacts of a generalist brood parasite: the brown-headed cowbird (*Molothrus ater*). *Ecology* 82: 868-881. Ecological Archives E082-010-A1 (www.esapubs.org/archive/ecol/E082/010/default.htm)

OVERVIEW OF THE ECOLOGICAL BACKGROUND

The brown-headed cowbird (*Molothrus ater*) in North America is an obligate or generalist brood parasite of over 200 songbirds. Numerous studies show reproductive losses for individual host species (e.g. Strausberger and Ashley 1997). It has long been assumed that cowbird parasitism can result in changes in songbird communities, but surprisingly the De Groot and Smith (2001) study is the first to assess whether this brood parasite can change overall bird community composition. They state their hypothesis as: brown-headed cowbirds change the composition of songbird communities by depressing the number of suitable host individuals.

This work has management implications in regard to cowbird removal programs designed to protect endangered birds. De Groot and Smith worked in northern Michigan where there is an extensive cowbird removal program to protect the Kirtland's Warbler (*Dendroica kirtlandii*). This bird only nests in young jack pine forests in northern Michigan. In 1971, a census recorded only 201 singing males, and both limited/poor quality of habitat and cowbird parasitism were proposed as responsible for their decline. A cowbird removal program began in 1972. In this study, De Groot and Smith compare songbird communities in cowbird removal sites and control areas.

The researchers divided the songbird communities into Suitable Hosts (birds that accept cowbird eggs and feed their young) and Unsuitable hosts (birds that reject cowbird eggs). They selected 10 Removal sites adjacent to active cowbird traps in operation for 5-11 yrs. Control sites were > 5 km from cowbird traps or any area that had not experienced cowbird removal within the last 5 yr. They matched general habitat characteristics for Removal and Control sites. In 1997 they added Control sites < 10 km from cowbird traps. Site areas were a half circle radius of 1 km.

Birds were identified by sight or sound on transect lines (four 1 km lines each 60 degree apart). Between dawn and 1000 on all sites birds were counted twice during summer in 1996 and three times in 1997. Cowbirds were assessed with additional playback of female chatters to improve likelihood of cowbird detection rates. In addition, nests were sampled (33 in 1996 and 98 in 1997) by visual checks every 3-4 d in 1996 and 3-7 d in 1997. Researchers made sure that nest were checked just prior and after chicks had fledged. Nests that had >1 chick until 1-2 d before fledging were scored as successful.

De Groot and Smith did not find significant differences in bird community composition in controls and areas where cowbirds have been removed for 5-11 yrs. They propose that cowbirds affect bird communities in more isolated places with limited immigration. They conclude that: "If brown-headed cowbirds influence songbird community composition only to a moderate degree when they are dominant members of the songbird community, they are not remarkable in their ability to influence community composition. Our results provide little support for adding cowbirds to the short list of species (Hurlburt 1997) that regulate community structure disproportionately in relation to their abundance. Thus, while cowbird removal has benefited some endangered species (Griffiths and Griffiths 2000) there is little reason to believe that it will improve the general health of songbirds". (see article for references)

References:

- De Groot, K. L., and J. N. M. Smith. 2001. Community-wide impacts of a generalist brood parasite: the brown-headed cowbird (*Molothrus ater*). *Ecology* 82: 868-881.
- Strausberger, B. M. and M. V. Ashley. 1997. Community-wide patterns of parasitism of a host "generalist" brood-parasitic cowbird. *Oecologia* 112: 254-262.

STUDENT INSTRUCTIONS

This data set concerns the possible effects of brood parasitism on the species composition of a songbird community. Your instructor will give you directions about using this file to make figures (graphs) to address this issue.

Background information

Some species of cowbirds don't appear to be the best parents. For example, *Molothrus badius* doesn't make nests and *M. ater* - the brown-headed cowbird studied here - does not even pair up, defend territory, and take care of its young.

The brown-headed cowbird is one of two cowbird species in North America. Both species are brood parasites - they lay their eggs in the nests of other birds. Brown-headed cowbirds are native to grasslands of the Midwest, but clearing of forests has resulted in their expansion across the U.S. The extent of parasitism varies with habitat and with the abundance, breeding behavior, and conservation status of different host species. The negative impact of brown-headed cowbirds on their hosts is very controversial, and there are many conservationists believe that cowbird parasitism is not a major factor in the decline of songbirds in the U.S. (see websites).

The brown-headed cowbird (*Molothrus ater*) in North America is a brood parasite with over 200 songbirds. Numerous studies show reproductive losses for individual host species, and therefore it has long been assumed that cowbird parasitism can result in changes in songbird communities. Surprisingly the De Groot and Smith (2001) study is the first to assess whether this brood parasite can change bird community composition. They state their hypothesis as: brown-headed cowbirds change the composition of songbird communities by depressing the number of suitable host individuals.

This work has management implications in regard to cowbird removal programs designed to protect endangered birds. De Groot and Smith worked in northern Michigan where there is an extensive cowbird removal program to protect the Kirtland's Warbler (*Dendroica kirtlandii*). This bird only nests in young jack pine forests in northern Michigan. A 1971 census recorded only 201 singing males, and both limited/poor quality of habitat and cowbird parasitism were proposed as responsible for their decline. A cowbird removal program began in 1972. De Groot and Smith compare songbird communities in cowbird removal sites and control areas that are at least 5 km from the removal sites.

The researchers divided the songbird communities into Suitable Hosts (birds that accept cowbird eggs and feed their young) and Unsuitable hosts (birds that reject cowbird eggs - includes cavity nesters which eat seeds and fruits). They selected 10 Removal sites adjacent to active cowbird traps in operation for 5-11 yrs. Control sites were > 5 km from cowbird traps or any area that had not experienced cowbird removal

within the last 5 yr. They matched general habitat characteristics for Removal and Control sites. In 1997 they added Control sites < 10 km from cowbird traps. Site areas were a half circle radius of 1 km.

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References

- De Groot, K. L., and J. N. M. Smith. 2001. Community-wide impacts of a generalist brood parasite: the brown-headed cowbird (*Molothrus ater*). *Ecology* 82: 868-881.

NOTES TO FACULTY

There are three Excel files:

- Student file - contains unsorted list plus additional control data
- Unformatted file from ESA archives
- Faculty file - includes removal and control data sorted by year and a scatter plot figure for each year

How to use this data set in a class:

This data set could be used in discussions of community ecology (species diversity), species interactions (brood parasitism), and management of an endangered bird species (the Kirtland's Warbler). It would also be a nice comparison with other removal studies showing great effects on community composition - e.g. Paine's starfish removals.

This is a fairly straightforward data set concerning possible effects of brown-headed cowbirds on songbird species diversity. Brood parasitism is a captivating phenomenon, and the idea that cowbirds negatively impact their hosts is a "truth" for most students who are familiar with cowbirds. Another attractive aspect of the study is that De Groot and Smith test this idea in two ways - 1) by comparing songbird composition for birds that accept cowbirds with community composition of birds that do not accept the parasites and 2) by comparing bird composition in sites with and without cowbirds.

Their hypothesis that songbird richness and evenness would be higher in cowbird removal sites was not supported. In addition, the proportion of suitable cowbird hosts did not decrease much in the cowbird removal locations. This is a good opportunity for students to see that even hypotheses that seem so likely must sometimes be rejected. In addition, this recent paper (2001) is the first on effects of a brood parasite on community composition, which will also surprise students.

Making and Using the Figures

I have reformatted the original Excel files so that columns could be manipulated; both original and reformatted files are here. There are two data sets in two separate files - comparisons of birds in removal and control sites in 1996 and 1997 and for birds that are suitable hosts for cowbirds and those that are not.

De Groot and Smith use histograms in Fig. 4 (below) to compare effects numbers of individual birds in cowbird removal sites and controls for suitable and unsuitable hosts. The archive data are tables showing the "number and species of passerine individuals detected per site at cowbird (*Molothrus ater*) Removal and Control sites near

habitat of the Kirtland's Warbler in northeastern Lower Michigan". In Data Files #2 and 3, I use a scatter plot to compare numbers of individuals for 39 species (suitable hosts) and x species (unsuitable hosts).

How your students work with these data depends on their experience with data in spreadsheets, your goals for the exercise, and the time available. You will need to prepare a handout or other form of instruction describing the data files and what you want the students to do with them.

Questions for discussion

1. As a result of cowbird control and habitat restoration Kirtland's Warbler populations in Michigan increased from 200 breeding pairs in 1972 to about 400 breeding pairs in 1998. However, cowbird control has not helped restore the endangered Willow Flycatcher in California. What are likely reasons for this difference?
2. Some ecologists believe that cowbird control is a short-term solution that ignores the real problem of habitat degradation from agriculture, grazing and development. Discuss.
3. In other studies researchers have found that cowbird predation did reduce numbers of songbirds living in forest fragments. Why might their findings be different from those of De Groot and Smith?
4. Compare the possible effects of obligate vs. generalist nest parasitism on bird community composition.
5. In the introduction to their paper, De Groot and Smith refer to several studies showing regulation of community structure by predators. Can you describe such studies? How is this research relevant to De Groot and Smith's?
6. The Kirtland's Warbler has very specific habitat requirements and a limited breeding range. Why do these characteristics make Kirtland's Warblers especially vulnerable to nest predation by cowbirds? How could you test your idea(s) using data from this study?

Assessment

Possible assessments include accuracy and clarity of figures students make using the Excel spreadsheet, written description and analysis of these figures, discussion or analysis of the DeGroot and Smith study, and a short essay about one of the Discussion questions above. A rich discussion on assessment and evaluation appears elsewhere in TIEE in an essay on Assessment and Evaluation.

Resources to Help Students Analyze these Data Sets

Ecological Archives:

- www.esapubs.org/archive/

Cowbird Websites:

- Audubon Society (www.audubon.org/bird/research)
- Cornell University (birds.cornell.edu/BOW/BNHCOW/)
- Cowbird Advisory Council (cowbird.lscf.ucsb.edu)
- USGS (www.mbr-pwrc.usgs.gov/id/framlst/i4950id.html)

Sites with Excel tutorials:

- www.usd.edu/trio/tut/excel/ - basic information - how to use functions, filling down, formatting, inserting, graphs and graphing
- homepage.cs.uri.edu/tutorials/csc101/pc/excel97/excel.html - basic - from "what is excel?" to "creating charts"; copyright of University of RI Computer Science Dept.
- www.fgcu.edu/support/office2000/excel/ - Florida Gulf Coast University; basic - includes visuals.
- www.baycongroup.com/el0.htm - a lot of introductory information; BayCon Group - commercial site.