

ISSUES : FIGURE SET

Do Antbirds Help or Hinder Army Ants?

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THE ISSUE:

The effects of species interactions are not always obvious. This issue examines the nature of the relationship between army ants and ant-following birds. Students will design a hypothetical experiment to measure the effect of birds on army ant foraging success, interpret the results of a real experiment, and consider the consequences of the interaction on the ant colony and the forest community.



Army ant workers (*Eciton burchellii*) clustered around a captured insect.

Photo by Alex Wild, used with permission.

SECTION 3:

How significant is this relationship to army ant colonies?

PURPOSE:

To practice interpreting graphical presentation of experimental results; to estimate the ecological significance of antbird parasitism on an army ant colony.

TEACHING APPROACH:

"informal group work"

COGNITIVE SKILLS:

knowledge, comprehension, application

STUDENT ASSESSMENT:

essay

CITATION:

Kuhlmann, Mark. April 2006, posting date. Do Antbirds Help or Hinder Army Ants? – Section 3. Teaching Issues and Experiments in Ecology, Vol. 4: Issues Figure Set #1 [online].
http://tiee.ecoed.net/vol/v4/issues/figure_sets/army_ants/background3.html

BACKGROUND

In this section, students interpret graphical data and make some calculations to figure out how significant "theft" of food by birds is to an army ant colony.

FIGURE SET

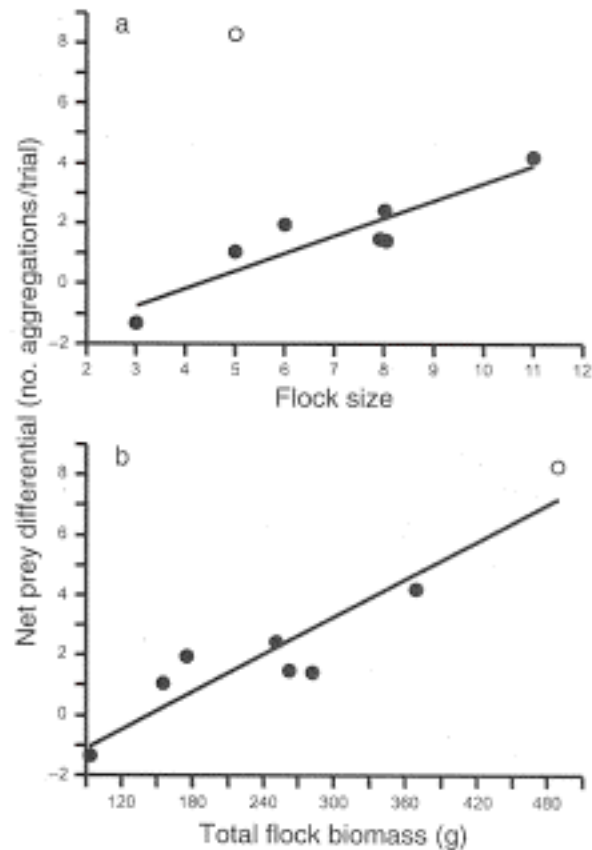


Figure 2. Cost of antbirds on foraging success of ants. Relationship between attending bird flock size (a) and flock biomass - combined mass of all birds following a swarm (b). Net prey differential is the difference in the number of prey aggregations between the control and exclusion treatment. *E. burchelli* aggregate on prey items when prey are too large to be handled by a single ant worker. In this study researchers measured "aggregations" larger than about 0.8 cm as an indication of ant foraging success because these aggregations persisted long enough for accurate measurements. Aggregations were measured in 20 min. trials in which antbirds were scared off by researchers (exclusion) and in controls (no exclusion). Area studied was about 10 m². The open symbol is a trial where one very large bird, a Rufous-vented Ground-Cuckoo (350 g, vs. 20-40 g/bird for other species), was present. From Wrege et al. (2005).

STUDENT INSTRUCTIONS

In the previous section, you figured out the nature of the relationship between army ants and ant-following birds. But how important is this interaction to the army ants? To figure this out, work with a partner or in a small group to answer the following questions.

- Describe the graphs in Figure 2 and what they show.
- Why is the trial with the large Rufous-vented Ground Cuckoo present shown with a special symbol? How did this trial influence how the researchers analyzed and presented their data?
- Interpret the data. Given your previous analysis of Figure 1, what new information does Figure 2 provide to increase your understanding of the interaction between ants and birds?
- Do ant-following birds represent a significant energy cost to army ant colonies? To figure this out, recall that army ants forage through daylight hours (always about 12 hours in the tropics), and the experimental trials lasted only 10 minutes. On average, an army ant colony consumes about 46 g (dry mass) of arthropods per day. The arthropods that ant-following birds remove are on average 1-1.5 cm long and have a dry mass of about 0.035 g. How significant is the removal of prey by birds to the energy intake of an army ant colony? That is, what proportion of a colony's normal daily food intake do birds remove?

NOTES TO FACULTY

The figures show that the effect of birds is proportional to the flock size. Note that the trial with the large cuckoo appears as an outlier in the top figure because a large bird has a larger effect (eats more) than a small bird. When flock size is measured as biomass (lower graph), this trial fits nicely in the overall trend.

Some students may have difficulty in understanding the relationship between the data in the two parts of Figure 2. The instructor may need to assist some groups by clarifying the concept of biomass and helping them understand why one large bird (that apparently eats a lot) would appear as an outlier when the number of birds is used as the independent variable and how using flock biomass corrects this.

According to Figure 2, birds often reduce army ant foraging success by about 1-3 insects/10 minutes, or about 75-200 insects in a 12-hour day. Using the average mass of 0.035 g/insect, this constitutes a loss of 2.6-7 g of food, or a 5.6-15% reduction in food intake.

The estimates of the significance of antbird parasitism on the army ant colony will likely vary from group to group. Students may come up with a variety of ways to do the calculation. For example, some may convert the daily intake by the ants into the number of large insects and compare that to what birds take. Answers will also vary depending on how "typical" flock size is estimated.

Army ant colonies are probably energy limited and live close to the break-even point. Ant-following birds can decrease daily foraging success by up to 15%, which is probably ecologically significant. This loss may slow colony growth rate, increasing the time required to reach the minimum size for fission (colony reproduction). This in turn means that the queen would have a greater chance of dying, increasing the probability of colony extinction. In addition, the loss of primarily litter arthropods to birds could shift army ant foraging more towards hymenopteran brood, causing changes in the forest community composition (Wrege et al. 2005).

A possible essay question for assessment:

Consider the broader implications of this experiment. What consequences might the bird-ant interaction have for an army ant colony and the forest community in which it lives?

Upper-level students should be able to come up with some ideas to answer this question. For less experienced students, this question could instead form the basis for a class discussion, guided by the instructor.