

## **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 2:**

What is the relationship between ant-following birds and army ants?

#### **PURPOSE:**

To practice interpreting graphical presentation of experimental results; to determine the type of ecological relationship between army ants and ant-following birds.

#### **TEACHING APPROACH:**

"turn-to-your-neighbor"

#### **COGNITIVE SKILLS:**

knowledge, comprehension, interpretation

#### **STUDENT ASSESSMENT:**

essay quiz

#### **CITATION:**

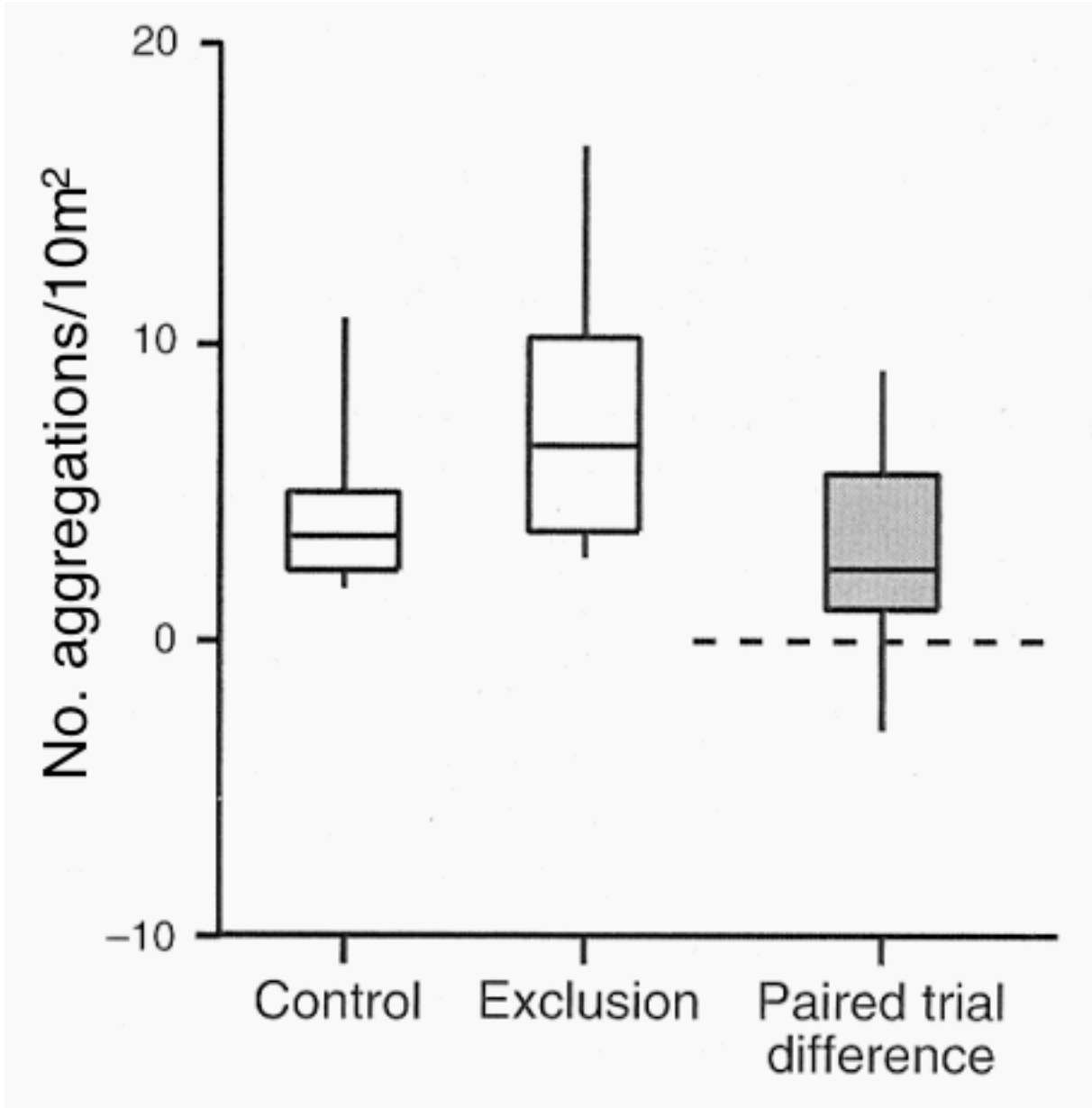
Kuhlmann, Mark. April 2006, posting date. Do Antbirds Help or Hinder Army Ants? – Section 2. Teaching Issues and Experiments in Ecology, Vol. 4: Issues Figure Set #1 [online]. [http://tiee.ecoed.net/vol/v4/issues/figure\\_sets/army\\_ants/background2.html](http://tiee.ecoed.net/vol/v4/issues/figure_sets/army_ants/background2.html)

## BACKGROUND

Ant-following birds clearly benefit from army ants by capturing prey they otherwise would not. The effect of the birds on the army ants is less obvious. Wrege et al. (2005) conducted an experiment designed to quantify the effect of ant-following birds on the army ant *Eciton burchellii* in Panama. Their experiment consisted of paired 10-minute trials replicated on 18 army ant swarms (see Section 1 for more details). For each swarm, observers first counted the number of ant aggregations (indications of the capture of large prey, see photo) during 10 minutes when ant-following birds ( $6.1 \pm 2.2$  birds per swarm, mean  $\pm$  1 SD) were present.

They then chased away the birds by waving their arms or, if a bird was extremely persistent, by squirting it with a water gun. They then again counted the number of aggregations during the next 10 minutes. Thus, their experiment had a control treatment (birds present) and exclusion treatment (birds absent). Unfortunately, they could not randomize the order of these treatments (that is, they always did the control treatment first) because some birds would not return quickly after being chased away.

## FIGURE SET



**Figure 1.** The effect of ant-following birds on the foraging success of the army ant *Eciton burchellii* in Panama. Shown are the standardized number of ant aggregations observed in each area of 18 paired trials (open boxes) and the difference between paired exclusion and control areas (shaded box). In the box plots, the horizontal line is the median (middle observation), the boxes show the interquartile range (25% of data points above and below the median), and the vertical bars show the range. The differences (shaded box) were significantly greater than zero (dashed horizontal line). From Wrege et al. (2005)

## STUDENT INSTRUCTIONS

Do ant-following birds have a positive (mutualism), neutral (commensalisms) or negative (parasitism) effect on army ant foraging success? With a partner or with a small group, use the Step One-Step Two approach, described below, to interpret the results of Wrege et al.'s (2005) experiment.

- Step One: Describe the graph and what it shows. Make sure you understand how the figure is set up, what the axes show, and what information is depicted. Carefully describe the overall patterns in the data.
- Step Two: Try to interpret the data. What do they tell you about the type of relationship between birds and army ants?

Be prepared to explain the graph and your conclusions from it to the class.

## NOTES TO FACULTY

The "step one-step two" approach is explained in more details in the "Interpreting Figures and Tables" essay. As the essay explains, students often have difficulty interpreting figures because they do not realize that understanding figures takes time. This approach slows them down and requires them to pay attention to axes and other aspects of a figure.

Students should read the background material and then work in pairs or small groups to interpret the figure. They should be able to figure out that the graph shows that the number of aggregations (feeding rate on large prey) was (significantly) higher where birds were excluded than where they were present. Thus, the birds steal food the ants would otherwise get, making the relationship parasitic.

The "paired difference" in the figure shows essentially the same thing as comparing the means from the control and exclusion treatments, but is more representative of what the statistical analysis (a paired t-test) was testing. The researchers also found that the cost of the birds to *E. burchellii* increased proportionally to the number of birds in a flock (see Fig. 2 in the third section of the main Figure Set table). An alternate conclusion from this figure is that ant-following birds are eating the ants themselves, reducing the number of aggregations. According to Willis and Oniki (1978), ant-following birds do not deliberately eat army ant workers, although they may occasionally incidentally consume a few that are attached to something else they are eating.

Students who have been taught that parasites, such as tape worms, are invasive organisms may not recognize resource competition as a type of parasitism. Definitions of parasites differ; for example, in his ecology text Molles (*Ecology: Concepts and Applications*, 3<sup>rd</sup> edition, 2005. McGraw Hill Higher Education, New York, NY) defines parasites as organisms that live on the tissues of their host, reducing fitness. A discussion about resource competition and parasitism as defined by Molles will help students work through their confusion.

Students may not be familiar with box and whisker plots. If they are not, explain that box plots are designed to visually represent the dispersion of data and is therefore a graphical summary of the data. Quartiles are used to divide the data into four groups, each containing 25% of the values. The box contains the "middle" 50% of the data, and the vertical line within the box indicates the median point. Each "whisker" shows 25% of the data and therefore the extremities of the whiskers are the minimum and maximum values.

For assessment, you can have students turn in a written explanation of the figure or have them (individually) answer a short essay question, such as:

*In this experiment the researchers always ran the control first, followed by the exclusion. What is the significance of the control treatment always being first in their paired trials? Is this the best design of an experiment? How does it affect your interpretation of their results?*

In my experience, students generally have no difficulty determining the nature of the relationship from the figure. Questions about the experimental design, such as the one suggested for assessment, pose more difficulty. Some students may frame their answers in terms of "realism" of the experiment, rather than the statistical or logical appropriateness of the design. For example, in nature, "birds don't suddenly depart from an ant swarm," or, "birds aren't always present first, then absent." Class responses to this question can be used as an opportunity to discuss the significance of randomization and independence in experimental design.