Bio 45 -- Discussion #3 - Evolution and Behavior – 24-26 Sept. 2002

I. GOALS:

You need to be comfortable with some basic evolutionary principles and definitions in order to make use of the behavioral ecology way of thinking about behavior. The goal of this discussion is to get us to a common starting point. You should work together to reach an understanding of the evolutionary terminology used in this course. When you answer a question in section try to do it in a way that helps others see your perspective rather than merely demonstrating that you know the (an) answer. The basics of adaptationist thinking must be clear to you for the rest of the course!

Our second goal is to get familiar with reading and interpreting the original literature in behavior. We will do this while we examine the testing of adaptation hypotheses. We will start with a paper on fiddler crab claw waving by Pope. We will concentrate on the messages of the paper **and** on the structure of the paper. There is a guide to reading the paper on the reverse of this handout.

II. READINGS:

1) Review: Alcock Chs. 1, 3 & 7 + Lecture notes and handouts for the first 9 lectures

2) Review: 3) Pope, D.S. 2000. Testing function of fiddler crab claw waving by manipulating social context. Behav. Ecol. Sociobiol. 47:432-437. [e-library see reading list] Read carefully!

III. ASSIGNMENT:

A. **Pick one question from group 1 and one from group 2 below and write short (100-200 words) answers to them. Make two copies of the answers. Paste one in your journal and hand in the other in section.** These questions will be the primary focus of the first part of the discussion. Everyone should have something to say about them! Help each other reach an understanding. Make sure everyone gets a chance to talk!

B. **Read and study the Pope (2000) paper. Make sure you can re-construct the logic behind her question, her hypotheses, and the design of her experiment.** Use the guide on the reverse to help you examine the structure of the paper and interpret the graphs. Come to class prepared to briefly describe what her central question was, what her hypotheses were and how she tested among them. Here is a web site (**http://www.public.asu.edu/~mrosenb/Uca**) you can visit to get a look at these crabs.

IV. QUESTIONS (for part A):

1. These questions have straight forward answers. You must be able to answer them. Make sure you leave section with an understanding of the answers. There are more than semantic issues here -- dig for the underlying evolutionary ones.

   a) Define and distinguish between: an adaptation and an adaptive trait.

   b) "Natural selection acts on individuals, but individuals do not evolve." Explain.

   c) Does selection always result in adaptation? Why?

2. The following questions are more open-ended. Think about different ways to answer them.

   a) What is a good (the best?) definition of fitness? How and when do you measure the fitness of an animal? How would you predict an animal's fitness? Is fitness relative (x is fitter than y) or absolute (x is fit y is not)?

   b) Help this person understand: "Why Is it important to distinguish between selection at the individual level and selection at the group or species level? Isn't saying "x evolved for the good of the species" really the same as saying "x evolved because it benefited individuals that possess the trait"? After all, if x is good for individuals isn't it good for the species too? Also, aren't things that are good for the species always good for individuals too?"

guide to Pope's paper ➔

V. GUIDE TO READING Pope (2000):

Notice the structure of the paper. The title gives you basic information about the paper and where the author was when she did the research (helpful when thinking about possible graduate schools). The abstract should clearly say what was done and found out. However, do not rely on the abstract to tell you all you need to know to evaluate the paper. Authors do not lie, but their conclusion may not be the only one you can reach from their data. Pope's abstract is a masterful one! The introduction puts the present study in a larger context, sets it up or states its importance. Pope relates her work to previous work and brings us up to the starting point of the work she will describe. Methods are just that, and a key part of any paper. Here you get to check for bias, poor design, missing controls and so on. Results are a quantitative presentation of what she found out with a minimum of interpretation. Don't worry about the statistics - just look hard at the graphs. I'll provide some explanations below for Figures 1 and 2.

The discussion interprets the results. Here you can judge how confident you feel with the conclusions. Does the discussion relate the introduction and results to general theory or just to fiddler crabs? Even the acknowledgments can be revealing. They tell you where research support comes from, and who else read the paper before it was submitted for publication. After submission, two or more anonymous reviewers read it and told the editor if they thought it should be published, revised or rejected. The bibliography is also important. It is a doorway to any further exploration of this paper or the topic in general. The completeness of the references allow an expert to judge whether their work overlooked other important studies.

Thinking about the experimental design

Let's reconstruct how Pope did the hypothesis testing. The following is a good exercise to do with questions and hypotheses you come up with. The question was: What is the function of the claw waving display? The three hypotheses are: 1) signal to males, 2) signal to females, and 3) signal to both. There is a "hidden" fourth hypothesis too – 4) it is not a signal to either sex.

Let's build a table without hypotheses and see how they might make different predictions about the claw waving frequency of male crabs. If we can separate the three hypotheses by these predictions, all we need to do is collect data on waving frequency.

Function ➔ Social Context	Signal to males	Signal to females	Signals to both
Alone	Low or intermediate?		
With males	Highest		
With females	Lowest		
With both sexes	Intermediate?		

Fill in the rest of the table. In each column rank the contexts based on expected waving frequency (I did the first column). Compare your predictions with figure 1. Do you agree with Pope?

What are the lines and arrows in Figure 1? Each black column has a line sticking out of it – an error bar. The top of the column is the mean # of waves per minute. There was variation in that number from crab to crab and across the study. The error bar (standard error, S.E.) is a measure of how much variation there was around the mean. A shorter error bar means less variation. Two horizontal lines group means that do not differ statistically (e.g., male alone and all male do not differ). Note that the error bars are actually on both sides of the mean (you just can't see the one inside the column). If you could see the line below the mean for "all female" it would overlap with the line above the mean for "male & female". That says that the two means are not statistically distinct the mean value for each is within the error bar of the other. The 3rd horizontal line with two ** above it says that the pair of columns on the right are statistically different from the two on the left.

Figure 2. Although the bars look different (higher mean for male & female) they are not. See how the error bars overlap. That means, given the variation found among males, the actual means are not totally trustworthy. The "real" mean most likely lies within the bound of the error bar but we can't say precisely where. That is why we can see in Figure 1 that the "male alone" and "all female" means probably do differ – the male alone mean (within its error bar) is quite distinct from where ever the all female mean is (within its error bar).