EXAM NO._____

BIO 45 -- Exam 2 – Optimization, Communication and Sexual selection
8 November 2000

NAME _____Answer Key_____

INSTRUCTIONS:

1. Put your name on this page only - **Transfer the exam number to each page** of the exam.
2. **Read each question very carefully.** Give us **concise, short answers**. **Do not write on the back of the page** unless you have had to change your answer. We will take off points for errors even if the correct answer is given.
3. When **examples** are asked for, **use well documented ones**. Do not use hypothetical or anecdotal information (unless it is asked for). Citing species names and names of those who did the experiments will reduce ambiguity in your answers.
4. Do not use the same example more than once on the exam.
5. **If you feel a question is ambiguous - ask for clarification!** Do not hesitate to ask - some ambiguities are not intended and will be corrected during the exam.
6. Terms:

   Explain = Show that you **understand** what is going on - don't just list facts.

   Cite or Identify = Who did the work, on what species and some details relevant to the question. If you can't remember names, give enough detail for us to identify the study you mean.

   Briefly = a few well-chosen words or phrases will suffice.

1. The grade distribution is posted on the web site. The mean was 35 out of 50 pts.
2. Many points were lost due to your not being able to use the vocabulary and concepts correctly in reading and answering questions. Note the words emphasized with bold and underlined text on the exam and in the answer key below.
3. I will be happy to talk about your exam and to go over it in detail. I ask that you first study the answer key and your exam to see if you can spot some of the reasons you lost points in general as well as in specific cases. If you felt you really understood the material going into the exam (it made sense to you) and did poorly, chances are that you haven't fully come to grips with the difference between something making sense to you and your being able to use it in general and specific ways. We can work on that.
4. If you did poorly on the exam -- especially less than 25 points you need to figure out what went. I would like to talk with you about it -- often an adjustment can be made in studying or thinking that will clear up the problem. You haven't ruined your grade yet, but you do need to have a solid grasp of the concepts and terminology since they will be on the next exam as well. Do this before the last exam!!!

5. RE-GRADE REQUESTS:

A. Carefully go through the answer key with your exam.

B. B. Write me a short note about the problem and leave it and the exam in my mailbox in Walter Hall.

C. Do that before 3 PM Tuesday 21 November

D. I will go over the entire exam to see if points can be added or taken off.

1. (12 pts) Let's explore your understanding of some basic concepts:

   A. Hawks always beat doves in individual contests. However, when C > V, **Doves can invade but not replace a population of Hawks**. No pay-off matrix or numbers are needed. Just explain in words that **show you understand the dynamics involved** that allow invasion but not replacement.

   Doves **can invade** because

The payoff for D vs H is greater than the payoff for H vs H when the population of hawks is first invaded by a dove. Dove can increase

   Doves **cannot replace** a population of hawks because

As dove increases, hawk encounters shift from all H vs H to more and more H vs D. The hawks begin to gain. The more doves the better hawks do on average. Eventually the average payoff for hawks will equal that for doves and the dove stop increasing.

Two other answers were accepted:

1. D can invade pure hawk population and H can invade a pure dove population. Thus there has to be an equilibrium of hawk and dove.
2. Hawks always beat doves so the last hawk cannot be removed from the population and dove cannot take over.

   B. Nuptial gifts of male hangflies (or the spermatophores of male katydids) could be mating effort or parental investment. **What has to be true if these nuptial gifts are:**

   Mating Effort: from the male's perspective

Gift has to increase the **fertilization success** of the male. Not the ability to attract a mate but the fertilization success – bigger gifts mean more fertilizations = M.E.

Partial credit (2 pts) for mating success, 1 pt for saying it attracts mate

   Parental Investment:

Nutrients in gift must go to eggs **AND** male must fertilize those eggs (you can't make a parental investment without being the parent).

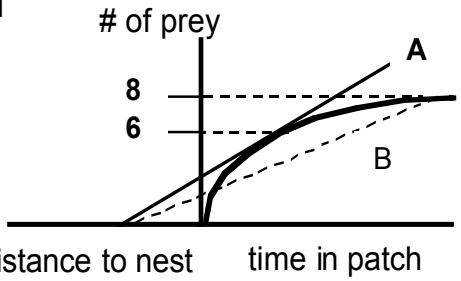
Note: The question was not about the definition of M.E. and P.I. You had to use the example (nuptial gifts) to show you understood the terms. Some of you lost points by doing the former and not the latter. You also lost points if you included role reversal – this is not a question about role reversal!

Writing below this line is NOT optimal:

2. (8 pts) Interpreting Graphs:

A. Starlings can easily carry 8 prey items to the nest. **Explain why**, given Graph #1, it is optimal for them to take 6 and not 8 on each trip. Make sure your explanation reflects your understanding of the model underlying the graph.

1

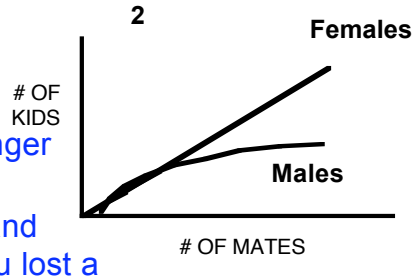


Your answer should have been about rates (prey delivered per time.) The slope of the line defines the rate so, collecting 8 will have a lower slope (line B) than collecting 8 (line A)

Partial credit for making an argument about longer foraging time (due to diminishing returns curve) for only a little additional gain in prey.

C. Someone shows you graph #2 and asks, "Is this possible?" You say, "Not just possible, it <u>really happens.</u>" **<u>Explain – an example will help.</u>**

2



Examples explain it best. The male has a lower rate of reproduction – e.g. pipefish or seahorses where males take longer to incubate eggs than females do to produce a new clutch.

Other examples: Mormon crickets and katydids. Preying mantids and red backed spiders do not work. They only have one mating. You lost a point if you talked about role reversal – not involved!

3. (8 pts) What is **the take-home message** (main point) **<u>of two</u>** of the following papers?

A. Amundsen's paper on ornamentation in females.

B. Olson & Owens' paper on carotenoids

C. Lima & Bednekoff's study of anti-predatory vigilance

The take-home message of paper ___ was:

The object is to make it clear you read and got the central message of the paper. Many answers were ambiguous in that regard and received no credit – i.e., you could write something basically correct by looking at what the paper was about in the list above.

The take-home message of paper ___was:

A. female ornamentation is probably more than correlated characters showing up in females. There is good evidence for it being do to male choice an female-female competition.

B. Carotenoids are likely to be honest signals not just because they are rare but also because they are risky (have detrimental eff3ects) and required (beneficial for health and growth). There are other costs you could specify but those were the main points.

C. The authors show that a general assumption of some optimality models (can't do two things at the same time) is not completely valid**. <u>Juncos can be vigilant (but not completely) when eating.</u>** You had to include the "not completely" to get full credit.

4. (10 pts)) **Models** of female choice that involve **indirect** benefits to females have some problems that those involving direct benefits to females do not always have.

A. (6 pts) Identify **two** of the **problems** that **indirect benefits models** have:

When we make or use these models we run into some problems with them or that they produce as results – what those problems are is what the question is about.

Runaway: 1) cost of female choice can "break" the model and 2) the C allele must get to a high enough frequency to start the runaway process.

G. Genes: 1) Lek paradox – selection quickly removes genetic variation among males and 2. Reliability (honesty) of signal – does it really indicate good genes.

The question is not about what has to be done to demonstrate female choice – a number of you took that to be the question and got no credit.

Natural selection is not a problem with runaway models, it is an essential part of the model.

B.(4 pts) Briefly describe a solution for one of these problems. Which problem _____.

Runaway 1 – revise the models to take cost of choice into account.

Runaway 2 – various solutions for getting C allele common - see handout

Good Genes 1 – multigenic viability, host parasite cycles, conditional expression

Good Genes 2 – reliable signals that females could use – handicaps, indicators of disease resistance, trait symmetry and so on.

5. (8 pts) Identify two different ways that **a** prey animal, **once detected**, can make capture by a predator more difficult. **Give an example of each anti-capture adaptation**.

The predator has seen and is after the prey. What can the prey do to make it harder for the predator to catch it? You lost points for examples that were not about this (mobbing, alarm calls, vigilance, selfish herds) and for not identifying a verified example.

1. Stotting display of strength
2. Out maneuver – diving moth when bat chases
3. Startle – owl eye spots on moth wings, caterpillar that looks like snake, tect
4. misdirection – false head on butterfly
5. part autonomy – lizard that drops tail
6. release toxin – spiders, octopus, darkling beetle…
7. attract other predators – rabbit scream, pike and minnow
8. other: rapid flighty of cryptic butterflies, porcupine quills…

We gave credit for Belding ground squirrel alarm calls (but not for other alarm call examples) because Alcock implies that they are done by an individual the predator has detected in order to get others moving and distract predator. In general alarm calls are not made by individuals under attack.

6. (4 pts) A matter of sex:

A. What is **THE** difference between males and females?

The gametes they produce –Males produce sperm, females produce eggs

B. What is wrong with this statement? "Sperm are cheap, relative to eggs, so the males in any species will always out reproduce the females. "

Every zygote results from one sperm and one egg. Thus, at the population level, males cannot out reproduce females

If you filled all this space, your answer is probably wrong!