WFSC 525 - Conceptual Foundations in Wildlife Ecology

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Schedule: 3:30-4:45pm, Tues and Thurs; Bio Sci East room 314

Readings: selected readings from the primary literature

Objectives:

1. To understand concepts and processes in ecology.
2. To understand how to effectively determine proximate and ultimate causation.
3. To provide students with the conceptual tools needed to critically evaluate scientific studies.
4. To provide students with the conceptual tools needed to develop an ecological question, identify all possible alternative hypotheses that address ultimate causation, design predictions that elucidate underlying ecological processes and mechanisms, and construct an appropriate experimental design to test competing hypotheses.

Prerequisites:

Graduate standing or permission from the instructor.

Grading Criteria:

Written critiques of the papers we read	50 pts
Written critiques of student presentations	50 pts
Class participation	50 pts
Oral Presentation	100 pts
Mid-term Exam	100 pts
Final Exam	100 pts
Total Points Possible =	450 pts

Grading Scale:

A = 90-100% B = 80-89% C = 70-79% D = 60-69% F = < 60%

Course Description: This graduate-level course is intended to give students the tools needed to develop and test original research hypotheses. Students will be trained to think critically and to understand the ecological processes underlying commonly-observed patterns in the natural environment. The first third of the course is lecture and class discussion. We will begin with a review of the scientific method and discuss how past and current research in ecology has used (and mis-used) the scientific method. We will review induction, retroduction, and deduction and discuss why studies in ecology have been criticized for failure to follow this recipe for gaining reliable knowledge. We then review and contrast common but often mis-used and misunderstood terms and concepts in ecology: proximate causation, ultimate causation, pattern,

process, mechanism, research vs statistical hypotheses, theory, strong vs weak predictions, multiple working hypotheses, and strong inference. As a class, we will work through a series of case studies to provide examples of the issues and concepts listed above. In each case, we will design a conceptual approach that will allow us to address the question of interest by employing the hypothetico-deductive method. We will discuss the advantages and disadvantages associated with the three most common approaches to gaining knowledge in ecology: correlational analyses, experimental manipulations, and comparative analyses.

The second part of the course involves reading papers from the primary ecological literature than help illustrate proper use (and mis-use) of the terms and approaches discussed in the course. Examples may include:

Caro, T. M. 1986. The functions of stotting: a review of the hypotheses. *Animal Behaviour* 34: 649–662.

Connell, J. H. 1961. The influence of interspecific competition and other factors on the distribution of the barnacle *Chthamalus stellatus*. *Ecology* 42:710-723.

Dobson, F. S. 1979. An experimental study of dispersal in the California ground squirrel. *Ecology* 60:1103-1109.

Dobson, F. S., and W. T. Jones. 1985. Multiple causes of dispersal. American Naturalist 126:855-858.

Gould, S. J., & R. C. Lewontin. 1979. The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. *Proceedings of the Royal Society of London* (Series B) 205:581-598.

Holekamp, K. E. 1986. Proximal causes of natal dispersal in Belding's ground squirrels. *Ecological Monographs* 56:365-391.

Janzen, D. H. 1967. Why mountain passes are higher in the tropics. *American Naturalist* 101:233-249.

Lewin, R. 1989. Biologists disagree over bold signature of nature. *Science* 244:527-528.

Mayr, E. 1983. How to carry out the adaptationist program? *American Naturalist* 121:324-334.

MacArthur, R. H. 1958. Population ecology of some warblers of northeastern coniferous forests. *Ecology* 39:599-619.

Schoener, T. W. 1982. The controversy over interspecific competition. *American Scientist* 70:586-595.

Sinclair, A. R. E. 1985. Does interspecific competition or predation shape the African ungulate community? *Journal of Animal Ecology* 54:899-918.

Stevens, G. C. 1989. The latitudinal gradient in geographic range: How so many species coexist in the tropics. *American Naturalist* 133:240-256.

Waser, P. M. 1985. Does competition drive dispersal? *Ecology* 66:1170-1175.

The goal in this portion of the class is to help students to critically evaluate published papers in the primary literature. We read 2-4 papers per week and a student will be called on to lead the discussion and critique of each paper. Our discussion will focus on identifying the explicit and implicit questions addressed by the paper, how well each paper used the scientific method, and how the questions proposed could have been answered more rigorously. Each student is required to hand in a one-page critique of each paper discussed.

The third part of the course involves a presentation by each student in the class. The presenter is expected to introduce a conceptual research question, justify why the question is of interest from both an applied and basic science perspective, present the suite of alternative hypotheses, explain the processes/mechanisms underlying each hypothesis, and provide a series of predictions that would allow one to prove/disprove each hypothesis. The students are expected to critically challenge the presenter throughout the presentation and to submit a one-page critique of each presentation.

WFSC525 - Topic Outline and Schedule - Fall 2005

30 Aug	The Scientific Method
1 Sep	Pattern vs Process, Proximate vs. Ultimate Causation
6 Sep	Case Study #1
8 Sep	Induction, Retroduction, and Deduction
13 Sep	Research Hypothesis vs. Statistical Hypothesis
15 Sep	Case Study #2
20 Sep	Mechanisms, Predictions, and Strong Inference
22 Sep	Case Study #3
27 Sep	**Exam**
29 Sep	Correlational Analyses, Experimental Manipulations, and Comparative Analyses
4 Oct	Class Discussion of Gould and Lewontin 1979 and Mayr 1983
6 Oct	Class Discussion of MacArthur 1958
11 Oct	Class Discussion of Connell 1967
13 Oct	Class Discussion of Caro 1986
18 Oct	Class Discussion of Dobson 1979
20 Oct	Class Discussion of Dobson and Jones 1985
25 Oct	Class Discussion of Waser 1985
27 Oct	Class Discussion of Holekamp 1986
1 Nov	Class Discussion of Sinclair 1985
3 Nov	Class Discussion of Janzen 1967
8 Nov	Class Discussion of Stevens 1989 and Lewin 1989
10 Nov	Class Discussion of some other paper
15 Nov	Student Presentations - 2 @ 30min each
17 Nov	Student Presentations - 2 @ 30min each
22 Nov	Student Presentations - 2 @ 30min each
24 Nov	Thanksgiving – no classes
29 Nov	Student Presentations - 2 @ 30min each
1 Dec	Student Presentations - 2 @ 30min each
6 Dec	Student Presentations (1) and Teaching Evaluations
13 Dec	**Final Exam**; 2-5 pm