



ELME - MTH 490 Section 432, June 19-23, 2006 (M-F 9 am-5 pm)

**Theory and Modeling in Behavioral Ecology** ([class picture](#))

Instructor: [Tom Getty](#), Michigan State University

The goals in this unit are to understand how models serve as tools in behavioral ecology, how we create put these tools to use, and how we assess whether the model-tool has done a good job for us. We will approach behavior (very broadly defined) as a set of phenotypes with ecological and

evolutionary causes and consequences. We will analyze (dismantle) and synthesize (build) models and in the process, try to get comfortable with the process of making analogies between the real world and simplified formal representations. Algebra, calculus and basic probability theory are sufficient background.

This syllabus is posted at <http://www.msu.edu/course/mth/490/Getty/elme06syllabus.pdf>

Below are links to course materials in pdf & xls formats (links will be activated asap).

Links to journals require that you use an MSU microlab computer or MSU's library Proxy server.

You need to enable macros when you open up xls files.

I have added little pdf-notes to some of the pdf handouts that open up when you click on them. If you want to be able to read these notes on paper printouts, instead of selecting <File Print>, you'll need to select <File Print with Comments Summary>.

We will do computations in Excel. If you know Mathematica and want to also work in that platform, notebooks corresponding to Bulmer's chapters are available at

<http://library.wolfram.com/infocenter/MathSource/769/>

## Schedule

### Monday 6/19

Introductions to each other & the course.

PPT disc: [Science and modeling](#).

Disc: [Introduction: mathematical models, ch 1, Bulmer 1994](#).

[Foraging economics: the logic of formal modeling, ch 1, Stephens & Krebs 1986](#).

Exercises: [Spreadsheet hints and tips, ch 1-3, Donovan & Weldon 2002](#)

[Donovan&Weldon\\_ch1\\_exercises.xls](#)

[Donovan&Weldon\\_ch2\\_exercises.xls](#)

[Donovan&Weldon\\_ch3\\_exercises.xls](#)

[SOLVER\\_regression.xls](#)

PPT disc: [An introduction to foraging theory in behavioral ecology](#).

Supplemental refs:

[The Evolution of Behavioural Ecology, ch 1, Krebs & Davies 1997](#)

[The prey and patch models, ch 2, Stephens & Krebs 1986](#)

[Mathematical notions and techniques, ch 20, Doucet & Sloop](#)

Excel Review Materials: <http://faculty.fuqua.duke.edu/%7Epecklund/ExcelReview/ExcelReview.htm>

We'll spend most of Monday afternoon playing with foraging models in Excel. Students with more experience can speed through this and take up one of the journal articles from the following list:

Getty T Discriminability and the sigmoid functional-response - how optimal foragers could stabilize model-mimic complexes. *American Naturalist* 125 (2): 239-256 1985

[VIEW FULL TEXT](#)

+ TBA

### Tuesday 6/20

Disc: [Foraging theory and resource management, ch 6, Bulmer 1994](#).

Exercises: [Bulmer\\_ch6\\_exercises.xls](#)

PPT disc: [Some modeling I have done on foraging, discrimination & phenotypic plasticity.](#)

Finish up foraging exercises.

Exercises: [Natural Selection and Fitness, ch 32, Donovan & Weldon 2002.](#)  
[Life History Trade-offs, ch 35, Donovan & Weldon 2002.](#)

Disc: [Life history evolution, ch 5, Bulmer 1994.](#)

Exercises: [Bulmer ch 5 exercises.](#)

Disc: Read and analyze one or two of the following papers. Reconstruct them in Excel; replicate the original results; examine the sensitivity to simplifying assumptions; extend to more general or different scenarios.

Getty T Search, discrimination, and selection - mate choice by pied flycatchers. American Naturalist 145 (1): 146-154 Jan 1995 [VIEW FULL TEXT](#)

Getty T. The discriminating babbler meets the optimal diet hawk. Animal Behaviour 63: 397-402 Part 2 FEB 2002 [VIEW FULL TEXT](#)

+ TBA

If time allows: Intro/review of how to find source papers via the Web of Science. Form teams and begin searching for candidate papers to build your independent project on (see Friday, below).

### Wednesday 6/21

PPT disc: [Games, conflict and cooperation.](#)

Disc: [Frequency-dependent selection, ch 7, Bulmer 1994](#)

Exercises: [Bulmer ch7 exercises.](#)

Disc: [Evolutionary game theory, ch 8, Bulmer 1994](#)

Exercises: [Evolutionarily Stable Strategies, ch 39, Donovan & Weldon 2002.](#)  
[Bulmer ch8 exercises.](#)

Disc: Read and analyze one or two of the following papers. Reconstruct them in Excel; replicate the original results; examine the sensitivity to simplifying assumptions; extend to more general or different scenarios.

Getty T The discriminating babbler meets the optimal diet hawk Animal Behaviour 63: 397-402 Part 2 FEB 2002 [VIEW FULL TEXT](#)

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### Thursday 6/22

PPT disc: [Signaling and sexual selection.](#)

Disc: [Sexual selection, ch 11, Bulmer 1994.](#)

Exercises: [Sexual Selection, ch 38, Donovan & Weldon 2002.](#)  
[Bulmer ch11 exercises.](#)

Disc: Read and analyze one or two of the following papers. Reconstruct them in Excel; replicate the original results; examine the sensitivity to simplifying assumptions; extend to more general or different scenarios.

Getty T  
Sexually selected signals are not similar to sports handicaps Trends In Ecology & Evolution 21 (2): 83-88 FEB 2006 [VIEW FULL TEXT](#)

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Work on independent group projects relevant to student interests. Find, read and analyze a relevant “model model.” Attempt to build a model that better serves your needs or interests.

### Friday 6/23

Finish up team projects and prepare presentations.

Class projects symposium at 1pm. Each team presents an analysis of their target article (“model model”) and their own elaboration of something new and useful.