

Syllabus
FiW 4614 – Fish Ecology
Spring Semester 2007
1860 Litton-Reeves Hall, 12:30-1:45 TR

Instructors: Paul Angermeier, Office 342 Latham Hall, 1-4501, biota@vt.edu, office hours: mornings 9:30-11:30. I strongly encourage appointments. There may be times when unexpected commitments may force cancellation of office hours.

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1. Course Objectives

Upon successful completion of this course, a student will be able to:

- A. Express a sound understanding of ecological concepts as they apply to fish in wild populations and communities,
- B. Explain the roles of individual response to environmental variation, adaptation by natural selection, and subsequent ecological diversification in generating fish species diversity and allowing population and community persistence,
- C. Show knowledge of basic principles of fish population dynamics, and influences of biotic and abiotic interactions and life-history strategies on population dynamics,
- D. Explain similarities and differences in the ways that fish maintain fitness and interact with other biota in various types of aquatic ecosystems,
- E. Demonstrate understanding of the ecological implications for fish of human activities that affect aquatic ecosystems, and
- F. Explain the limits of ecological resiliency and adaptation, as well as management options to maintain or improve ecosystem function for the future.

2. Texts

Although there are several texts in fish ecology, none adequately covers the breadth of material in this course. Instead, the knowledge you will need will come primarily from lectures, handouts, and supplementary readings. Lecture outlines and handouts, as well as supplementary readings will be available as downloadable pdf files at the course website: <http://www.fishwild.vt.edu/fiw4614/>. Please note that supplementary readings are optional, in the sense that you are not required to know their content for tests or quizzes. However, we feel strongly that reading them will enhance your learning by giving you time to explore fish ecology topics in greater detail than is possible during lectures. Therefore, as extra incentive, each quiz will contain an extra credit section that will evaluate your understanding of the supplementary readings.

Fish Facts, on the other hand, is a required supplementary reading assignment prepared specifically for this course, designed to ensure that all students are at least somewhat acquainted with major groups of North American freshwater fishes,

as well as basic terminology we will be using to describe fish. Therefore, you can expect to be tested on your knowledge of *Fish Facts*.

Students will be most successful if they: 1) take good class notes, 2) review their notes in conjunction with other handouts, 3) read supplementary readings, and 4) ask for clarification from the instructor and/or other students when something is confusing.

3. Research paper

This semester, you will complete an ecological research paper on an instructor-approved species of your choice. This assignment is designed to help you: 1) become an expert on a fish with which you are unfamiliar, 2) hone your research and writing skills, and 3) apply concepts and frameworks developed in the class to real-world situations. The paper counts for one-fifth of your final grade (see below). More details are contained on the following page.

4. Grading

Testing will seek to evaluate how well you are learning ecological concepts and processes, adding these to your intellectual toolbox, and applying them to fish and aquatic ecosystems. As such, expect mostly short-answer and essay questions. Quizzes will serve the additional purposes of: 1) helping you to keep up with studying during the doldrums between exams, and 2) giving us feedback on how well you are understanding individual topics so that we can design tests accordingly.

Grades will be determined by cumulative performance on five announced quizzes (5 points each), two in-term exams (20 points each), a research paper (20 points), and the final exam (20 points). The lowest quiz score of the semester will be discarded, giving a possible cumulative total of 100 points (plus extra credit). Quizzes will be given at the beginning of a class period, will be short (\approx 15 minutes), and will focus on lecture material (and supplementary material, see above) presented since the prior quiz. Exams will be more cumulative in nature, but will emphasize topics covered since the prior exam. Participation in class will not be quantified but will be considered in instances where the final course grade may be in question. Although we reserve the right to curve final grades to obtain a satisfactory grade distribution, we expect to assign final grades on a standard thirteen-step scale (i.e., A+, A, A-, ...D+, D, D-, F).

5. Other Items

The Virginia Tech Honor Code will be strictly enforced in this course. Any suspected violations of the Honor Code will be promptly reported to the Honor System. The faculty and students of Virginia Tech will not tolerate any form of academic dishonesty. Honesty in your academic work will develop into professional integrity. See <http://www.honorsystem.vt.edu/> for more details.

If you need adaptations or accommodations because of a disability (learning disability, attention deficit disorder, psychological, physical, etc.), if you have emergency medical information to share with us, or if you need special

arrangements in case the building must be evacuated, please make an appointment with us as soon as possible. See <http://www.ssd.vt.edu/> for more details.

Species Research Paper

Introduction

Your task is to develop a research paper that thoroughly describes the ecology of one fish species. Along the way, you will synthesize the findings of diverse studies from the primary literature into a comprehensive yet succinct document that describes the: 1) basic taxonomy, zoogeography, and biology, 2) ecology at individual, population, and community levels, 3) interactions with humans, and 4) conservation status and outlook of the species selected. By the time you are done, you will be an expert on the species you select.

Deadlines

The species you choose can be marine or freshwater, common or rare, game or non-game - we only require that the species not occur in the waters of Virginia. We will examine your choice to make sure that enough literature is available for the species. **Your selection is due to us by February 6th**, and we will let you know by February 8th whether your choice is acceptable. **A final draft of the paper is due by 12:30 PM on April 19th**. The paper counts for 20 points (i.e., 20%) of your final grade. Two points will be deducted from the maximum attainable score for each day the paper is late. You may submit to us an early working draft of your paper, from which we will offer suggestions for improvement for the final draft; these early drafts must be submitted by March 29th to receive review.

Structure of the paper

The paper should focus on one, instructor-approved fish species. At least 10 primary, scientific-journal articles must be cited and their findings used in a meaningful way to illustrate a point. Beyond these 10 scientific articles, certain types of "grey" literature (e.g., magazine articles, technical reports) can be used to complement your analysis, as can personal communication with authorities on the species (which we highly recommend). Except in rare, instructor-approved instances, internet sources cannot be used. Always ask if you're uncertain. The paper should be between five and eight pages long (12-point, Times New Roman font, 1" margins), excluding references, tables and figures. How you lay out the paper is up to you, but below we outline some questions that you should address with your analysis:

Introducing the species

- What is the name of the species, when and where was it discovered?
- What is the phylogeny of the species?
- What does the species look like?
- In what sorts of ecosystems does the species occur, and what is the extent of its range?

Autecology of the species

- What habitats does it use? What does it eat? How fecund is it?

- What sorts of adaptations does the species possess that help it to succeed in living in its environment? In feeding successfully? In escaping predation? In reproducing successfully?
- What movements does the species exhibit? Why?
- Does the biology and ecology of the species change over its lifetime? How?

Population ecology

- How much is known about the vital rates (e.g., survival, reproduction, dispersal) of the species?
- How would you characterize the life-history strategy employed by the species? How stable and productive is its environment? Is population regulation density-dependent or density-independent? What are the primary limiting agents on population size and growth?
- How are populations distributed in space and time? Any evidence for metapopulation-type dynamics?

Community ecology

- What roles does the species have within the communities (= fish and non-fish) it occupies? What trophic level does it occupy? What does it compete with for resources?
- Why does the species occur in some places but others? Is it strongly tied to a particular community?
- What is life like in these communities? What other species are there?

Influences of humans

- Have humans modified the environments or communities occupied by the species? How?
- Is the species or its habitat exploited directly by humans? How?
- What new human influences are on the horizon for the species? How will climate change affect the species?
- What are the biggest threats to the species? (informally rank them)

Conservation

- Are there any protective measures afforded the species? If so, are these appropriate? If not, should there be, and what kind?
- What is the evolutionary trajectory of the species? Will it adapt to human-influenced environments?
- In your opinion, will the species persist for the next 100 years? 50? 10?

Grading

Adherence to requirements of the assignment	_____	out of 5
Thoroughness of research	_____	out of 5
Accuracy and synthesis of findings	_____	out of 5
Soundness of conclusions	_____	out of 5
Total	_____	out of 20

Pick a species that you can get excited about, ask us when something doesn't seem to add up, and have fun with it!

Current events in fish ecology

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Objectives

1. To stay current in issues of fish ecology.
2. To become familiar with news-alert systems and free online news sources.
3. To critically evaluate news stories related to issues of fish ecology.

Instructions

1. Chose a current news story related to fish ecology.
2. Read the story and answer the questions below.
3. Briefly introduce this story at the beginning of a class. Describe (a) the main issue and (b) what a fish ecologist might do about it (e.g., Future studies? Other actions?). These introductions should be very brief (<1 minute).
4. Turn in a print-out of the news story and your responses to the following questions.

Questions

1. What is the focus of this news story?
2. How is this story related to fish ecology?
3. Who are the main human and nonhuman "players" in this story?
4. What socioeconomic issues are embedded in this story?
5. Does the reporting of this story appear to be accurate and unbiased?
6. What kind of fish-ecology knowledge would help in this situation?
7. What could/should a fish ecologist do to help resolve this issue?

Due date

Each student will provide 1 current event report sometime over the course of the semester. The timing of these reports will be randomly assigned.

Potential sources

Google News Alerts: <http://news.google.com>

Click "news alerts" to request news summaries by email. Consider using search keywords such as "fish AND ecology", "fish AND environment", "science AND fish", etc. Tailor these keywords to your own interests.

CNN: <http://www.cnn.com/>

National Public Radio: <http://www.npr.org/>

New York Times: <http://www.nytimes.com/>

Washington Post: <http://www.washingtonpost.com/>

The Associated Press: <http://www.ap.org/>

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Spring 2007 Course Timeline

Unit	Topic	Date	Readings
<i>Introductory topics</i>	01 Course intro / Ecology and fish fundamentals	16-Jan	Odum pp. 3-7; Fish facts
	02 The nature of adaptation	18-Jan	Gross 1991
	03 Water as an environment	23-Jan	Warren pp. 43-56
<i>Individual Ecology</i>	04 Adaptations for particular ways of life	25-Jan	Helfman pp. 295-317
	05 Eating, and avoiding being eaten (Quiz 1)	30-Jan	Helfman pp. 321-347
	06 Reproduction	1-Feb	Johnston & Page 1992
	07 Migration (research paper topic due)	6-Feb	Lucas & Baras pp. 66-92
<i>Population Ecology</i>	08 Population dynamics / Stock-recruitment	8-Feb	Odum pp. 162-199
	09 Life-history strategies / Stochasticity	13-Feb	Winemiller & Rose 1992
	10 Metapopulation dynamics (Quiz 2)	15-Feb	Schlosser & Angermeier 1995
	11 Speciation	20-Feb	Smith et al. 1995
	First Exam	22-Feb	
<i>Community Ecology</i>	12 Predation	27-Feb	Power et al. 1985
	13 Competition	1-Mar	
	Spring Break		
	14 Determinants of community structure	13-Mar	
	15 Stream and river communities (Quiz 3)	15-Mar	Schlosser 1991
	16 Lake and reservoir communities	20-Mar	Carpenter et al. 1985
	17 Marine communities I	22-Mar	Moyle & Cech pp. 412-475
	18 Marine communities II	27-Mar	
	Second Exam	29-Mar	
<i>Human Influences</i>	19 Chemical inputs	3-Apr	Warren pp. 57-63
	Chemical inputs, part 2 (Quiz 4)	5-Apr	
	20 Nutrient and sediment inputs	10-Apr	Allan 2004
	21 Habitat and hydrologic changes	12-Apr	Poff et al. 1997
	22 Fisheries	17-Apr	Pauly et al. 1998
	23 Climate change	19-Apr	Poff et al. 2001
	(research paper due)		
	24 Responses of fish communities to landscape transformation	24-Apr	
	(Quiz 5)		
	25 Introduction of non-native biota	26-Apr	Christie 1974
26 Class summary, class evaluation	1-May		
Final Exam (7:45-9:45 AM, L-R 1860)	5-May		

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Background Questionnaire – Spring 2007

1. My name is...
My major...
My year...
My email address...
2. My academic level is...
3. My major is...
4. My career goals are...
5. My favorite fish is...
6. Define "fish":