

Yellow shading reflects changes to enhance the topic of sustainability.

BSCI 467: FRESHWATER BIOLOGY Fall, 2013

"To a person uninstructed in natural history, his country or seaside stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall." - Thomas Henry Huxley

"One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise." – Aldo Leopold, Sand County Almanac

Overview

"Freshwater Biology" is designed for upper undergraduates with interests in aquatic ecology and the biology of organisms inhabiting lentic (e.g., lakes, ponds, wetlands) and lotic (e.g., rivers, streams, creeks) habitats. One feature of the course is the extensive hands-on experience through field trips during the first third of the course. This experience will provide background and reinforcement of principles and facts from lectures and discussions on the ecology of freshwater organisms, population and community ecology, and the ecosystem structure and function of freshwaters. The identification portion of the laboratory during the last two-thirds of the course will emphasize aquatic insects, which are often the most diverse and abundant group of organisms associated with freshwater habitats. Other components of freshwater ecosystems, e.g. plankton and periphyton as primary producers, and fish as higher level consumers, will be included in discussions. A second feature of the course is the use of primary research articles to introduce key ecological concepts and to generate discussion on the process and growth of knowledge within freshwater ecology.

The biology of freshwaters is set in the context of the human landscape: our freshwater needs, our use for disposing wastes, and our transformation of our environment, especially as it disrupts the hydrologic cycle. All of these activities impact the quantity and quality of water resources for humans as well as the organisms that live in the water. The theme of sustainability of water resources for future generations underlies many of the topics of freshwater biology.

Instructor (Office hours by appointment)

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Educational Objectives

Freshwater Biology is designed for students to:

1. Develop an understanding of freshwater ecosystems, as well as the biology and ecology of organisms found in freshwater,
2. Develop skills and knowledge required to collect and identify common macroinvertebrate freshwater taxa,
3. Become familiar with the diversity, function, and adaptation of macroinvertebrates in freshwater habitats,
4. **Consider the sustainability of freshwater for human use**, and examine monitoring techniques and ecological responses of freshwater organisms in association with water quality deterioration,
5. Learn to critically read, with an understanding of salient points, original research articles relating to freshwater ecology, and
6. Become exposed to communication of science using examples from freshwater biology.

Credit and Location

Four credits: lectures at 1:00-1:50 on Monday, Wednesday, and Friday in Room 0283, Biology/Psychology Bldg., and laboratories at 2:00-5:00 on Wednesday or Thursday in Room 1161, Plant Sciences Bldg.

Frequency of Offering

Each fall.

Prerequisite

BSCI 106.

Course Description for Schedule of Classes

BSCI 467 Freshwater Biology (4) Formerly ENTM 482. Three hours of lectures and three hours of laboratory per week. Biology and ecology of freshwater invertebrates in lotic and lentic habitats, their adaptation to aquatic life, their function in aquatic ecosystems, and their relationship to environmental deterioration. Laboratory will include field trips, demonstrations, and identifications.

The Course's Targeted Audience

The course is being offered as an upper level lab course for undergraduate students in biology and environmental science majors. The maximum enrollment is 48.

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Website

The course website is accessed through <https://elms.umd.edu>
The site includes the syllabus, course schedule, handouts, lecture materials, pictures from field trips, handouts, old exams, glossary, and other information.

Texts

REQUIRED: Freshwater Biology Lab Manual (to be provided). For lab practicals, you may use this, and only this, manual.

OPTIONAL: Voshell, J. Reese, Jr. 2002. A Guide to Common Freshwater Invertebrates of North America. McDonald & Woodward Publishing, Blacksburg, Virginia. 442 p. ISBN 0-939923-87-4 (This is a “field guide” to help you with identifications and learning about the morphology, biology, and ecology of macroinvertebrates.)

Grading

Source	Points	Percentage
Exams		
Midterm	100	14.29
Final	100	14.29
<i>Subtotal</i>	200	28.58
Lecture		
Assignments, Part I (5@10 pts)	50	7.14
Assignments, Part II (5@10 pts)	50	7.14
Sustainability exercise	25	3.57
Project	25	3.57
Participation (given at end)	50	7.14
<i>Subtotal</i>	200	28.56
Lab		
Order practical (in field)	50	7.14
Midterm practical	50	7.14
Final practical	50	7.14
Exercises (2@10 pts)	20	2.86
Collection	80	11.43
Participation (given at end)	50	7.14
<i>Subtotal</i>	300	42.86
TOTAL	700	100.00

The grading scale is:

97-100%, A+	87-89.9%, B+	77-79.9%, C+	67-69.9% D+
92-96.9%, A	82-86.9%, B	72-76.9%, C	62-66.9% D
90-91.9%, A-	80-81.9%, B-	70-71.9%, C-	60-61.9%, D-
<60%, F			

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Attendance in Lecture and Lab

Attendance for all lectures and laboratories is required. Each unexcused absence will result in an automatic 5% reduction in your total score. It is your responsibility to provide written excuses for absences.

- If you expect to miss class because of a religious holiday, a special travel event, or some otherwise reason that you know you will miss class, send Dr. Lamp an email (lamp@umd.edu) beforehand providing the reason, the dates you will be absent, and include the statement, “I acknowledge that the information in this note is accurate.” You are required to make up any information that you miss. Every effort should be made to turn in due assignments before you miss class, or to make up the lab by attending the other section.
- If you missed class because of a medical issue or some unforeseen event, send Dr. Lamp an email (lamp@umd.edu) as soon as possible providing the reason, the dates you were absent, and include the statement, “I acknowledge that the information in this note is accurate.” You are required to make up any information that you miss. You should turn in due assignments at the next class period.

I reserve the right to verify any absence through the contact of your family, medical provider, etc.

Additional information on the University of Maryland policy on medically-necessitated absence from class can be found at:

<http://president.umd.edu/policies/docs/V-100G.pdf>

Code of Academic Integrity

The University of Maryland, College Park has a nationally Recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity, please visit:

<http://www.president.umd.edu/policies/iii100a.html>

Honors Option

Freshwater Biology can serve the fulfillment of the Honors course requirement of departmental and college Honors programs. To participate, an Honors student must submit a completed Honors Option Contract form provided by the University Honors Program. The requirements for completion of Freshwater Biology for the Honors Option should be discussed with Dr. Lamp. These requirements, to be written in a contract, are qualitatively beyond the

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normal requirements of the course. The contract must be submitted for approval to the University Honors Program by the 10th day of class.

Overview of Laboratory

The laboratory period will be divided into two general parts: field trips during the first third of the semester, and labs for identification of macroinvertebrates during the last two-thirds of the semester. The skills and knowledge gained during the identification labs will be applied to the organisms observed and collected during the field trips. Students are paired to help each other with both field collection and lab identification.

The first lab is designed to help you learn the higher taxonomy of macroinvertebrates. You are expected to learn the orders of macroinvertebrates by sight by the first field trip. During the field trips, you will make a collection from several sites. You will collect macroinvertebrates from the field sites, and separate specimens by order into separate vials. Each vial should be labeled clearly with location (state, county, specific site), date, and collector. These specimens will help you to learn the family level taxonomy in subsequent weeks. The collection will be graded. Details will be provided by the TA.

For the identification lab sessions, an overview of the biology and classification of the taxa will be provided by the TA. You will use your own and reference specimens to learn identification using the Lab Manual and noting primary characteristics. We encourage you to use your Lab Manual during practicals for identification. We also encourage you to take notes in the Manual during the “Taxon” lectures that may also be useful in identifications. More information will be provided by the TA.

Boots for Field Trips

IF YOU HAVE BARE FEET, OR ONLY WEAR FLIP-FLOPS, YOU WILL NOT BE ALLOWED TO ENTER THE WATER. Some students desire to wear hip boots or waders when collecting specimens in streams and ponds during field trips. Hip boots may be purchased on line or locally at Walmart, Dick’s, Bass Pro Shop, and other sporting goods stores. On the first day, we will discuss the need for boots and options for purchase.

Lab Practical

The lab practicals will test your knowledge of the habits and ecology of collected organisms as well as their identification. You will be expected to know all aquatic subclasses/orders of macroinvertebrates by sight, and selected families by using the key (Lab Manual). Questions on the practicals will also cover key morphological features used in identification and major biological characteristics of the taxa. The first practical (covering orders) may occur at any time during the last 2 field trips. A second and a final lab practical will be held for the whole class as noted on the schedule.

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General Reference Books

Allan, J.D., and M.M. Castillo. 2009. *Stream Ecology*, 2nd ed.. Springer, Netherlands.

Brönmark, C. and L. Hansson. 1998. *The Biology of Lakes and Ponds*. Oxford University Press, New York.

Closs, G., B. Downes, and A. Boulton. 2004. *Freshwater Ecology*. Blackwell Publishing, UK. *** used as the text in BSCI 467 for years, this book guides the reader through research on fundamental ecological questions impacting freshwater ecology, like dispersal, disturbance, and predation.

Cole, G.A. 1994. *Textbook of Limnology*, 4th ed. Waveland Press, Prospect Heights, Illinois.

Dodds, W.K., and M.R. Whiles. 2010. *Freshwater Ecology – Concepts and Environmental Applications of Limnology*, 2nd ed. Elsevier, Amsterdam. ***excellent coverage of the ecology of freshwaters; this text covers details of topics covered in lecture.

Giller, P.S., and B. Malmqvist. 1998. *The Biology of Streams and Rivers*. Oxford University Press, New York.

Holland, M.M., E.R. Blood, and L.R. Shaffer (eds.). 2003. *Achieving sustainable freshwater systems*. Island Press, Washington, DC. ***excellent information on our water resources, as well as the science and policy relating to the need for action to develop sustainable practices in the future.

Hynes, H.B.N. 1970. *The Ecology of Running Waters*. University of Toronto Press.

Karr, J.R., and E.W. Chu. 1999. *Restoring Life in Running Waters: Better Biological Monitoring*. Island Press, Washington, D.C.

Keddy, P.A. 2000. *Wetland Ecology – Principles and Conservation*. Cambridge University Press, Cambridge, UK.

Leopold, L.B. 1994. *A View of the River*. Harvard University Press, Cambridge, Mass. *** great little book by a well-known geomorphologist on the dynamics of river flow and the consequence; written for everyone.

Leopold, L.B., M.G. Wolman, and J.P. Miller. 1964. *Fluvial Processes in Geomorphology*. W.H. Freeman, San Francisco.

Li, Judith, and Michael Barbour. 2011. *Wading for bugs*. Oregon State University. *** paperback with short stories on the lives of aquatic insects, and the discoveries made by entomologists.

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- Mackie, Gerald. 2005. Applied Aquatic Ecosystem Concepts, 2nd edition. Kendall/Hunt Publishing, Dubuque, Iowa. 757 p.
- Maitland, P.S. 1990. Biology of Fresh Waters, 2nd edition. Chapman and Hall, New York.
- Merritt, R.W., K.W. Cummins, and M.B. Berg (eds.). 2008. An Introduction to the Aquatic Insects of North America, 4th ed. Kendall/Hunt Publ. Co. *** most recognized, standard key for biology, ecology, and identification of North American aquatic insects; nearly all taxa identified to genus.
- Peckarsky, B.L., P.R. Fraissinet, M.A. Penton, and D.J. Conklin, Jr. 1990. Freshwater Macroinvertebrates of Northeastern North America. Cornell University Press, Ithaca, New York.
- Pielou, E.C. 1998. Fresh Water. University of Chicago Press, Chicago. *** great paperback on the life history of water on Earth; written for everyone.
- Thorp, J.H., and A.P. Covich (eds.). 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, New York.
- Ward, J.V. 1992. Aquatic Insect Ecology. 1. Biology and Habitat. John Wiley, New York.
- Wetzel, R.G. 2001. Limnology – Lake and River Ecosystems. Academic Press, New York.
- Williams, D.D., and B.W. Feltmate. 1992. Aquatic Insects. CAB International, Wallingford.

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BSCI 467 – Freshwater Biology
Schedule, Fall-2013
 July 25, 2013 (subject to change)

Week	Lecture	Laboratory	Assignments¹
1	Sep 4-6 W: Objectives and procedures F: Life in freshwater	Lab: Orders of macroinvertebrates	
2	Sep 9-13 M: Taxonomy revisited and field trips W: Water properties F: Water properties, cont.	Field: Sampling of campus aquatic habitats	“Observations of Paint Branch”
3	Sep 16-20 M: Life history of water W: Lakes, ponds, and lentic habitats F: cont.	Field: Middle Patuxent R. (To 5:30)	“Drainage Basins and Hydrology”
4	Sep 23-27 M: Rivers, streams, and lotic habitats W: cont. F: Freshwater ecosystems	Field: Lake Artemesia or Cheltenham Wetlands	“Major Water Bodies”
5	Sep 30-Oct 4 M: Sustainability of freshwaters W: Sustainability group discussion F: Group presentations	Field: Fishing Creek, Catoclin Mts (To 6:30)	“American Rivers Quiz”
6	Oct 7-11 M: Ecosystem case histories W: Trophic relationships F: Fish biology	Non-Insecta Crayfish behavior exercise	“Insect Morphology”
7	Oct 14-18 M: Autotrophs W: Aquatic insects: Physiological adaptations F: Morphological/behavioral adaptations	Ephemeroptera Insect mouthpart exercise	
8	Oct 21-25 M: Midterm review W: Midterm exam F: Project description	Odonata	
9	Oct 28-Nov 1 M: Science and ecology W: Science writing F: Paper discussion	Plecoptera, Hemiptera	Moore & Williams (1990)

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10	Nov 4-8	M: Disturbance W: cont. F: Paper discussion	Lab practical Minor insect orders	Death & Zimmerman (2005)
11	Nov 11-15	M: "River Webs" film W: Trophic interactions F: Paper discussion	Trichoptera	TBD
12	Nov 18-22	M: TBD W: cont. F: Paper discussion	Coleoptera	Wissinger & McGrady (1993)
13	Nov 25	M: Dr. Brett Kent: Fly-Fishing and Trout Behavior W: No class	Happy Thanksgiving!	
14	Dec 2-6	M: Pollution and biomonitoring W: cont. F: TBD	Diptera	Palmer et al. (2005)
15	Dec 9-13	M: Biodiversity W: Future prospects and conclusions F: Final preparation and course evaluation	Final lab practical	

Final Exam

Tuesday, December 17, 1:30-3:30, in BPS 0283

¹ Assignments are due by the end of the day on Monday following the week noted in the schedule.