BSCI 467: FRESHWATER BIOLOGY
Fall, 2015

"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

"There are three principal means of acquiring knowledge... observation of nature, reflection, and experimentation. Observation collects facts; reflection combines them; experimentation verifies the result of that combination." - Denis Diderot (1713-1784)

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.

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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 (24 for each lab section).

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.

If interested, there is a list of books on topics within freshwater biology at the end of this syllabus.

Clickers

Clickers are required for each student in the class. We will use them for immediate assessment of understanding in the lecture, although class grades will NOT be impacted by responses. Be sure to have a working, registered clicker, available new through the bookstore for about $40. It should be a clicker with the following on it: ***"Turning Technologies RF-LCD".*** For more information, go to: http://clickers.umd.edu/. If you have registered your clicker since Fall 2013, you do not need to register it again. If you did *not* have a registered clicker since Fall 2013, please follow these simple steps to register your device (for both clickers and ResponseWare users):

1. Click here to go to the Registration site.

2. Click on the "Register Your Clicker" button (to register both clickers and ResponseWare licenses).

3. When prompted, log in to ELMS as you normally do, using your Directory ID and password.

4. If you are prompted with a Security Warning, click "Continue."

5. Enter your clicker ID or your ResponseWare license device ID.

6. Enter the security code, displayed, and then click "Register Device."

Grading

Source	Points	Percentage
Exams		
Midterm	100	13.33
Final	100	13.33
Subtotal	*200*	*26.67*
Lecture		
POGIL in-class discussions (5@10 pts)	50	6.67
Assignments, Part I (5@10 pts)	50	6.67
Assignments, Part II (5@10 pts)	50	6.67
Sustainability exercise, Part I	25	3.33
Research Proposal, Part II	25	3.33
Participation (given at end)	50	6.67
Subtotal	*250*	*33.33*
Lab		
Order practical (in field)	50	6.67
Midterm practical	50	6.67
Final practical	50	6.67
Exercises (2@10 pts)	20	2.67
Collection	80	10.67
Participation (given at end)	50	6.67
Subtotal	*300*	*40.00*
TOTAL	***750***	***100.00***

The grading scale is:

97-100%, A+	88-89.9%, B+	78-79.9%, C+	68-69.9% D+
91-96.9%, A	81-87.9%, B	71-77.9%, C	61-67.9% D
90-90.9%, A-	80-80.9%, B-	70-70.9%, C-	60-60.9%, D-
<60%, F			

POGIL Discussions

POGIL (process-oriented guided-inquiry learning) is a structured method of increasing student involvement in class and engaging students in learning. The class will be assigned into groups of 3 or 4 students, with each student performing a specific role: manager, presenter, recorder, and reflector. These roles will be explained in class. During the period, each group will be given a model and set of questions, work collaboratively on the answers, and prepare written answers. Discussion across groups will also occur to help with clarification of the topic. There is no work done on the topic beforehand, and answers are due by the end of class. If a student misses class that day, then he/she must review the model and questions (which will be posted on ELMS after class), and submit the answers by the next class period. Grades will be given equally within each group based on the written answers, and will be evaluated for both content and readability.

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 other reason, 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 normal requirements of the course. The contract must be submitted for approval to the University Honors Program by the 10^{th} 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.

Transportation

Vans are provided for off-campus field trips. Some students may wish to drive their own vehicles – directions will be provided by your TA. Those students are responsible to ensure they will have the necessary sampling supplies.

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. Old tennis shoes, Keene's, or other water shoes are acceptable. During the first lab, we will discuss the need for boots and options for purchase.

Lab Practicals

The lab practicals will test your knowledge of collected organisms. You will be expected to know all aquatic subclasses/orders of macroinvertebrates by sight, and selected families by using the key (Lab Manual). Questions will also cover key morphological features used in identification and major biological characteristics of the taxa. The first practical (covering orders) will occur during the last field trip to Fishing Creek. See the schedule for dates.

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.

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.

Voshell, J.R. 2002. A Guide to Common Freshwater Invertebrates of North America. McDonald and Woodward Publ. Co., Blacksburg, VA. *** we used this as a field guide for freshwater creatures for several years in BSCI 467; has great illustrations, and a good description of biology and ecology of groups.

BSCI 467 – Freshwater Biology
Schedule, Fall-2015
August 26, 2015 (subject to change)

Week		Topic	Lecture	Laboratory	Assignments[1]
1	**Aug 31-Sep 4**	Life in Freshwater	M: Objectives and procedures W: Life in freshwater F: POGIL: Life in freshwaters	Lab: Orders of macroinvertebrates	
2	**Sep 9-11**	Water, water, everywhere?	M: Labor Day! W: Taxonomy revisited and field trips F: Water and life	Field: Sampling of campus aquatic habitats	"Getting to Know Paint Branch"
3	**Sep 14-18**	Hydrology as a template for ecosystems	M: Water properties W: Life history of water F: POGIL: Stream discharge	Field: Middle Patuxent R. (To 5:30)	"Drainage Basins and Hydrology"
4	**Sep 21-25**	Ecosystems flowing and still	M: Freshwater ecosystems W: Lentic habitats: Lakes, ponds, wetlands F: Lotic habitats: Rivers, streams, creeks	Field: Lake Artemesia	"American Rivers Quiz"
5	**Sep 28-Oct 2**	Food is the substance of life	M: POGIL: Seasonality of lentic and lotic waters W: Trophic relationships F: Ecosystem case histories	Field: Fishing Creek, Catoctin Mts (To 7:00)	"Observations of Fishing Creek"
6	**Oct 5-9**	For a sustainable future …	M: Sustainability of freshwaters W: Sustainability group discussion F: Videos of aquatic insects	Non-Insecta Crayfish behavior exercise	"Insect Morphology"
7	**Oct 12-16**	Species adapt to habitats	M: Group presentations W: Aquatic insects: Respiration/osmoregulation F: Fish biology and ecology	Ephemeroptera Insect mouthpart exercise	
8	**Oct 19-23**	Mid-semester transition	M: Midterm review W: Midterm exam F: POGIL: Scientific method	Odonata	

9	**Oct 26-30**	Science is a verb	M: Science and ecology W: Science writing F: Hypothesis testing; paper discussion	Plecoptera, Hemiptera	Moore & Williams (1990)
10	**Nov 2-6**	Disturbance is not so bad	M: Balance of nature? W: Pollution and biomonitoring F: Disturbance in streams; paper discussion	Lab practical Minor insect orders	Death & Zimmerman (2005)
11	**Nov 9-13**	Unintended and restored interactions	M: Dr. Paul Leisnham: "Mosquitoes in space and time: hypotheses for species coexistence" W: Hypothesis development F: Dr. Margaret Palmer: "Stream Restoration"	Trichoptera	Palmer et al. (2014) Proposal hypothesis due Nov. 13
12	**Nov 16-20**	Ecosystem boundaries	M: POGIL: Trophic interactions W: "River Webs" film F: Ecosystems linkages; paper discussion	Coleoptera	Nakano et al. (1999)
13	**Nov 23**	Underwater perception	M: Dr. Brett Kent: "Fly-Fishing and Trout Behavior" W: No class	Happy Thanksgiving!	
14	**Nov 30-Dec 4**	Social side of freshwaters	M: Dr. Jen Shaffer: "Water Resources and Human Culture" W: Aquatic ecology, science, and society F: GMO crops and non-target effects; paper discussion	Diptera	Chambers et al. (2005) Proposal due Dec. 3
15	**Dec 7-11**	Future of freshwaters and their inhabitants	M: Biodiversity W: Future prospects and conclusions F: Final preparation and course evaluation	Final lab practical	
Final Exam			Tuesday, December 15, 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.

Freshwater Biology. Scopus journals. Agricultural and Biological Sciences(all). Aquatic Science. The scientific journal Freshwater Biology is included in the Scopus database. Based on 2020, SJR is 1.487. Publisher country is . The main subject areas of published articles are Aquatic Science. We offer making basic requirements to academic papers compliance test using "Paper quality checking" service. Paper quality checking service is in demand among researchers who wish to make final improvements to their work before submitting it to the target journal.The experienced editors of ORES, who have published papers in cited journals, with the participation of foreign partners go through finished articles. The journal Limnology and Freshwater Biology is financially supported by Limnological institute SB RAS. Editorial office email: limnolfwbiol@gmail.com. Registered in Roscomnadzor (the Federal Service for Supervision of Communications, Information Technology, and Mass Media). Freshwater Biology. Download Product Flyer. Description. Permissions. Freshwater Biology. Edited By:David Dudgeon. Vol 63(12 Issues in 2018) Print ISSN: 0046-5070 Online ISSN: 1365-2427 Impact Factor: 3.835.Â Freshwater Biology publishes papers on all aspects of the ecology of inland surface waters, including rivers and lakes, connected ground waters, flood plains and other freshwater wetlands. We publish studies of micro-organisms, algae, macrophytes, invertebrates, fish and other vertebrates, as well as those concerning whole systems and related physical and chemical aspects of the environment. Freshwater Biology publishes papers on all aspects of the ecology of inland waters, including rivers and lakes, ground waters, flood plains and other freshwater wetlands. We include studies of micro-organisms, algae, macrophytes, invertebrates, fish and other vertebrates, as well as those concerning whole systems and related physical and chemical aspects of the environment, provided that they have clear biological relevance.Â Papers interpreting fundamental research in a way that makes clear its applied, strategic or socio-economic relevance are also welcome. Review articles (FRESHWATER BIOLOGY REVIEWS) and discussion papers (OPINION) are also invited: these enable authors to publish high-quality material outside the constraints of standard research papers. BSCI 467 - Freshwater Biology. Subject: Biological Sciences Program.Â Term: Fall 2009. KeywordsÂ Freshwater Habitats: Lotic "You could not step twice into the same river; for other waters are ever flowing on to you." - cli u f p suHeraclitus of Ephesus BSCI 467 21-Sep-2009 Lentic Habitats Lotic Habitats L tLotic a at : Habitats: Unique Characteristics ï¿½ Unidi ec onal loUnidirectional flow ï¿½ Linear form ï¿½ Hierarchical ï¿½ Unstable channel and bed morphology.