

BSCI 467: FRESHWATER BIOLOGY
Fall, 2020

August 21, 2020 (subject to change)

"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



"Here is the means to end the great extinction spasm. The next century will, I believe, be the era of restoration in ecology."
 - E.O. Wilson, "The Diversity of Life" (1992)

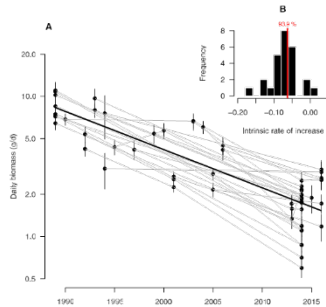


Fig 4. Temporal distribution of insect biomass at selected locations. (A) Daily biomass (mean \pm 1 se) across 25 locations sampled in multiple years (see Fig. 2 for seasonal distributions). (B) Distribution of mean annual rates of decline as estimated based on plot-specific logistic models (annual trend coefficient = -0.103, $se = 0.002$, i.e. 5.2% annual decline).



"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)



COVID-19 crisis, Fall-2020: Message from the Provost, Dr. Mary Ann Rankin

“Our efforts regarding teaching this Fall are grounded on the four basic principles listed below:

1. **The health of our students, faculty, and staff comes first.** That means everyone working or taking classes on campus will need to abide by the University’s health regulations.
2. We will use in-person and remote course options to maximize flexibility and equity of access and to accommodate the needs of faculty members and students who may not be able to return to campus because of risks associated with COVID-19.
3. We commit to offering each Maryland student a deeply engaging curriculum whether in-person, blended, or online—along with co-curricular opportunities designed to maximize student learning, involvement, and personal growth.
4. We continue to be committed to creating an inclusive, just, respectful, and supportive environment for all members of the community, striving to ensure that all of our actions and decisions prioritize equity and careful consideration for individuals and groups of students and employees who may be most vulnerable during the pandemic.”

Freshwater Biology: Overview for Fall-2020

Because of the current pandemic situation, I will need to transform Freshwater Biology to abide by current state and local restrictions as well as University of Maryland and Department of Entomology rules. My goal is to limit our potential transmission of the COVID-19 virus. At the same time, the course will be taught to all enrolled students in a manner that maintains my desire for high quality instruction within an engaging atmosphere. Because students vary in their concern for exposure to the virus, the course will be offered with a range of instructional elements between a completely online approach to a blended, in-person approach. The lectures will be entirely online, but the blended approach includes options for reduced-size field trips and for independent use of the facilities in our teaching lab. Because pandemic conditions may shift during the semester, I may need to alter the plan described below. In addition, students are free to choose to do any specific activity using either the online approach or the blended approach. Grading will be equivalent either way. Details are provided below.

Course Description

“Freshwater Biology” is designed for upper-level 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 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 and invited scientists 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.

Topics covered in Freshwater Biology are listed as “Key Questions” on the class ELMS webpage. See “Modules”, then “General Information” for the document.

Instructor (Office hours on many Fridays at 1:00, or by appointment)

Dr. William O. Lamp, Professor, Department of Entomology, lamp@umd.edu

Teaching Assistants (Office hours by appointment)

Wednesday Section: Maggie Hartman, Graduate Student, mehartma@umd.edu

Thursday Section: Darsy Smith, Graduate Student, dsmith28@umd.edu



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: Synchronous lectures at 1:00-1:50 on Monday and Friday online (not all days will be required). Laboratories online or in Room 1161, Plant Sciences Bldg. on Wednesday or Thursday afternoons.

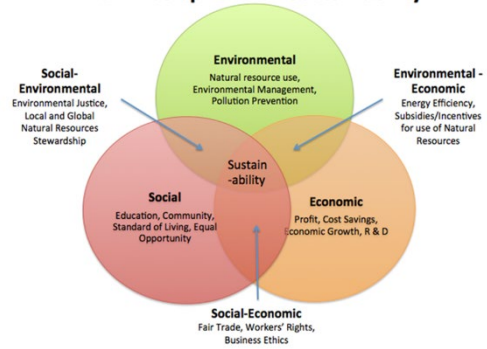
Frequency of Offering

Each fall.

Prerequisite

BSCI 106/160.

The Three Spheres of Sustainability



Course Description for Schedule of Classes

BSCI 467 Freshwater Biology (4). 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. The maximum enrollment is 48 (24 for each lab section).

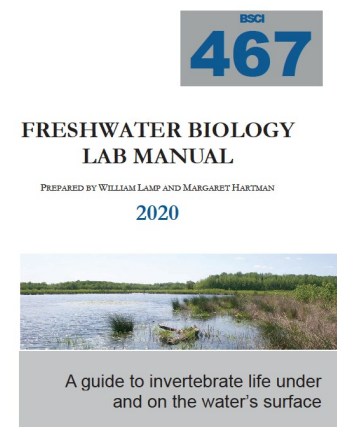
Website

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

Texts

The “Field Guide to Aquatic Macroinvertebrates” will be provided before the first lab and will be useful to identify the higher taxa of what we collect. The “Freshwater Biology Lab Manual” will be provided in late September and will be helpful for identifications in the lab. Both are posted on ELMS, as well. If interested, there is a list of books on topics within freshwater biology posted.

No other text is required. Articles will be made available to you as PDF files for reading assignments, Part II.



Grading

Source	Points	Percentage
Exams		
Midterm	100	13.33
Final	100	13.33
<i>Subtotal</i>	<i>200</i>	<i>26.67</i>
Lecture		
POGIL group discussions (5@10 pts)	50	6.67
Assignments, Part I (6@10 pts)	60	8.00
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)	40	5.33
<i>Subtotal</i>	<i>250</i>	<i>33.33</i>
Lab		
Questionnaire: Student use of lab	10	1.33
Order practical	50	6.67
Midterm practical	50	6.67
Final practical	50	6.67
Exercises (2@10 pts)	20	2.67
Collection	100	13.33
Participation (given at end)	20	2.67
<i>Subtotal</i>	<i>300</i>	<i>40.00</i>
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			

Online and Blended (or In-Person) Details

Lectures. The lecture portion of the course will be taught entirely online. The course will progress through weekly modules; use the “Modules” tab on ELMS to view resources, lectures, and assignments. A Resources page for each week provides background, readings, videos, etc. All students will be required to participate in all the following components (with exception of office hours):

1. Live on Mondays. Dr. Lamp will provide a mix of lecture and discussion at 1:00-2:00 on Mondays during a live Zoom call. In addition, guest speakers will provide examples of current research in freshwater biology.
2. Prerecorded Panopto lectures. Dr. Lamp will upload a lectures each week.
3. Weekly assignments. During the first half of the semester, assignments will cover special topics within freshwater biology. During the second half of the course, assignments will

focus on primary research articles that are assigned to be read, with questions provided to be answered.

4. POGIL group discussions. On five live Zoom calls on Fridays, the class will be broken into 12 groups of four students to discuss topics related to freshwater biology. See a description of POGIL discussions below.
5. Sustainability exercise. One week during the first half of the semester will be set aside for this role-playing exercise. The class will be divided into groups of 8 students on a specific topic relating to a social/environmental issue somewhere in the world. See the “Sustainability exercise” in the Assignments tab of ELMS for more information.
6. Research proposal. During the second half of the course, students may work alone or with one other student to develop a proposal for research within freshwater biology. See the “Research proposal” in the Assignments tab of ELMS for more information.
7. Examinations. Mid-term and Final exams will be given online. Exams will be open book, but time will be limited. Previous exams for 2018 and 2019 are posted in the “Course information” module, although the uniqueness of this semester will require changes in the exams.
8. Office hours. On Fridays at 1:00-2:00, when a POGIL discussion is not occurring, an optional online office hour will be available for discussions with Dr. Lamp and the TAs.

Laboratories/field trips. Direct experience with freshwater habitats and their inhabitants is a fun and engaging way to experience freshwater biology. Clearly, any outdoor or in laboratory experience must be conducted in a safe way while we experience the pandemic. I will do my best to provide this direct experience to students, while always providing an online version as an option. During the first week of classes, students will be asked, individually and confidentially, which of the following options they desire to pursue for the semester. Your decision at that time may be changed as the semester progresses, and if the pandemic situation changes, all students may need to change their option. So, the following are guidelines, with details evolving both over the summer and during the semester.



1. First lab. (Online only) The first week of lab is designed to help students to start learning the phyla and classes of all macroinvertebrates, and the orders of all aquatic insects. Field guides will be provided to help with the exercise, either as hardcopy or as PDF. Feedback from TAs will be provided after answering questions. This is a no-points, just-for-fun quiz. The quiz will follow an introductory presentation to the lab on Zoom.
2. Second lab. (Online only) A recorded lecture will be provided to review the higher classification of macroinvertebrates, followed by an at-home flash card exercise. The flash cards are to help you to memorize the higher classification of macroinvertebrates. No points are assigned to the flashcards, but the questions will be part of the first lab practical.
3. Field trips. Weeks 3-6 of the semester will include field trips, either outdoors or online. The goal is to give you a first-hand experience in nature, and for you to observe and collect specimens of macroinvertebrate for later identification. The four field trips (6

locations) can be attended in-person or online as described below. You may choose to attend any or all of the field trips in-person. The specimens you collect (either as preserved macroinvertebrates or photos of macroinvertebrates) will form the basis of your collection.



- a. Blended, in-person approach. If you are to attend field trips, you will need to provide your own transportation. We will provide directions. The first field trip (Campus habitats) is on campus, and the third (Lake Artemesia) is not far from campus, so they are both accessible if you are living on campus. The second and fourth are more distant, and require a car for transportation. To maintain social distancing, we will need to coordinate field trips so that a maximum of 8 students at a time are collecting. This will occur within the lab section time on your schedule. Collecting supplies will be provided. Specimens that you collect will be placed in a tray, and if you like, the tray will be transported for you to the Teaching Lab for storage. After field trips are done, you may visit the Teaching Lab and identify your specimens. You may also choose to keep the collection at home, and perform the identifications at home.
- b. Online approach. The field trip will be documented with video and photos, including a set of photos of specimens collected on your behalf. You will download the photos and identify them during the rest of the semester. The photos will serve as your collection.
4. Identification labs. For Weeks 7-14, the Lab Manual will be provided to help you learn how to identify macroinvertebrates to the family level using keys. The TAs will provide a pre-recorded Panopto lecture each week to provide information on the biology and identification of specific taxa within the aquatic macroinvertebrates. After viewing the lecture, you can either schedule time in the lab, or work online.
 - a. Blended, in-person approach. During your scheduled lab time, you can view reference specimens to help you learn the keys to family, as well as to apply those skills to your collected specimens to identify them to family.
 - b. Online approach. Using online resources provided to you, you can learn how to use the key by using high-quality photos of macroinvertebrates. Then, you can apply the skills learned to your photographs of collected specimens.
5. Practicals. There are three lab practicals. The first is conducted by Dr. Lamp with each student alone and online. During a two-person Zoom call, each student will be shown live specimens of aquatic macroinvertebrates, and the student will be asked to provide the phylum, class, and order of the macroinvertebrate (order is only asked for those in the Class Insecta). The second and part of the third will be either in lab or online. The third practical will also involve our Freshwater Biology Quiz Bowl during Week 15.
 - a. Blended, in-person approach. Practical will occur in the Teaching Lab. During your appointment period, you will be given a certain number of specimens in

separate petri dishes to identify and answer questions. The practical is timed, and you will have access to your lab manual.

- b. Online approach. Practicals will occur online at a specific time based on your lab section. You will be given photographs of specimens to identify and answer questions. The practical is timed, and you will have access to your lab manual.

Boots and Safety for Blended 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.



The field trip sites are generally safe places to collect invertebrates. The TAs will inform you about safety; e.g., some locations can be especially slippery. Also, it is not safe to expose open wounds to freshwaters. If you have an open cut, you should not get into the water. If you are cut during a field trip, inform the TA immediately for care. The TA will have a first aid kit available in case of minor injuries.

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.

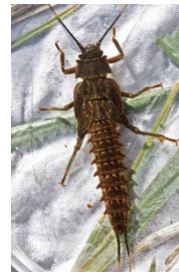


Attendance in Lecture and Lab

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 contact Dr. Lamp and your TA, either Maggie Hartman or Darsy Smith, in a timely way for any absence:

- 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 will miss the lab, contact both Dr. Lamp and the TA.
- 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.” If you missed the lab, contact both Dr. Lamp and the TA. You are required to make up any information that you miss. You should turn in due assignments at the next class period.
- Check with Dr. Lamp and/or the TA for specific information and activities you may miss.

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 as well as a wide range of course-related policies can be found at: <http://www.ugst.umd.edu/courserelatedpolicies.html>



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 the website cited above.