

# Spring 2020 BIOL-5550-001 XL Syllabus

## Freshwater Invertebrates WATS/BIO 5550

**Lectures and labs:** Tuesdays and Thursdays: 1:30 – 4:20 pm; BNR 004

**Prerequisites:** One year of general biology or zoology

### Instructors:

**Charles Hawkins:** BNR 162D. [chuck.hawkins@usu.edu](mailto:chuck.hawkins@usu.edu) (<mailto:scott.miller@usu.edu>).

797.2280.

### Office hours: by appointment

**Joe Kotynek:** BNR 160. [joe.kotynek@usu.edu](mailto:joe.kotynek@usu.edu) (<mailto:joe.kotynek@usu.edu>). Phone: 797.3945.

Office hours: Monday – Friday 8:30 – 10 am or by appointment

### Course Fee

The course fee is \$55.00. The fee covers field trip costs (Motor Pool vans), collecting supplies, and photocopy expenses.

### Course Goals and Objectives

This course is designed to provide a thorough understanding of freshwater invertebrate taxonomy, ecology, and biology. This course is relevant to those interested in ecology and evolution, fisheries biology, natural resources science and management, or environmental assessment and monitoring.

Specific learning objects include:

- Understand the evolutionary origins and phylogenetic relationships of freshwater invertebrate groups, basic theory and practice of taxonomy and systematics, adaptations and habitat requirements of freshwater invertebrates, the functional role of invertebrates in freshwater ecosystems, the factors that influence their abundance and distribution across different spatial scales, the use of freshwater invertebrates in environmental assessment, and conservation and restoration science as applied to freshwater invertebrates.
- Learn how to:
  1. use taxonomic keys to identify freshwater invertebrates,
  2. sample streams, lakes, and wetlands for freshwater invertebrates, and
  3. process invertebrate samples to known data quality standards.
- Practice conducting, interpreting, and reporting project results.
- Improve your written and oral communication skills.

### Texts and Reading

There is no required text for this class, but both mandatory and optional reading materials will be provided prior to each class period. You are required to complete readings **before** the assigned class period, as this will greatly enhance your comprehension of lecture materials. Resources include:

Allan, J.D. and M.M. Castillo. 2007. Stream Ecology: Structure and Function of Running Waters. Kluwer Academic, Dordrecht, Netherlands.<sup>1</sup>

Hauer R.F. & G.A. Lamberti. 2007. Methods in Stream Ecology (2<sup>nd</sup> edition). Academic Press.<sup>1</sup>

Merritt, R.W., K.W. Cummins, and M. B. Berg. 2008. An Introduction to the Aquatic Insects of North America (4<sup>th</sup> edition). Kendall/Hunt Dubuque, Iowa.<sup>2,3</sup>

Resh, V.H. & D.M. Rosenberg. 1984. The Ecology of Aquatic Insects. Praeger, New York.<sup>4</sup>

Thorp, J.H. & A.P. Covich. 2010. Ecology and Classification of North American Freshwater Invertebrates (3<sup>rd</sup> edition). Academic Press, San Diego California.<sup>1</sup>

Thorp, J. H. and D. C. Rogers. 2011. Field Guide to the Freshwater Invertebrates of North America, Academic Press, Burlington, Massachusetts.<sup>1</sup>

Ward, J. V. 1992. Aquatic Insect Ecology. John Wiley & Sons, New York.<sup>3</sup>

Williams, D.D. & B. W. Feltmate. 1992. Aquatic Insects. CAB International, Wallingford UK.<sup>3</sup>

<sup>1</sup>Available online through the USU library course catalog. <sup>2</sup>Copy available in BNR 160. <sup>3</sup>Scanned material available on Canvas.

## Canvas

We will use Canvas for sharing announcements, accessing lecture/lab outlines and identification materials, and accessing reading assignments. Your A-number and strong password allows you to access the WATS 5550 course site. The course website can be accessed by browsing to <https://usu.instructure.com/>. Under course list click "Sp20 BIO-5550-001". If you have additional questions or problems, please ask us.

### Course Activities and Evaluation

Evaluation of your performance will be based on four metrics:

1. how well you understand material presented on the evolution, biology, and ecology of freshwater invertebrates;
2. how well you summarize aspects of theory and practice in written assignments;
3. how well you develop skills in identifying freshwater invertebrates; and
4. the quality of the report you produce for the course project.

Grades will be based on how many total points, out of a hundred, that you accrue over the term.

Graded item	Points
Two exams on lecture material (10 points each)	20
Two response papers (10 points each)	20
Identification skills	40
Mid-term lab exam	20
Final lab exam	20
Project and report	20
Total possible points	100

### Activities and Grading Explained

**Evolution, biology, and ecology** – We will cover several aspects of the evolution, classification, and ecology of freshwater invertebrates. This material will be covered by a combination of lecture, reading, and in-class discussion. You will be evaluated on your command of this material by two in-class, “closed-book” exams.

**Response papers** – You are responsible for reading two assigned papers from the primary literature and writing 2-page response papers for each of them (11-point, Times Roman font, double spaced, 1-inch margins). The objective of these assignments is to provide you with experience interpreting and synthesizing the scientific literature on freshwater invertebrates and to provide practice honing your written communication skills. Assigned papers will relate to topics covered in lecture. I will grade based on both content and clarity of writing. In general, your papers should be organized as follows:

1. Introduce the topic of the paper including the author’s objectives/hypotheses and concisely summarize what motivated the authors to conduct the study – i.e., what knowledge gap did the authors want to fill and why was it important to do so.
2. Describe the study design and how it allowed the authors to answer their research question or test their research hypothesis. Summarize the methods they used to collect and analyze data.
3. Summarize the key findings (results).
4. Comment on the strength of the inferences the authors draw. How convinced were you that their conclusions were sound? What questions remained unanswered, if any, or what new questions emerged? Briefly describe what study you would conduct next that would build on this study if you were part of a research lab. Be sure to state what the new question/hypothesis is and what study type/design you would use.
5. Email me your paper in Word format named as: LastName-WATS5550-ResponsePaper-1 (or 2).

**Identification skills** – We will test your ability to identify the groups of freshwater invertebrates we cover in class. Exams will focus on taxonomy (short answer questions), morphology (short answer questions), function (short answer), and your ability to identify freshwater invertebrate taxa (combination of sight identifications and use of keys to identify unknowns).

**Project and report** – You will participate in a class project designed to improve your understanding of freshwater invertebrate ecology, how invertebrate data are used in environmental assessment, and the factors that affect data quality. The project will compare the invertebrate assemblages at two locations on the Logan River – a ‘reference’ site and a degraded site that is in the process of being restored. You will be responsible for taking quantitative samples, processing the samples in the lab, and using the data to draw inferences regarding differences between the sites. You will also be responsible for writing a ~ 10-page report (11 point Times Roman font, double spaced) that describes the project and the conclusions you drew from the data you collected. The report must be written in the standard format of a scientific journal article (Abstract, Introduction, Methods, Results, Discussion, Literature Cited) and must incorporate relevant literature. Your grade will be based on both scientific content as well as the quality of your writing. Provide a Word file named as follows: YourLastName-WATS5550-ProjectReport.

### **Field Experiences**

The field experience consists of 2 field trips. One trip will be held during class time, and your active participation is required. We will return to campus by 4:15 on that day. This trip will focus on collecting quantitative samples in support of the class project. The third trip will be a day-long Saturday excursion that will highlight sampling of pond and wetland habitats and the ecology and natural history of their invertebrate inhabitants.

To effectively participate in, and enjoy, the field excursions, you will need to be prepared for **wading in winter conditions**. We can provide waders or hip-boots, but strongly encourage you to bring your own gear if you have it. Despite our best efforts, some of our equipment leaks. All necessary collecting equipment will be provided. When sampling, we ask that you put safety first and be conscious of the conditions in which you wade. Do not put yourself or your classmates in danger.

### **Laboratory Experiences**

The laboratory experiences are designed to both provide practice in identifying freshwater invertebrates and a realistic experience in sample processing. Each laboratory experience will start with a lecture that introduces a taxonomic group and will conclude with time working on identifying both reference specimens and individuals you have collected. Over the course of the semester, we will provide you with taxonomic keys and other handouts that you should keep in a three-ring binder that we will provide.

A significant portion of the laboratory will also be spent processing the samples you collect. This exercise is designed to introduce you to sample processing procedures and make you aware of the importance of data quality when estimating the presence and abundance of the organisms you sample. You will be expected to follow standard laboratory sample processing protocols that we provide you that will include subsampling, sorting, identification, and data compilation.

### **Classroom, Departmental, and University Policies**

**Cell phones, laptops, and other electronic communication devices** – Active use of cell phones, laptops, and similar is prohibited in the classroom and during field trips except that you may use your laptop during lab sessions when you are entering or analyzing data or need to view identification materials (e.g., keys and images). Cell phones must be stowed out of sight for the duration of every class. If someone needs to contact you during class, they can call the Watershed Sciences Department (435-797-2459).

**Students with disabilities – Accommodations are collaborative efforts between students, faculty and the Disability Resource Center (DRC). Students with accommodations approved through DRC are responsible for contacting the course instructors prior to or during the first week of the semester to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DRC should contact DRC immediately at 797-2444.**

**Academic Honesty and Integrity** – This course follows the University rules on civility and honesty. These can be found at <http://catalog.usu.edu/content.php?catoid=12&navoid=3140> (<http://catalog.usu.edu/content.php?catoid=12&navoid=3140>).

USU defines **cheating** as “intentionally: (1) using or attempting to use or providing others with any unauthorized assistance in taking quizzes, tests, examinations or in any other academic exercise or activity; (2) depending upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems or carrying out other assignments; (3) substituting for another student, or permitting another student to substitute for oneself, in taking an examination or preparing academic work; (4) acquiring tests or other academic material belonging to a faculty member, staff member or another student without express permission; and (5) engaging in any form of research fraud.” **Falsification**, “includes the intentional and unauthorized altering or inventing of any information or citation in an academic exercise or activity.” **Plagiarism**, “includes knowingly representing, by paraphrase or direct quotation, the published or unpublished work of another person as one’s own in any academic exercise or activity without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.” (This includes internet sources.)

The penalty for cheating in this class will be an automatic F grade. In addition, the offense will be reported to the Judicial Officer and University for potential additional disciplinary action.

### **Schedule**

Dates	Tuesdays	Thursdays	Important Dates
Lecture / Discussion	Lab	Lab / Field	Reading
			Quizzes / Papers / Exams Reports

Jan 7/9	Overview of the course / Pretest / Introduction to the lab portion of the course to taxonomy	Introduction to the lab portion of the course	Habitats and sampling / Aquatic insect orders / Taxonomy and keys	MCB 2,3		Pretest 7 Jan
Jan 14/16		Field trip to Logan River (Rendezvous Park)	Orders / Sample processing	TC 1 MCB 8 Ward 2		
Jan 21/23	Writing your papers	Sample processing	Ephemeroptera / Sample processing	MCB 4,5 TC 2 RR 3,5		
Jan 28/30	Phylogeny and evolution	Sample processing	Odonata / Sample Processing			Paper 1 assignment: 29 Jan
Feb 4/6	Adaptations and niches	Sample processing	Plecoptera / Sample processing			Paper 1 due 6 Feb
Feb 11/13	Adaptations and niches	Sample processing	Trichoptera / Sample processing			
Feb 18/20	Drift	Sample processing	Sample processing			Lecture exam 1 20 Feb
Feb 25/27	Biodiversity patterns 1	Mid-term lab exam review / Catch up	ID Midterm / Sample processing		ID Midterm 27 Feb	Paper 2 assignment 27 Feb
Mar 3/5	Spring Break	Spring Break	Spring Break	Spring Break		
Mar 10/12	Biodiversity patterns 2	Sample processing	Megaloptera & Collembola / Lecture quiz / Sample processing			Paper 2 due 12 Mar
Mar 17/19	Biological assessment	Sample processing	Diptera			

21 Mar	Field Trip			Field Trip	
(Sat)					
Mar 24/26	Biological assessment	Diptera / Sample processing	Hemiptera and Coleoptera	MCB 7, <a href="https://qcnr.usu.edu/wmc/bioassessments/">https://qcnr.usu.edu/wmc/bioassessments/</a> ( <a href="https://qcnr.usu.edu/wmc/bioassessments/">https://qcnr.usu.edu/wmc/bioassessments/</a> )	Lecture exam 2 26 Mar
Mar 31/ Apr 2	Project data analysis	Hemiptera and Coleoptera / Sample data entry	Lecture quiz / Mollusca and benthic Crustacea		
Apr 7/9	Project data analysis	Mollusca and benthic Crustacea	Annelids, Mites		
Apr 14/16	Project data analysis	Annelids, Mites	Project questions and discussion / Zooplankton		
Apr 21/23	Project questions and discussion	Zooplankton	Final lab exam review		Project report due 24 Apr
Apr 28			Lab Final: 1:30-3:20		ID Final 28 Apr