Freshwater Biomonitoring Syllabus
ENT/BIOL/FIW (4 credit hours)
Fall 2022
Aquatic macroinvertebrates as biological indicators of environmental change

Instructor: Sally Entrekin
Office: Price Hall 319
Email: sallye@vt.edu (best and preferred)
Student hours: Monday 1-4 pm and by appointment via email
Cell phone: 501-269-2108 (when you have an immediate need)
Zoom Link for virtual meetings: https://virginiatech.zoom.us/j/8164163756

Teaching Assistant: Sergio Sabat-Bonilla
Office: Price Hall 301C
Email: ssabatbonilla@vt.edu
Student hours: Thursday 11 am -2 pm

Lecture Meeting: T/R 9:30-10:45 AM (In-class or on-line), Price Hall 220
Laboratory Meeting: T 2:00-4:45 PM (In-class/Field), Price Hall 220

Textbook and Required Reading: No textbook will be required. We will use the following published resources and others that will be posted by your instructor to Canvas.

- Barbour, Michael T., Jeroen Gerritsen, Blaine D. Snyder, and James Bentley Stribling. *Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish*. Vol. 339. Washington, DC: US Environmental Protection Agency, Office of Water, 1999.
- Resh, V.H., Norris, R.H., and Barbour, M.T. "Design and implementation of rapid assessment approaches for water resource monitoring using benthic macroinvertebrates." *Austral Ecology* 20, no. 1 (1995): 108-121.
- Clements, William H., Donald S. Cherry, and John H. Van Hassel. "Assessment of the impact of heavy metals on benthic communities at the Clinch River (Virginia): evaluation of an index of community sensitivity." *Canadian Journal of Fisheries and Aquatic Sciences* 49, no. 8 (1992): 1686-1694.
- Bonada, Nuria, Narcís Prat, Vincent H. Resh, and Bernhard Statzner. "Developments in aquatic insect biomonitoring: a comparative analysis of recent approaches." *Annu. Rev. Entomol.* 51 (2006): 495-523.

Course Description
The Clean Water Act mandates that waters of the U.S. support designated uses. Designated uses include fishing, recreation, and drinking. U.S. waters may also be designated as Scenic Waterways, Ecologically Sensitive, or an Extraordinary Resource. Designations are largely driven by public interest and the aquatic organisms that live in the waters. Aquatic invertebrate community structure is commonly used as metrics of environmental change that inform impairment outside of the designated uses. Students will gain an understanding of the policy that supports biological assessments and an appreciation for the process of developing assessment protocols that can detect different environmental stressors.

The course will be a combination of lecture, discussion with invited guests, and activities in the laboratory and field. We will conduct field assessment, sample processing, macroinvertebrate identification, data analysis, and report writing that will be presented to the class. Lectures will provide background and context on the history of biological assessments, various assessment approaches, experimental designs, and effectiveness given different impairments to waters. Each student will lead a discussion on a current topic where biological indicators are being used to address

emerging environmental stressors. In addition, students will perform toxicity testing as another component in bioassessment.

After this course you should be able to:

1. Describe the history of bioassessment in the U.S.
2. Compare U.S. Clean Water Act and other federal legislation to similar legislation in some other countries.
3. Conduct an aquatic invertebrate bioassessment in streams, lakes or wetlands.
4. Connect environmental conditions with aquatic community characteristics to inform bioassessment results.
5. Learn how to develop and calculate assessment scores for multimeric indices.
6. Know the difference between structure and function and their interactions.
7. Complete an independent biological assessment and communicate results to interested stakeholders.

Course Performance Assessment: I want you to understand how you are evaluated in this class. If you have any questions about your grade or feedback on course work, please email me to schedule a time to meet. I kindly ask that you wait at least 24 hours after work has been returned before requesting an appointment. This is to give you time to more thoroughly consider questions you have about your work.

Grading: Course grades will be earned based on the following points:

Letter grade	Percentage	Points		Letter grade	Percentage	Points
A	92	549		C	72	429
A-	90	537		C-	70	417
B+	88	525		D+	68	405
B	82	489		D	62	369
B-	80	477		D-	60	357
C+	78	465		F	≤59	≤356

Evaluation:

Lecture	Assignments	Points
	Exam 1	**50**
	Exam 2	**80**
	Exam 3	**90**
	Class assignments 8@10pts (there are 10 total but you can miss 2 without penalty)	**80**
	Student Presentations	**50**
		350 (56%)
Lab	**Project proposal**	**30**
	Project Report	**85**
	Project presentation	**100**
	Toxicity report	**35**
	Assignments (3@10pts)	**30**
		280 (44%)
Total		**630**

Helpful links for macroinvertebrate descriptions and identification along with Restoration Resources:

- Macroinvertebrate identification made easy: https://www.macroinvertebrates.org/
- USGS macroinvertebrate digital reference collection of North America: https://sciencebase.usgs.gov/naamdrc
- General macroinvertebrate information: https://bugguide.net/node/view/15740
- Digital reference for common macroinvertebrates of East North America: https://www.macroinvertebrates.org/
- Restoration resources: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage/restoration/

Attendance

Students are expected to participate in lectures and labs. If you have to miss a lecture, please get notes from your peers. In-class assignments may only be made up with a valid reason for missing (please talk to the professor). Students are expected to attend all labs and will be dropped from the course after 2 unexcused absences. Labs cannot be made-up.

Honor System

The Undergraduate Honor Code pledge that each member of the university community agrees to abide by states: "As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do." Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit: www.honorsystem.vt.edu.

Services for Students with Disabilities

Virginia Tech welcomes students with disabilities into the University's educational programs. The University promotes efforts to provide equal access and a culture of inclusion without altering the essential elements of coursework. If you anticipate or experience academic barriers that may be due to disability, including but not limited to ADHD, chronic or temporary medical conditions, deaf or hard of hearing, learning disability, mental health, or vision impairment, please contact the Services for Students with Disabilities (SSD) office (540-231-3788, ssd@vt.edu, or visit www.ssd.vt.edu). If you have an SSD accommodation letter, please meet with me privately during office hours as early in the semester as possible to deliver your letter and discuss your accommodations. You must give me reasonable notice to implement your accommodations, which is generally 5 business days and 10 business days for final exams.

Classroom and laboratory health and safety

Virginia Tech is committed to protecting the health and safety of all members of its community. By participating in this class, all students agree to abide by the Virginia Tech Wellness principles. To uphold these principles, in this class you must do the following: • Wear a face covering during class, including as you enter and exit the classroom • Maintain the designated distancing guidelines of the classroom • Enter and exit the classroom according to posted signage. If you are exhibiting even the slightest sign of illness, you must not attend an in-person class. Notify me by email and follow the instructions posted at https://vt.edu/ready/health.html#tips.

Diversity and Inclusivity: inclusivevt@vt.edu

Diversity statement: Respect: Students in this class are encouraged to speak up and participate during class meetings. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class must show respect for every other member of this class. (Adopted from California State University)

Inclusivity Statement: I support an inclusive learning environment where diversity and individual differences are understood, respected, appreciated, and recognized as a source of strength. We expect that students, faculty, administrators and staff at will respect differences and demonstrate diligence in understanding how other peoples' perspectives, behaviors, and worldviews may be different from their own. (Adopted from University of Northern Colorado)

Expectations for communication (Zoom, email, texting)
If possible, please use email for our primary communication. Please reply to all that are involved and need the information. You will have my cell number and you'll need it when we're in the field. So, use it when there is an immediate need. We will have a shared course folder or drive to facilitate data sharing.

Course Success
This is a discussion-focused course. To best prepare for class sessions, you should arrive to class with notes from the readings and a list of questions you would like to discuss. The readings can be intense to digest, which is why I recommend starting your reading early and doing a little bit at a time. A useful tip is to time yourself actively reading (meaning reading for understanding) 2 pages of the text. This will give you an idea of how long it will take you to read the full text. If you find yourself struggling to comprehend the readings, I am happy to meet with you and discuss effective reading strategies that you can try.

Additional campus resources
There are so many resources for students. Please use them and if you're struggling with a particular issue, let me know and I can help you get you resources for support. Don't be afraid to ask.