SYLLABUS · SUMMER 2027 · HIGHLANDS BIOLOGICAL STATION

Mayflies, Stoneflies, and Caddisflies

Taxonomy and natural history in the Southern Appalachians

WHEN
June 21–July 2, 2027
Two weeks, Monday to Friday

WHERE
Highlands Biological Station
Highlands, North Carolina

INSTRUCTORS
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About the *course*

Natural history and taxonomy of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera), including systematics, ecology, and behavior of larvae and adults, with emphasis on those aspects important in ecological studies, biological monitoring of water quality, and sport fishing. Students will collect insects from mountain stream habitats and identify them in the laboratory.

PREREQUISITES

Students should have prior training in zoology, but not necessarily entomology.

OBJECTIVES: TO LEARN

1. the literature, characters, and methods for identification of EPT larvae (at least to genus) and adults (at least to family);
2. morphological, physiological, and behavioral modifications for life in fresh water;
3. life history characteristics and habitat preferences of the different EPT groups;
4. a variety of qualitative and semi-quantitative collecting techniques appropriate for ecological studies and biological monitoring of water quality.

Format and *evaluation*

Lectures will be about 50 minutes in duration. **Laboratories** and field trips will be about 180 minutes. The instructors will be available to assist with identifications for as long as students need them.

COLLECTION

Each student will be responsible for submitting an identified collection of EPT larvae and adults. A collection of at least 60 correctly identified and curated genera (larvae) and families (adults) will be evaluated as "Excellent." Students will collect specimens during scheduled field trips and on students' personal time; identification and curation of specimens will be accomplished during laboratory sessions and on students' own time.

EVALUATION

Final written examination	25%
Practical examination	25%
Collection	**50%**

GENDER IDENTITY

Your instructors are sensitive to gender identity diversity. Please let us know what name and pronouns are most affirming for you.

Required *texts*

Merritt, R.W., K.W. Cummins, and M.B. Berg, editors. 2019. *An Introduction to the Aquatic Insects of North America,* 5th Edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. Available without bookstore markup from Kendall Hunt.

The fifth edition (2019) enables identification of genera of both the aquatic and aerial forms of the freshwater insects in North America and includes updated ecological tables; earlier editions are far out of date. Please be aware that unauthorized copies of this book circulate online: they are substandard, cumbersome to use, do not include corrections made since the first printing, and infringe the publisher's copyright.

Morse, J.C., W.P. McCafferty, B.P. Stark, & L.M. Jacobus, editors. 2017. *Larvae of the Southeastern USA Mayfly, Stonefly, and Caddisfly Species.* Biota of South Carolina, Vol. 9. Technical Bulletin 1109, PSA Publishing, Clemson University, Clemson, South Carolina. 482 pp. Order print-on-demand for $40 from the Clemson University store. **Please tell the instructors if you want them to bring your purchased copy to you.**

Equipment and *supplies*

PROVIDED BY HIGHLANDS BIOLOGICAL STATION

- Microscope, with magnification of 6.7 to 80×
- Light source (incandescent)
- Alcohol preservative

Because you are more likely to be familiar with their operation and peculiarities, you may prefer to bring your own dissecting microscope and light source.

PROVIDED BY CLEMSON UNIVERSITY OR HIGHLANDS BIOLOGICAL STATION

- Watch glasses
- Kick screens
- Benthic nets
- White pans
- Brass sieves, #10 and #30
- Vials (but see below)
- Notebooks (providing PowerPoint lectures and supplemental information)

PROVIDED BY THE STUDENT, IN ADDITION TO THE REQUIRED TEXTS

1. Waders or sturdy wading shoes suitable for kicking stones (felt-covered soles help prevent slipping on slick rocks, but newer alternatives that do not spread fish diseases are available and recommended).
2. Field-collecting forceps: sturdy, fine point, straight tip, cheap. (A lanyard or float attached to these forceps will help prevent losing them in the water.)

3. Very fine-point laboratory forceps (2 pairs required). Options include: (a) 13.5 cm, with “biologie” tips (very fine, 0.1 × 0.06 mm), e.g., Dumont SS Fine Forceps, Fine Science Tools catalogue no. 11200-33, $40 each (the forceps used by your instructors and their students); (b) Towot SA-11, 140 mm, fine tip, straight, long/pointed; or (c) Towot SA-12, 135 mm, fine tip, straight.
4. Very fine-point, indelible-ink pen for writing labels, e.g., Sakura Micron Pigma pen, black, 0.2 mm #005 (art supply stores; Blick catalog no. 20702-2010).
5. Vials (optional; see below).
6. Scissors, for cutting paper labels.
7. A forceps repair kit (optional), to maintain your forceps: Fine Science Tools catalogue no. 29000-00, $105.
8. Any other equipment or supplies you have found useful for collecting or identifying aquatic insects.

> **Vials.** Vials for student collections will be provided, if desired. Students for whom vials are provided will contribute their collections to the Clemson University Arthropod Collection and the Highlands Biological Station. Students who provide their own vials will be able to retain most of their collections (up to 7 specimens may be kept by the CUAC and the HBS). If your laboratory has not yet begun maintaining a voucher collection, this will be a good opportunity to initiate this legally and scientifically significant resource. The Clemson University Arthropod Collection stocks and uses archival-quality vials, 4-dram screw-cap vials each with a conical polyethylene liner that fits inside the lip of its vial, and recommends this style for permanent storage of alcohol-preserved specimens: SS S912 clear screw-thread glass vials, which work best with CAP PS20 (black, phenolic, Taperseal liner). Other types of seals either allow evaporation or introduce specimen-damaging chemicals into the alcohol.

Course *outline*

1. Freshwater biotopes, habitat type, river continuum concept.
2. How to collect and preserve larval mayflies, stoneflies, and caddisflies (EPT) and other aquatic insects.
3. Insect morphology and special adaptations for aquatic life.
4. Orders of aquatic insects.
5. Evolution and natural history of mayflies (Ephemeroptera).
6. Identification of larvae of Ephemeroptera families.
7. Identification of larvae of southeastern Ephemeroptera genera.
8. Evolution and natural history of stoneflies (Plecoptera).
9. Identification of larvae of Plecoptera families.
10. Identification of larvae of southeastern Plecoptera genera.
11. Evolution and natural history of caddisflies (Trichoptera).
12. Identification of larvae of Trichoptera families.
13. Identification of larvae of southeastern Trichoptera genera.
14. Using Rapid Bioassessment Protocols and an EPT Index to monitor pollution of southeastern streams.

Course *schedule*

With consideration for optimal weather conditions, students will also undertake one night of light trapping for adult EPT. Times are a.m. until noon, p.m. after.

MONDAY June 21	8:00	**Lecture I.** Introductions, course objectives, schedule, evaluation procedures. Freshwater biotopes, habitat type, river continuum concept. *Merritt et al. 2019, Chapters 1, 5, 6*
	10:00	**Lecture II.** How to collect and preserve larval mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera = EPT) and other aquatic insects. *Merritt et al. 2019, Chapter 3*
	1:00	**Field trip.** Collecting EPT in an Appalachian third-order stream (East Fork Overflow Creek).
TUESDAY June 22	8:00	**Lecture III.** Insect morphology and special adaptations for aquatic life. *Merritt et al. 2019, Chapters 2, 4, 5*
	10:00	**Lecture IV.** Orders of aquatic insects. *Merritt et al. 2019, Chapters 8, 9, 10, 11*
	1:00	**Laboratory.** Insect morphology and diagnosis of orders of EPT larvae.
WEDNESDAY June 23	8:00	**Field trip.** Collecting EPT in a fifth-order stream (Chattooga River).
	1:00	**Lecture V.** Evolution and natural history of mayflies (Ephemeroptera). *Merritt et al. 2019, Chapter 13; Morse et al. 2017, Chapter 1*
	2:30	**Lecture VI.** Identification of larvae of Ephemeroptera families. *Merritt et al. 2019, Chapter 13; Morse et al. 2017, Chapter 2*
	4:00	**Laboratory.** Identification of larvae of Ephemeroptera families.
THURSDAY June 24	8:00	**Lecture VII.** Identification of larvae of southeastern Ephemeroptera genera. *Merritt et al. 2019, Chapter 13; Morse et al. 2017, Chapter 2*
	10:00	**Lecture VIII.** Identification of larvae of southeastern Ephemeroptera genera and of adults of families. *Merritt et al. 2019, Chapter 13*
	1:00	**Laboratory.** Identification of larvae of southeastern Ephemeroptera genera and of adults of families.
FRIDAY June 25	8:00	**Field trip.** Collecting EPT in a fourth-order stream (Whitewater River).
	1:00	**Lecture IX.** Evolution and natural history of stoneflies (Plecoptera) and identification of larvae of Plecoptera families. *Merritt et al. 2019, Chapter 16; Morse et al. 2017, Chapter 3*
	2:30	**Lecture X.** Identification of larvae of Plecoptera genera and adults of Plecoptera families.
	4:00	**Laboratory.** Identification of larvae of Plecoptera families and genera.

SATURDAY June 26	8:00	**Laboratory.** Identification of larvae and adults of southeastern EPT.
	1:00	**Personal time.** The laboratory and field equipment will be open to enable course participants to collect and identify specimens if they choose.
SUNDAY June 27	All day	**Personal time.** The laboratory and field equipment will be open to enable course participants to collect and identify specimens if they choose.
MONDAY June 28	8:00	**Field trip.** Collecting EPT in a third-order stream (East Fork Chattooga River) and a first-order stream source (unnamed tributary of Wash Branch).
	1:00	**Lecture XI.** Evolution and natural history of caddisflies (Trichoptera). *Merritt et al. 2019, Chapter 19; Morse et al. 2017, Chapter 4*
	2:30	**Laboratory.** Identification of larvae of southeastern Plecoptera genera and adults of their families.
TUESDAY June 29	8:00	**Lecture XII.** Identification of larvae of Trichoptera families. *Merritt et al. 2019, Chapter 19; Morse et al. 2017, Chapter 4*
	10:00	**Lecture XIII.** Identification of larvae of southeastern Trichoptera genera. *Merritt et al. 2019, Chapter 19; Morse et al. 2017, Chapter 4*
	1:00	**Laboratory.** Identification of larvae of Trichoptera families and genera.
WEDNESDAY June 30	8:00	**Lecture XIV.** Identification of larvae of southeastern Trichoptera genera.
	1:00	**Laboratory.** Identification of larvae of southeastern Trichoptera genera and of adults of their families.
THURSDAY July 1	8:00	**Lecture XV.** Using Rapid Bioassessment Protocols and an EPT Index to monitor for pollution of southeastern streams. *Merritt et al. 2019, Chapter 7*
	1:00	**Discussion.** Using Rapid Bioassessment Protocols and an EPT Index to monitor for pollution of southeastern streams (or optional field exercise in Ravenel Lake outflow).
	2:30	**Laboratory.** Identification of larvae and adults of southeastern EPT.

FRIDAY July 2	8:00	**Examination (1).** Closed-book examination on lecture information and reading assignments.
	9:00	**Examination (2).** Practical, open-book identification of Southern Appalachian EPT larvae to genus [or the optional SFS Taxonomic Certification Program Level 2 (genus-level), Eastern Group 2 (EPT) examination; participants must register separately for this option in advance at stroudcenter.org/sfstcp/exam]. Collection submission.
	12:00	**Departure:** course participants.
	1:00	**Examination.** SFS Taxonomic Certification Program Level 2 (genus-level) exam for any taxonomic group. Anyone may take this examination, including persons who did not undertake the EPT course. Examinees must register in advance at stroudcenter.org/sfstcp/exam/schedule.
	4:00	**Departure:** second SFS certification exam participants.

Highlands Biological Station · 265 N. Sixth Street, Highlands, NC 28741 Schedule subject to change with weather and conditions.