Taxonomy and Natural History of Southern Appalachian Mayflies, Stoneflies, and Caddisflies
6–18 July 2026 (Session 1) or 3–15 August 2026 (Session 2)

SYLLABUS

COURSE DESCRIPTION: 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 the 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.

INSTRUCTOR: J.C. Morse (864-367-6342, jmorse@clemson.edu)
TEACH ASSIST: Session 1: A. Orfinger (386-290-2505, aorfinger@daltonstate.edu)
Session 2: K.M. Murray-Stoker (229-402-2417, kmmurray14@gmail.com)

LECTURES: All lectures will be ~50 minutes in duration.

LABORATORIES: All scheduled laboratories and field trips will be ~180 minutes. The instructor and/or teaching assistant 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: Student evaluation will be based on a final written (25%) and practical (25%) examination, and on the collection (50%).

GENDER IDENTITY: Your instructor and teaching assistant 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, P.O. Box 539, Dubuque, Iowa 52001. Available without bookstore markup from https://he.kendallhunt.com/product/introduction-aquatic-insects-north-america
[The FIFTH EDITION of this book (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 there is a piracy problem with this book. It is being offered free of charge on one or more websites. The quality of the unauthorized book is substandard, it is very cumbersome to use (especially moving between text and figures), and it does not incorporate changes made since the first printing. The act of unauthorized copying or distributing is not a "victimless" crime. It threatens jobs, employees, and viability of companies whose goal is to bring reasonably priced educational products to market in the most convenient and efficient way. When products are copied or distributed without authorization, the impact is immediate—in the form of lost sales, royalties, income and, perhaps most importantly, the incentive to create new educational products and product delivery methods. Anyone who knowingly participates in this piracy process could be liable for contributory infringement of copyright protected works and subject to substantial fines.

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, USA. 482 pp. Library of Congress Control Number: 2017933502. Order by Print-on-Demand for $40 from the following website:
https://secure.touchnet.net/C20569_ustores/web/store_cat.jsp?STOREID=168&CATID=352&SINGLESTORE=true
PLEASE TELL ME IF YOU WANT ME TO BRING YOUR PURCHASED COPY TO YOU.

EQUIPMENT AND SUPPLIES:

Provided by Highlands Biological Station
Microscope - With magnification of 6.7 to 80 X.
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 note below)
Notebooks (providing PowerPoint lectures and supplemental information).

Provided by Student (in addition to 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**). Some options are the following:
(a) 13.5 cm, with "biologie" tips (**very fine**, 0.1 x 0.06 mm) (e.g., Dumont SS Fine Forceps, Fine Science Tools https://www.finescience.com/en-US/Products/Forceps-Hemostats/Dumont-Forceps/Dumont-SS-Fine-Forceps/11200-33 , Catalogue Number 11200-33, $40 ea). [These are the forceps used by your instructors and their students.]
(b) Towot SA-11, 140 mm, fine tip, **straight**, long/pointed
https://www.amazon.com/Electronics-Experimental-Jewelry-Making-Non-Magnetic-TOWOT/dp/B09J95YPXF?th=1
or
(c) Towot SA-12, 135 mm, fine tip, **straight**
https://www.amazon.ae/Electronics-Experimental-Jewelry-Making-Industrial-TOWOT/dp/B09J95H7X2/ref=pd_day0_d_sccl_3_1/261-9826154-4493861?pd_rd_w=GPTNQ&content-id=amzn1.sym.0f8b5c78-bef2-4995-a2a2-12a1821132e8&pf_rd_p=0f8b5c78-bef2-4995-a2a2-12a1821132e8&pf_rd_r=58J4TRBK4T4F8099RKC0&pd_rd_wg=7nJ1R&pd_rd_r=ed7e19ce-6f64-4461-adb9-5a9466512dd7&pd_rd_i=B09J95H7X2&th=1

(4) **Very fine-point**, indelible-ink pen (for writing labels) (e.g., Sakura Micron Pigma pen, black, 0.2 mm #005, available at art supply stores or at https://www.dickblick.com/items/sakura-pigma-micron-pen-set-black-005-set-of-3/ , Catalog Number 20702-2010).

(5) Vials (optional, see below)

(6) Scissors (for cutting paper labels)

(7) A forceps repair kit (optional). You may need one to maintain your forceps (Fine Science Tools, Catalogue Number 29000-00, $105.00 ea)
https://www.finescience.com/en-US/Products/Instrument-Care-Accessories/Sharpening-Stones/Repair-Kit-for-Dumont-Forceps

(8) Any other equipment/supplies you have found useful for collecting or identifying aquatic insects.

VIALS:
Vials for student collections will be provided, if desired. Those 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 cap with a conical polyethylene liner that fits inside the lip of its vial, and recommends this style for permanent, archival storage of alcohol-preserved specimens [< https://www.acmevial.com/vial-manufacturing/item-details.asp?idvial=110 > SS S912, Clear Screw Thread Glass Vial. These vials work best with https://acmevial.com/products/20-400-black-phenolic-cap-cone-lined/ CAP PS20 (Black, Phenolic, Taperseal Liner). Other types of seals on the vials either allow evaporation or introduce specimen-damaging chemicals into the alcohol.

COURSE OUTLINE:
Freshwater biotopes, habitat type, river continuum concept.
How to collect and preserve larval mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera = EPT) and other aquatic insects.
Insect morphology and special adaptations for aquatic life.
Orders of aquatic insects.
Evolution and natural history of mayflies (Ephemeroptera).
Identification of larvae of Ephemeroptera families.
Identification of larvae of southeastern Ephemeroptera genera.
Evolution and natural history of stoneflies (Plecoptera).
Identification of larvae of Plecoptera families.
Identification of larvae of southeastern Plecoptera genera.
Evolution and natural history of caddisflies (Trichoptera).
Identification of larvae of Trichoptera families.
Identification of larvae of southeastern Trichoptera genera.
Using Rapid Bioassessment Protocols and an EPT Index to monitor pollution of southeastern streams.

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SCHEDULE:
Also, with consideration for optimal weather conditions, students will undertake one night of light trapping for adult EPT.

Mon	0800	Lecture I:	Introductions, course objectives, schedule, evaluation procedures. Freshwater biotopes, habitat type, river continuum concept. Merritt et al., 2019, Chapters 1, 5, 6
	1000	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
	1300	Field Trip:	Collecting EPT in an Appalachian third-order stream (East Fork Overflow Creek).
Tue	0800	Lecture III:	Insect morphology and special adaptations for aquatic life. Merritt et al., 2019, Chapters 2, 4, 5
	1000	Lecture IV:	Orders of aquatic insects. Merritt et al., 2019, Chapters 8, 9, 10, 11
	1300	Laboratory:	Insect morphology and diagnosis of orders of EPT larvae.
Wed	0800	Field Trip:	Collecting EPT in a fifth-order stream (Chattooga River).
	1300	Lecture V:	Evolution and natural history of mayflies (Ephemeroptera). Merritt et al. 2019, Chapter 13 Morse et al. 2017, Chapter 1
	1430	Lecture VI:	Identification of larvae of Ephemeroptera families. Merritt et al. 2019, Chapter 13 Morse et al. 2017, Chapter 2
	1600	Laboratory:	Identification of larvae of Ephemeroptera families.

Thur	0800	Lecture VII:	Identification of larvae of southeastern Ephemeroptera genera. Merritt et al. 2019, Chapter 13 Morse et al. 2017, Chapter 2
	1000	Lecture VIII:	Identification of larvae of southeastern Ephemeroptera genera and of adults of families. Merritt et al. 2019, Chapter 13
	1300	Laboratory:	Identification of larvae of southeastern Ephemeroptera genera and of adults of families.
Fri	0800	Field Trip:	Collecting EPT in a fourth-order stream (Whitewater River).
	1300	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
	1430	Lecture X:	Identification of larvae of Plecoptera genera and adults of Plecoptera families.
	1600	Laboratory:	Identification of larvae of Plecoptera families and genera.
Sat	0800	Laboratory:	Identification of larvae and adults of southeastern EPT.
	1300		Personal time. The laboratory and field equipment will be open to enable course participants to collect and identify specimens if they choose.
Sun	All day		Personal time. The laboratory and field equipment will be open to enable course participants to collect and identify specimens if they choose.
Mon	0800	Field Trip:	Collecting EPT in a third-order stream (East Fork Chattooga River) and a first-order stream source (unnamed tributary of Wash Branch).
	1300	Lecture XI:	Evolution and natural history of caddisflies (Trichoptera). Merritt et al. 2019, Chapter 19 Morse et al. 2017, Chapter 4
	1430	Laboratory:	Identification of larvae of southeastern Plecoptera genera and adults of their families.

Tue	0800	Lecture XII:	Identification of larvae of Trichoptera families. Merritt et al. 2019, Chapter 19 Morse et al. 2017, Chapter 4
	1000	Lecture XIII:	Identification of larvae of southeastern Trichoptera genera. Merritt et al. 2019, Chapter 19 Morse et al. 2017, Chapter 4
	1300	Laboratory:	Identification of larvae of Trichoptera families and genera.
Wed	0800	Lecture XIV:	Identification of larvae of southeastern Trichoptera genera.
	1300	Laboratory:	Identification of larvae of southeastern Trichoptera genera and of adults of their families.
Thu	0800	Lecture XVI:	Using Rapid Bioassessment Protocols and an EPT Index to Monitor for pollution of southeastern streams. Merritt et al. 2019, Chapter 7
	1300	Discussion:	Using Rapid Bioassessment Protocols and an EPT Index to Monitor for pollution of southeastern streams (or optional field exercise in Ravenel Lake outflow).
	1430	Laboratory:	Identification of larvae and adults of southeastern EPT.
Fri	0800	Examination (1):	Closed-book examination on lecture information and reading assignments.
	0900	Examination (2):	Practical, open-book identification of Southern Appalachian EPT larvae to genus [or optional SFS Taxonomic Certification Program Level 2 (genus-level), Eastern Group 2 (EPT) examination – Participants must register separately for this option by 12 June 2025 [registration at https://stroudcenter.org/sfstcp/exam/ or https://stroudcenter.org/sfstcp/exam/schedule/]. Collection submission.
	1200	Departure:	Course Participants.
	1300	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, but any who wish to attempt certification for any Group. Examinees must register for

		this option IMMEDIATELY [registration at https://stroudcenter.org/sfstcp/exam/ or https://stroudcenter.org/sfstcp/exam/schedule/].
1600	Departure:	Second SFS Certification Exam Participants.