Entomological Techniques and Data Analysis: Syllabus

ENTOMOLOGY 6707, AUTUMN 2024

Course Information

Course times and location: Tuesdays and Thursdays, 1:30 – 2:50 PM (synchronous online via Zoom)
Credit hours: 3
Mode of delivery: Distance Learning
Zoom link: https://osu.zoom.us/j/94936777085?pwd=ao0XmlUUyYkQZdiYrLg3aVAzSZg7g7.1

Instructors

Name: Dr. Kayla I Perry, Ph.D., Assistant Professor, Department of Entomology
Email: perry.1864@osu.edu (preferred contact method)
Phone Number: 330-263-8002
Office location: 258 Wooster Science Building
Office hours: By appointment.

Name: Dr. Samuel F Ward, Ph.D., Assistant Professor, Department of Entomology
Email: ward.1792@osu.edu (preferred contact method)
Phone Number: 614-292-3286
Office location: 408C Kottman Hall
Office hours: By appointment.
Preferred means of communication:

- Our preferred method of communication for questions is **email.**

- Class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to be sure you receive these messages.

Course Prerequisites/Co-Requisites

None

Course Description

Students will be introduced to the design and analysis of simple experiments and studies frequently used in entomology. This hands-on course will cover analysis of data generated from commonly-used entomological techniques and observational approaches. Throughout, students will use and analyze data using statistical and version control software programs commonly used in the scientific community (i.e., Excel, R, RStudio, Git, and GitHub).

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Learning Goals and Outcomes

Goal 1: Students will engage in statistical analyses as applied in entomology and use this knowledge to design and interpret results from their own experiments.

Learning objectives for Goal 1

Students will:

- Demonstrate proficiency in conducting and interpreting analyses of data generated from entomological techniques.
- Design simple experiments and distinguish between observational vs. experimental approaches.

Goal 2: Students will understand best practices in data management and become good communicators of statistical results within their discipline.

Learning objectives for Goal 2

Students will:

- Design a laboratory/field logbook and digital repository to keep track of important activities related to an experiment and analysis.
- Use common software to graph and analyze data sets.
- Determine the type(s) of data, such as continuous and categorical, generated from entomological techniques, and develop knowledge of how to choose appropriate statistical tests based on data type.
- Produce informative, quantitative summaries in tables and figures that would be suitable for peer-reviewed publications.

How This Course Works

Mode of delivery: Online lectures will be synchronous and thus students are expected to attend virtually during the scheduled meeting times. To that end, reliable internet access through a desktop or laptop computer is required along with a webcam.

The syllabus will be posted to CarmenCanvas, whereas lectures, assignment descriptions, and other class resources will be posted to the course GitHub page. Students will submit assignments for grading via CarmenCanvas.

Credit hours and work expectations: This is a 3 credit-hour course. According to Ohio State bylaws on instruction (go.osu.edu/credithours), students should expect around 3 hours per week of time spent on direct instruction (instructor content and CarmenCanvas activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of [C] average.

Attendance and participation requirements: Research shows regular participation is one of the highest predictors of success. With that in mind, we have the following expectations for everyone's participation:

- **Attendance of online synchronous classes**: **twice a week**
  You are expected to attend class each week during the scheduled meeting sessions. If you have a situation that might cause you to miss an entire week of class, discuss it with us *as soon as possible.* Attendance will not be recorded per se, but there are weekly, in-class activities that students will be required to submit before the end of the lecture in which they are assigned (please see "In-class Activities" in the Grading and Faculty Response section for more details).

Course Materials and Technologies

Required Materials and/or Technologies

- Textbook not required.

- Course readings are listed in this syllabus and will be posted to the course GitHub.

Required Equipment

- **Computer:** current Mac (MacOS) or PC (Windows 10) with high-speed internet connection.

- **Webcam:** built-in or external webcam, fully installed and tested

- **Microphone:** built-in laptop or tablet mic or external microphone

- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

If you do not have access to the technology you need to succeed in this class, review options for technology and internet access (go.osu.edu/student-tech-access).

Required Software

Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Visit the installing Office 365 (go.osu.edu/office365help) help article for full instructions.

R Software: Freely available for download at https://www.r-project.org/

RStudio Software: Freely available for download at https://posit.co/downloads/

Git Software: Freely available for download at https://git-scm.com/

GitHub Desktop: Freely available for download at https://desktop.github.com/

GitHub Account: Go to https://github.com/ to sign up for a free account.

CarmenCanvas Access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in CarmenCanvas. To ensure that you are able to connect to CarmenCanvas at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device (go.osu.edu/add-device) help article for step-by-step instructions.

- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes, good for 365 days, that can each be used once.

- [Install the Duo Mobile application](#) (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at [614-688-4357 (HELP)](#) and IT support staff will work out a solution with you.

Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- [Navigating CarmenCanvas](#) (go.osu.edu/canvasstudent)
- [CarmenZoom virtual meetings](#) (go.osu.edu/zoom-meetings)

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat**: [go.osu.edu/it](#)
- **Phone:** [614-688-4357 (HELP)](#)
- **Email:** [servicedesk@osu.edu](#)

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Grading and Faculty Response

How Your Grade is Calculated

Assignment Category	Points
In-class Activities (*N*=10 worth 2 points each)	**20**
R/GitHub Assignments (*N*=11 worth 4 points each; drop the lowest score)	**40**
Group Project	**40**
Letter of intent	1
Preliminary data analysis	4
First submission	8
Peer review	5
Presentation	10
Final submission	12
Total	**100**

Descriptions of Major Course Assignments

In-class activities

Description: There will be at least 15 in-class activities throughout the semester (at least one per week), **ten** of which must be completed for full credit. Activities will involve tasks like short answer writing prompts, coding problems (e.g., making a simple graph), identifying an appropriate statistical analysis given some data, and interpreting R output, among others. You will be given sufficient time in class to complete such activities, and each activity will need to be submitted via CarmenCanvas by the end of the lecture in which it was assigned.

R/GitHub Assignments

Description: The assignments will typically involve the use of GitHub and R (both of which are free to use and download) and be provided at regularly scheduled class meeting times. The first few lectures will introduce students to software, and no prior experience with R/GitHub is expected. A laptop with moderate computing power will be necessary to complete course assignments.

You will be assigned 11 problem sets each worth 4 points (the lowest score will be dropped). The first two problem sets are only graded for completeness (i.e., evaluating whether a genuine attempt was made on each question) so that you can get a sense of the minimum amount of information required for full credit before being formally assessed; problems sets 3-11 will be evaluated for clarity as well as correctness. Problem sets emphasize understanding, synthesis, and application and are designed to equip students with a quantitative skillset so that they feel comfortable organizing, analyzing, interpreting, and presenting data long after they have completed the course.

For each problem set, you will be required to submit an organized answer sheet – generated via R markdown within Rstudio – to the course webpage. When applicable, answers should include the code you used, the relevant output, and any required written response(s). Problem sets will be posted on Tuesdays and due the following Tuesday by 5:00pm (i.e., one week later). Specific due dates will be posted on CarmenCanvas. Please submit all assignments through CarmenCanvas.

Academic integrity and collaboration: Students should make frequent use of Google and/or the several textbooks available (some freely) to R users. This course is meant to reflect the "real world" and you should use the resources available to you, including your peers (group work is encouraged!). However, we expect each of you to submit your own work for these assignments.

Group Project

Description: Instructors will randomly assign students to groups of 3-4 to complete a semester project. This is a tiered project with multiple assignments due throughout the semester that build on the final completed project report and presentation. This is an extremely flexible project in which each group will propose, complete, and present a statistical analysis on a data set of their choosing. The goal is to gain hands-on experience with collaboration, data analysis, and written/oral presentation of quantitative information. Students are welcomed to source data from thesis/dissertation work (please clear this option with adviser(s)), previously published datasets (e.g., from a lab mate, adviser, or elsewhere in the primary literature), or open-source options (e.g., NSF National Ecological Observation Network (NEON) data, NSF Long Term Ecological Research Network (LTER) data). Regardless of the data source, the analysis should be entirely novel. Each group will be expected to create a GitHub repository for their project where each member will have collaborator access.

Note on collaboration: for each item below, only one document is required to be submitted per group. All submissions should be completed through CarmenCanvas. As described in the

Letter of Intent below, the role of each student in a group should be clearly defined from the beginning. However, each assignment below is to be accompanied by a short (1-2 sentence) description of each member's contribution that is signed by all group members. In the event of imbalanced group efforts – as reported by students or perceived by the instructors – each member of a given group will be asked to submit a peer evaluation of each member's contributions at that time. The authors of each review will remain anonymous, and the instructors may adjust assignment grades accordingly to reflect actual contributions. Otherwise, all members of the group will receive the same grade per assignment.

Note on references: Throughout all assignments, be sure to cite your sources. Reporting of citations and references should be formatted as appropriate for submission to a peer reviewed journal (e.g., https://academic.oup.com/jee/pages/Manuscript_Preparation#References).

Letter of Intent (1 page) Letters should propose the research question and outline planned efforts. Please include a brief description of the data source and structure, potential analyses to be conducted, and responsibilities of each group member (including roles in the final presentation). The objective of this assignment is to ensure that projects are of an appropriate scope and responsibilities are distributed equally among group members.

Preliminary data analysis (1-2 pages or a video presentation) Provide a description of the data, including but not limited to the source (e.g., thesis data, published data), any data wrangling undertaken to prepare the data for analysis, summary statistics for relevant variables, variable types (e.g., categorical vs. continuous), potential challenges in analysis (e.g., violations of normality; pseudoreplication), and pertinent graphical depictions. If using a published database or data from a publication, please provide a complete citation and explain how your analyses build upon any existing analyses of those data.

First submission (3-5 pages) An initial draft of your report will be submitted for peer review. Similar to submitting a manuscript for the first time, each group should strive to produce the highest quality product possible for this submission. However, we will grade this submission mainly based on completeness and will reserve more rigorous evaluation for the final submissions. Our hope is that this first submission and peer review process (we will also provide feedback!) will help each group produce a more polished final product. See "Peer reviews" for more detail.

This report should reflect a short manuscript, with an Abstract, Introduction, Materials and Methods, Results, Discussions, References, and Tables/Figures (as appropriate). This initial report submission should be double-spaced and include continuous line numbers and page numbers to facilitate review.

Peer reviews When you submit a proposal or a manuscript for publication, it will be reviewed by subject matter experts that provide feedback and (hopefully) helpful critiques. In the case of research manuscripts, if the paper is not rejected after the first round of review, authors are invited to make revisions in which they can respond to and incorporate reviewer comments. Once you publish a paper, you might be asked to review a paper! So, it's helpful to practice.

To gain exposure to this process, the instructors will randomly assign peer reviewers (exact number of reviewers will be dictated by course enrollment) to the first submission of each project. Reviewers will have two to three weeks to complete their review. Authors will then be required to respond to those reviews and incorporate reviewer feedback into their final project.

More guidance on peer review will be provided, including proper formatting, but try to remember the "golden rule" and treat others as you wish to be treated. Be thorough, respectful, and aim to improve the work rather than needlessly criticize.

Presentation Each group will deliver a presentation (~15 minutes, depending on course enrollment) on their final project to include a description of the research question, its relevance to the field/society, the structure of the data, the statistical analyses and potential challenges therein, and broader implications of the findings. The slide deck will be submitted through CarmenCanvas, and both scientific content and presentation style (including slide design) will be graded following the rubric used in the Student 10-minute Paper Competition at the Entomological Society of America (https://www.entsoc.org/events/annual-meeting/student-competition/ten-minute-paper).

Final submission (3-5 pages) A final, written report of the project should be submitted along with responses to peer reviews. Formatting of the final submission should be equivalent to the first submission, but the final submission should incorporate feedback from peer reviewers and instructors.

Academic integrity and collaboration: Students are expected to contribute to the project as per the outlined responsibilities of each group member documented in the letter of intent. However, collaboration to complete the project is required such that only one submission per group is required for each assignment.

Late Assignments

Please refer to the course schedule in the syllabus or CarmenCanvas for due dates. Due dates are set to help you stay on pace and to allow timely feedback that will help you complete subsequent assignments.

An assignment that is submitted late will be reduced in value 5% per day that it is late. In the case of an emergency or illness, contact the instructors as soon as possible to discuss potential accommodations that will be determined on a case-by-case basis.

Instructor Feedback and Response Time

We are providing the following list to give you an idea of our intended availability throughout the course. Remember that you can call 614-688-4357 (HELP) at any time if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact us first through our Ohio State email addresses. We will reply to emails within **24 hours on days when class is in session at the university**.

- **Class announcements:** We will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.

- **Grading and feedback:** For assignments submitted before the due date, we will try to provide feedback and grades within **seven days**. Assignments submitted after the due date may have reduced feedback and grades may take longer to be posted.

Grading Scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

Other Course Policies

Discussion and Communication Guidelines

The following are expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably.

- **Citing your sources**: For R assignments and the group project, please cite the sources used to complete the work.

Academic Misconduct/ integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute Academic Misconduct.

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: Any activity that tends to compromise the academic integrity of the University, or subvert the educational process. Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Disability accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Counseling and Consultation Services/Mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing.

If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614¬-292-¬5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Columbus
For students in the College of Food, Agricultural, and Environmental Sciences, David Wirt, wirt.9@osu.edu, is the CFAES embedded mental health counselor on the Columbus campus. To contact David, please call 614-292-5766. Students should mention their affiliation with CFAES if interested in speaking directly with David.

Wooster

Dr. Schaad, schaad.15@osu.edu, is the CFAES embedded mental health counselor in Wooster. She is available for new consultations and to establish routine care. To schedule with Dr. Schaad, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

Creating an environment free from harassment, discrimination and sexual misconduct.

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate based on age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:
1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:
- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

Diversity Statement

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from

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diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment.

To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit:

- https://odi.osu.edu/
- https://odi.osu.edu/racial-justice-resources
- https://odi.osu.edu/focus-on-racial-justice
- https://cbsc.osu.edu/

In addition, this course adheres to **The Principles of Community** adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at https://go.osu.edu/principlesofcommunity. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (https://equityandinclusion.cfaes.ohio-state.edu/). If you have been a victim of or a witness to harassment or discrimination or a bias incident, you can report it online and anonymously (if you choose) at https://equity.osu.edu/.

Religious Accommodations

Our inclusive environment allows for religious expression. Students requesting accommodations based on faith, religious or a spiritual belief system in regard to examinations, other academic requirements or absences, are required to provide the instructor with written notice of specific dates for which the student requests alternative accommodations at the earliest possible date. For more information about religious accommodations at Ohio State, visit odi.osu.edu/religious-accommodations.

Weather or short-term closing

Should in-person classes be canceled, I will notify you as to which alternative methods of teaching will be offered to ensure continuity of instruction for this class. Communication will be via an announcement on Carmen Canvas.

Artificial Intelligence and Academic Integrity Statement

There has been a significant increase in the popularity and availability of a variety of generative artificial intelligence (AI) tools, including ChatGPT, Sudowrite and others. These tools will help shape the future of work, research and technology but when used in the wrong way, they can stand in conflict with academic integrity at Ohio State.

All students have important obligations under the Code of Student Conduct to complete all academic and scholarly activities with fairness and honesty. Our professional students also have the responsibility to uphold the professional and ethical standards found in their respective academic honor codes. Specifically, students are not to use unauthorized assistance in the laboratory, on field work, in scholarship or on a course assignment unless such assistance has been authorized specifically by the course instructor. In addition, students are not to submit their work without acknowledging any word-for-word use and/or paraphrasing of writing, ideas or other work that is not your own. These requirements apply to all students undergraduate, graduate, and professional.

To maintain a culture of integrity and respect, these generative AI tools should not be used in the completion of course assignments unless an instructor for a given course specifically authorizes their use. Some instructors may approve of using generative AI tools in the academic setting for specific goals. However, these tools should be used only with the explicit and clear permission of each individual instructor, and then only in the ways allowed by the instructor.

Course Schedule

Refer to the CarmenCanvas course for up-to-date due dates.

Week	Date	Topic	Lead K=K.Perry S=S.Ward	Asgmt Posted	Due	Reading
1	20-Aug	Class introduction, discussion of syllabus	K,S	Practice		
	22-Aug	Intro to R/R studio	K,S			Beckerman & Childs (Ch. 1)
2	27-Aug	Data entry and logbook curation; GitHub; Open Science	K	1		Broman & Woo (2018)
	29-Aug	Keeping electronic records and backing up data				Borer et al. (2009)
3	3-Sep	Using basic statistical designs; importance of appropriate replication	S	2		Hurlbert (1984)
	5-Sep	Sampling, variables, and distributions			Letter of Intent	
4	10-Sep	Data wrangling; tidyverse	S	3		
	12-Sep	Data visualization; ggplot2				Weissgerber et al. (2015)
5	17-Sep	Analyzing and presenting insect feeding data (t-tests; nonparametrics)	K	4		
	19-Sep					

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6	24-Sep	Randomized complete block designs (ANOVA)	S	5		
	26-Sep				Preliminary data analysis	
7	1-Oct	Randomized complete block designs (ANOVA)	S			
	3-Oct					
8	8-Oct	Analyzing and presenting insect growth data (Simple linear regression)	K	6		
	10-Oct	Autumn Break - No Class				
9	15-Oct	Observational studies in entomology and open source data (Multiple linear regression)	K	7		
	17-Oct					
10	22-Oct	Dealing with repeated measurements (Mixed-effects models)	S	8		Harrison et al. (2018)
	24-Oct				First Submission	
11	29-Oct	Analyzing and presenting insect survival and trapping data (GLMMs)	S	9		Bolker et al. (2009)
	31-Oct					
12	5-Nov	Election Day (asynchronous learning only)	K			

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	7-Nov	Analyzing and presenting insect biodiversity surveys (biodiversity metrics)				
13	12-Nov	ESA		10		
	14-Nov	ESA				
14	19-Nov	Analyzing and presenting insect biodiversity surveys (PCA, NMDS)	K	11		
	21-Nov	Presentations	K,S		Peer review	
15	26-Nov	Presentations	K,S			
	28-Nov	Thanksgiving Break - No Class				
16	3-Dec	Presentations (Last day of class)	K,S			
	5-Dec	No class			Final Project	

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References for assigned readings:

Beckerman, A. P., and D. Z. Childs. 2017. Getting started with R: an introduction for biologists.

Bolker, B. M., M. E. Brooks, C. J. Clark, S. W. Geange, J. R. Poulsen, M. H. H. Stevens, and J.-S. S. White. 2009. Generalized linear mixed models: a practical guide for ecology and evolution. Trends in Ecology & Evolution. 24: 127–135.

Borer, E. T., E. W. Seabloom, M. B. Jones, and M. Schildhauer. 2009. Some simple guidelines for effective data management. Bulletin of the Ecological Society of America. 90: 205–214.

Broman, K. W., and K. H. Woo. 2018. Data organization in spreadsheets. American Statistician. 72: 2–10.

Harrison, X. A., L. Donaldson, M. E. Correa-Cano, J. Evans, D. N. Fisher, C. E. D. Goodwin, B. S. Robinson, D. J. Hodgson, and R. Inger. 2018. A brief introduction to mixed effects modelling and multi-model inference in ecology. PeerJ. 6: e4794.

Hurlbert, S. H. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs. 54: 187–211.

Johnson, J. B., and K. S. Omland. 2004. Model selection in ecology and evolution. Trends in Ecology & Evolution. 19: 101–108.

Makin, T. R., and J.-J. Orban de Xivry. 2019. Ten common statistical mistakes to watch out for when writing or reviewing a manuscript. eLife. 8: e48175.

Spurgeon, D. W. 2019. Common Statistical Mistakes in Entomology: Pseudoreplication. American Entomologist. 65: 16–18.

Weissgerber, T. L., N. M. Milic, S. J. Winham, and V. D. Garovic. 2015. Beyond bar and line graphs: time for a new data presentation paradigm. PLOS Biology. 13: e1002128.