

Bioacoustics and Soundscape Ecology, May 2025

Instructor Information:

Lead Instructor: Dr. Ian Jones (he/him/his)
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Cornell Course # ___ (3 Credits)

UNH Course # ___ (4 Credits)

Start Date: May 19, 2025

End Date June 02, 2025

Class Enrollment Limit: 12

Classroom: TBD

Laboratory: TBD

Syllabus and Course Schedule

General Course Description:

In this course students will gain hands-on introductory experience in bioacoustics and soundscape ecology research, including biological concepts behind animals' sound production and hearing, skills for deploying acoustic sensors in terrestrial and underwater habitats, and acoustic data analysis methods. The course will consist of several lectures covering fundamental concepts in acoustics, soundscapes, and digital sound signal processing. The majority of class time will be spent deploying and recovering acoustic sensors and conducting experiments in the field, as well as in computer-lab sessions to analyze and summarize collected data. We will primarily focus on "Passive Acoustic Monitoring (PAM)" which involves non-invasive recording of sounds present in an environment (i.e., soundscapes) with microphones (when deployed on land) or hydrophones (when deployed underwater). Gulls and other seabird residents of the Isles of Shoals will be the main focal animals for terrestrial field work, and opportunistic recordings may be made of other vocalizing animal inhabitants including mammals, fishes, and invertebrates. Students will further learn how to study the contributions of anthropogenic sounds (i.e., from human-made sources) to natural soundscapes. Students will also conduct field-based acoustic playback experiments to study how different properties of gull vocalizations influence gull behavior.

Student Learning Objectives: At the completion of this course, students will be able to:

1. Deploy and recover passive acoustic sensors (microphones, hydrophones) in terrestrial and aquatic habitats.
2. Analyze and visualize bioacoustic data (soundscapes, animal vocalizations) using software commonly used by bioacoustics researchers

3. Conduct acoustic playback experiments in the field and measure animal (e.g., herring gull) behavioral responses to sound.
4. Explain how animals across multiple taxa (e.g., mammals, birds, fishes) hear and produce sounds, and appreciate the diverse roles that sounds play in ecology.
5. Apply fundamental physical acoustic, biological, and ecological concepts to interpret bioacoustic data and results.

Suggested Prerequisites:

Bioacoustics is interdisciplinary by nature, and bioacousticians often apply fundamental physical and mathematical concepts to answer fascinating biological questions involving acoustics. Introductory Biology, Physics, and Calculus I will be helpful, but these are not required.

Reading Materials:

No primary textbook will be required for the course, and all readings and resources will be provided digitally. Peer-reviewed articles, book chapters, and tutorials will be provided to support each course topic.

Materials for students to bring:

Required:

- A weatherproof field notebook. Rite in The Rain notebooks like these are strongly suggested: <https://www.amazon.com/gp/product/B00YDGV50G>
- Your own laptop, for using sensor deployment software, data analysis software, writing, and reading.
 - Laptops will need to have Word, Excel, or equivalent software installed for writing and data analysis.
 - All acoustic analysis software we will use during the class can run on Windows and Mac OS
- Waterproof footwear (e.g. rainboots), and rain jackets, as we may be out in the field during rainy weather and in the intertidal zone

Required Software/Apps:

- To save time during the course, please download the following (free) software **before you arrive at Shoals Marine Lab**, following instructions below to your personal laptop you will be bringing:
 1. Audacity: <https://www.audacityteam.org/download/>
 2. Raven Lite: <https://www.ravensoundsoftware.com/software/raven-lite/>
 3. MANTA: <https://bitbucket.org/CLO-BRP/manta-wiki/wiki/MANTA%20Downloads%20and%20Installation%20Video>
- Additionally, please download the below apps compatible your smartphone before our first field activity with soundscapes. (if you do not have a smartphone covered below please let the instructor know and we will work to accommodate you)
 1. *Apple iOS users:* “SpectrumView”, by Oxford Wave Research (access from the App Store)
 2. *Android users:* “Spectroid”, by Carl Reinke (access from Google Play)
 3. *Apple iOS and Android users:* Merlin Bird ID, by Cornell Lab of Ornithology

- In the app, download the “US: Northeast” Bird Pack

Optional, but recommended:

- Good-quality headphones, for acoustic data analysis. The ideal headphones have active noise cancelling and fit over (to fully enclose) the ear. The second-best headphones over-the-ear without a noise cancelling function. The goal here is to have headphones that isolate you well from surrounding sounds so you can hear subtle or quiet sounds in your acoustic data. We will have several pairs of assorted headphones for students who cannot bring their own.
- Swimwear and snorkel gear (mask, snorkel, fins, wetsuit) for deploying acoustic sensors in nearshore water. This course **does not require** students to swim or snorkel, however having this gear may expand underwater acoustic sensor deployment opportunities for interested students.
- Binoculars, to observe behavior of vocalizing animals from afar.

Assignments and Grading:

- Field & Lab activities: 30%
- Quizzes: 15%
 - Quiz 1: physical acoustics & audio data recording
 - Quiz 2: animal hearing & sound production
 - Quiz 3: soundscape ecology, & noise
- Sound library database: 15%
- Final project oral presentation: 15%
- Final project written report: 15%
- Participation: 10%

Expectations and Conduct:

Students are expected to read and understand all information presented in this syllabus. If you have questions about any part of the syllabus and course structure, please reach out to the instructor as early as possible.

Safety training will take place on the day of students’ arrival to Shoals Marine Lab. Students are expected to understand and adhere to all safety policies, including but not limited to boat safety, swimming and snorkeling, general and medical emergencies, fire safety, and field and lab guidelines specific to the work they will be performing in this course.

Students are *always* encouraged to ask questions, and to reach out to the instructor if they encounter difficulties with any of the activities or materials covered in this course. We will work with you to review material and skills and adapt as needed to ensure every student achieves all learning objectives.

Attendance is expected for all class sessions. If you must miss class due to ill health or other personal emergencies, please let the instructor know as early as possible.

During class sessions (lectures and labs) you may use your laptop to take notes if you wish, but please turn off WiFi (unless required for accessing online materials specific to the class), close background apps, and silence cell phones to avoid creating distractions.

Academic Integrity:

Students are expected to adhere to the highest standards of academic honesty and integrity. Cheating, plagiarism, or other violations of academic principles will be handled according to UNH policy (<https://catalog.unh.edu/srrr/university-policies-regulations/academic-integrity/>) and Cornell policy (<https://deanoffaculty.cornell.edu/faculty-and-academic-affairs/academic-integrity/>). Additionally, if you are unsure of the specifics of what constitutes plagiarism, please see the UNH Plagiarism Tutorial here: <https://cola.unh.edu/academics/plagiarism-tutorial>.

Artificial Intelligence Tools Policy:

Unless otherwise specified, the **use of automated writing tools, including ChatGPT, ChatPDF, and similar artificial intelligence (AI) tools, is strictly prohibited** in this course, even when properly attributed. Such tools may not be used to generate responses toward any assessments in this course, including but not limited to quizzes, written reports, and presentations. The use of automated writing tools is considered plagiarism (as defined by UNH's [Academic Integrity Policy](#)) and will be handled in accordance with existing UNH policy. If you find yourself stuck on how to approach an assignment, please reach out to your instructor and your peers for guidance.

Collaboration:

Each student's work must be their own and students may not collaborate/communicate with each other while taking quizzes. However, for all other activities and assignments students are strongly encouraged to share ideas and feedback with one another (e.g., when designing experiments, analyzing and interpreting data, preparing written reports, practicing oral presentations, studying for quizzes). Under no circumstances are students allowed to work alone in the field (for safety reasons). Thus, during field work expect work together in pairs, groups of three, and sometimes as a whole class.

Disabilities & Accommodations:

According to the Americans with Disabilities Act (as amended, 2008), each student with a disability has the right to request services from UNH to accommodate their disability. If you are a student with a documented disability or believe you may have a disability that requires accommodations, please contact Student Accessibility Services (SAS); 227 Smith Hall, or sas.office@unh.edu.

Accommodation letters are created by SAS with the student. Please follow-up with your instructor as soon as possible to ensure timely implementation of the identified accommodations in the letter. Faculty have an obligation to respond once they receive official notice of accommodations from SAS, but are under no obligation to provide retroactive accommodations.

For more information, contact SAS: 227 Smith Hall, www.unh.edu/sas, 603.862.2607, 711 (Relay NH) or sas.office@unh.edu

Mental Health:

Sexual Harassment and Rape Prevention Program (SHARPP) provides free and confidential advocacy and direct services to survivors (<https://www.unh.edu/sharpp/>).

Title IX Confidentiality and Mandatory Reporting:

The University of New Hampshire and its faculty are committed to assuring a safe and productive educational environment for all students and for the university as a whole. To this end, the university requires faculty members to report to the university's [Title IX Coordinator](#) (Bo Zaryckyj, Bo.Zaryckyj@unh.edu, 603-862-2930/1527 TTY) any incidents of sexual violence and harassment shared by students. If you wish to speak to a confidential support service provider who does not have this reporting responsibility because their discussions with clients are subject to legal privilege, you can contact SHARPP (Sexual Harassment & Rape Prevention Program) at (603) 862-7233/TTY (800) 735-2964. For more information about what happens when you report, how the university treats your information once a report is made to the Title IX Coordinator, your rights and reporting options at UNH (including anonymous reporting options) please visit [student reporting options](#).

Help us improve our campus and community climate. If you have observed or experienced an incident of bias, discrimination or harassment, please report the incident by contacting the Civil Rights & Equity Office at UNH.civilrights@unh.edu or TEL # (603) 862-2930 voice/ (603) 862-1527 TTY / 7-1-1 Relay NH, or [visit the CREO website](#). Anonymous reports may be submitted.

Tentative course calendar (subject to change, based on weather, etc.):

Date	Morning (0900-1200)	Afternoon (1300-1700)	Evening (1900-2100)
Monday, May 19		Arrive at Appledore, welcome, campus tour	Course Introduction, Overview of Syllabus & Expectations, Lecture/Activity: Intro to physical acoustics;
Tuesday, May 20	Lec: Intro to decibels, acoustic data recording & visualization Field activity: Acoustic scavenger hunt [with smartphones]	Lec: Soundscape ecology [terrestrial & aquatic] Activity: 'Guess that sound' Lab: Brainstorm research questions for soundscape recordings & playback experiments.	ROCK TALK; Reading time (Isles of Shoals/Gulf of Maine bioacoustics research papers)

Wednesday, May 21	Lec/Lab: Design and deployment of acoustic recording devices	Field: deploy acoustic recorders on land near gull nests, for soundscape & gull vocalization monitoring, and at wind turbine 16:00: FOOD RUN	Lab: prepare underwater sound recorders & moorings; reading time
Thursday, May 22	Joint lecture with Field Ornithology? (Avian communication/bioacoustics); Lab: finish underwater sound recorder preparation	Field: Deploy underwater acoustic recorders for soundscape monitoring ; Lec: Signal Processing 101	Lab: Visualizing sound data with Raven [example data provided]; study time
Friday, May 23	Lec: Sound Reception [birds, marine mammals, fishes] Joint activity with Biological Illustration course? (connection bird skull anatomy with hearing)	Lab: Who hears better: humans or goldfish?	Quiz 1; reading time
Saturday, May 24	Lec: Sound Production [birds, marine mammals, fishes]; Lab: Visualizing Soundscape data with MANTA	Field & Lab: recover acoustic recorders from terrestrial sites; Field: build library of biological sounds @ Appledore	Data analysis time
Sunday, May 25,	Lec & Lab: How to design a playback experiment	Field & Lab: recover underwater acoustic recorders ; Write playback experiment plans	submit playback experiment plans; study time
Monday, May 26	Lec: Acoustic propagation (in-air and underwater); review playback experiment plans	Field: playback experiments with gulls round 1	Quiz 2; Data Analysis time
Tuesday, May 27	Lec: Anthropogenic noise impacts; Field: recover recorder at wind turbine	Field: playback Experiments with gulls round 2	ROCK TALK; Data Analysis/writing time
Wednesday, May 28	Lab: wind turbine noise vs. wind speed, noise propagation	Field: playback Experiments with gulls round 3 16:00: FOOD RUN	Data Analysis/writing time;
Thursday, May 29	Field: build library of biological sounds @ Appledore; Data analysis time	Field: build library of biological sounds @ Appledore; Data analysis time	Field: build library of biological sounds @ Appledore; Data analysis time

Friday, May 30	0600-0700 Field: build library of biological sounds @ Appledore. 0900-1200: Lec & Lab: How to report acoustic results	Prepare presentations; study time	Quiz 3; Prepare presentations; writing time
Saturday, May 31	Prepare presentations; writing time	Practice oral presentation session; writing check-ins	Submit sound library entries; writing time
Sunday, June 01	Writing time; prepare presentations	Final oral presentation session; writing time	Written research reports due; Course debrief, self-assessments
Monday, June 02	Pack & lab cleanup, Departure		

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