

Shoals Marine Laboratory
Marine Invasive Species: Ecology, Evolution and Management

Dates: Mid-late July, 2022

Faculty (in alphabetical order): Dr. April Blakeslee (blakesleeap14@ecu.edu); Dr. Amy Fowler (afowler6@gmu.edu) & Dr. Carolyn Keogh (carolyn.keogh@emory.edu)

Prerequisites: One semester of college biology or equivalent; or by permission of instructors. One semester of ecology preferred, but not required.

Course Description: This course will focus on one of the top 5 conservation concerns worldwide: the spread, establishment, and impact of **invasive species**. Students will become familiar with ecological and evolutionary theories pertaining to species invasions, and with methods for assessing the spread and impacts of invasive species at local and global scales. The course will examine: (1) ecological impacts and predictors of invasive species establishment and spread (competition, predation, symbiotic relationships); (2) evolutionary insights of invasions and recipient communities (founder effects, hybridization, spatial sorting, coevolutionary history); (3) taxonomic identification and surveys of invasive species, including Rapid Assessment Surveys (RAS); (4) management implications of invasive species establishment and spread (e.g., prevention, mitigation, eradication); and (5) the effects of human-induced global change on the spread of invasive species.

Course Credits: BIOSM XX (3 Credits); MEFB XX (4 Credits)

Learning Goals and Objectives:

1. Students will identify taxa of invasive species using scientific keys and descriptions and prepare formal voucher specimens during their guided inquiries.
2. Students will evaluate the ecological, evolutionary, and management importance of invasive species.
3. Students will use fundamental principles, concepts, and theories in invasion biology in discussions of primary literature.
4. Students will pose original research questions and test fundamental ecological and evolutionary concepts using current scientific literature to develop and hone ideas for student-led open inquiries.
5. Students will design and carry out original research on the invasive species ecology, evolutionary biology, or management questions they develop for their open inquiries.
6. Students will organize, synthesize, and effectively communicate the scientific data that they collect during their open inquiry projects.

Course Overview: The course will explore invasive species including class lectures, paper discussions, species profiles, field observations, and guided and open inquiries. Major assignments/assessments will include student-led paper discussions, an invasive species profile, a guided inquiry report, submission of a vouchered specimen collection, a lab identification practical, a content/concept final exam, and an open inquiry and presentation.

Expectations and Code of Conduct: Students are responsible for understanding the information presented in this syllabus and should discuss any questions they may have with their instructors as soon as possible. Students are responsible for attending all activities associated with this course and completing all assignments—your experience in the course will be most valuable and effective if you are present, enthusiastic, and prepared!

Each student is responsible for their own behavior: always be respectful and collegial to other students, with instructors, SML staff, interns, visiting researchers, and other visitors. SML is a community, so please strive to be a positive member of that community. Students are responsible for fully understanding and adhering to all of the information presented in the SML Appledore Handbook:

https://www.shoalsmarinelaboratory.org/sites/shoalsmarinelaboratory.org/files/media/pdf/Manuals/appledorehandbook2016_ada.pdf.

1. *Personal Technology / Electronic Devices*. Do not use cell phones, smart phones, iPads, headphones, or similar devices in the classroom or during course activities. If you take notes with your computer, disable wifi access during lecture. Device use during lectures and activities is distracting, disrespectful, and detrimental to your learning.
2. Shoals Marine Lab has a modest *computer facility* in Loughton Library; please treat this shared facility with respect and be conservative in all activities and with all materials.
3. *Transmission of Course Materials*. Students are not authorized to replicate, reproduce, copy or transmit lectures and course materials presented, or derivative materials including class notes, for sale or free distribution to others without written consent of the instructors who are the original source of the materials.
4. *Academic Integrity*. Any work submitted must be your own. Uncredited use of another person's words, data or images is considered plagiarism, a serious violation of the Code, whether the material comes from another student, a web site, or a published paper. Students must adhere to Cornell's and UNH's Policies for Academic Integrity:
 - a. Cornell: <https://theuniversityfaculty.cornell.edu/dean/academic-integrity/code-of-academic-integrity/>
 - b. UNH: <https://www.unh.edu/dean-of-students/processes-policies-protocols/student-rights-rules-responsibilities>
5. *Disabilities & ADA Accommodation*: Students should contact Cornell's (<https://sds.cornell.edu/>) or UNH's Student Accessibility Services (<https://www.unh.edu/studentaccessibility/>) four weeks prior to start of class for confidential discussion of needs and for registration to verify eligibility for academic accommodations. No retroactive accommodations can be made.
6. *Mental Health*: Shoals Marine Laboratory cares about you and your well-being. If you experience unusual personal or academic stress during the course or need to talk with someone about a personal problem, seek support from your instructors as soon as possible. In addition, you can consult any SML staff 24/7. Staff can be located in the Hamilton House office 8am – 7pm or knock on the door of Bartell House after hours.

Assessments / Grading Breakdown and Assessment Descriptions:

Paper Discussion: 15%. Class members will partner with another student to present a peer-reviewed manuscript of their choice related to specific topics on invasive species (with instructor input). All students will read each paper and submit 2-5 questions about the paper to the instructors in advance of the class discussion to facilitate discussion

Guided Inquiry: 20%. We will have one guided inquiry in the field and lab – a Rapid Assessment Survey (RAS) – where we will survey 2-3 locations in the intertidal and subtidal zones of Appledore for as many species as we can find in a set period of time. At the end of our course, the class will produce a list and vouchered collection of native and non-native species that we find in each habitat. Each student will contribute to the class iNaturalist bioblitz project and produce vouchers of a set number of species that will be added to the Shoals Marine Lab voucher collection. Students will also submit notes and morphometric details for each specimen they contribute to the vouchered collection.

Species Profile: 10%: Using information from primary sources, each student will closely research one species from among the invasive species we find during the RAS and submit a species profile / fact sheet for their selected species. The profiles will be species specific, but could include information about the native and invasive ranges, documented impacts, similar

native species and how to tell the difference, maximum size and weight, habitat, reproductive metrics, and/or any management strategies.

Presentation / Open Inquiry: 30%. In the second week of the class, students choose to either work in a small group, or independently, to design and carry out their own invasion biology or ecology research project. Students will present their project to the class at the end of the second week.

Exams: 25%. There will be two exams that will assess student knowledge of lecture material and the species they found during the RAS. The first exam will be a lab practical (10%) to identify the species found during the RAS, and the final exam will include content- and concept-based (15%) questions.

DAILY CLASS SCHEDULE

DAY	TOPIC / THEME	CLASS ACTIVITIES / ASSIGNMENTS
1	- Arrival Day: Syllabus and Course Expectations; Introductions - Introduction to Invasion Biology	Afternoon: Settling in, safety information Evening: Class Introductions, Syllabus, Assignments and Assessments Lecture (<i>Introduction to Invasion Biology</i>)
2	- Transport Vectors, Pathways, and Propagules - RAS Methodologies	Morning: Lecture (<i>Introduction Vectors, Pathways, and Propagules</i>) Afternoon: Introduction to RAS Methodology, iNaturalist project discussion, Databases and resources, Voucher Prep Discussion Evening: Guest Lecture #1 (tbd)
3	- Disturbance - RAS Intertidal Transects and Identifications	Morning: Lecture (<i>Disturbances and Invasions</i>) Afternoon: RAS Transects (Intertidal) Evening: <i>Species Profile Assignment Discussion</i>
4	- Mechanisms of Establishment Success and Spread - RAS Subtidal Transects and Identifications	Morning: Lecture (<i>Establishment and Spread; Range Shifts</i>) Afternoon: RAS Transects (Subtidal via snorkel and seine) Evening: Guest Lecture #2 (tbd)
5	- Biogeography and Invasions - RAS Identifications	Morning: Lecture (<i>Invasion Biogeography</i>) Afternoon: RAS Identifications; Range Shifts Lab Evening: "Rock Talk"
6	- Ecological Impacts - RAS Identifications	Morning: Lecture (<i>Ecological Impacts of Invaders</i>) Paper discussion modeled by instructors <i>*Form groups for paper discussions*</i> Afternoon: Continue RAS Identifications Evening: Guest lecture #3 (tbd)
7	- Evolutionary Implications of Invasions - RAS Identifications	Morning: Lecture (<i>Evolutionary Implications of Invasions</i>) Afternoon: <i>*Complete and Turn in Species Profile*</i> Continue RAS Identifications Class field trip (tbd) Evening: Guest lecture #4 (tbd)
8	- Invasion Management (Predicting, Preventing & Controlling Invasions) - Voucher Showcase	Morning: Lecture (<i>Predicting, Preventing & Controlling Invasions – Management Actions</i>) Afternoon: Final RAS Identifications and <i>*Voucher Showcase*</i> Evening: <u>Study for Lab Practical</u>

DAY	TOPIC / THEME	CLASS ACTIVITES / ASSIGNMENTS
9	- Lab Practical - Open Inquiry: Formulate hypotheses and research plan; start collecting data	Morning: <u>Study for Lab Practical</u> Early Afternoon: <i>*Lab Practical on RAS Species Identifications*</i> Late Afternoon: Discuss <i>Open Inquiry Assignment</i> and experimental design. Think about equipment and supplies; map out plans for collecting data. Evening: <i>Paper Discussion #1</i>
10	-Open Inquiry: Data Collection	Morning: Meet and discuss research questions. Collect data. Afternoon: Collect data. Evening: <i>Paper Discussion #2</i>
11	-Open Inquiry: Data Collection	Morning: Meet and discuss research progress. Collect data. Afternoon: Collect data. Evening: <i>Paper Discussion #3</i>
12	-Open Inquiry: Data Collection and Data Analysis	Morning: Meet and discuss research progress. Collect data. Afternoon: Finalize data collections. Evening: <u>Study for Final Exam</u>
13	-Open Inquiry: Data Analysis and Presentation Prep	Morning: <i>*Final Exam*</i> Afternoon: Conduct data analysis, make figures, and work on presentation. Instructors will be available for questions and help. Evening: Career Panel; Field trip (tbd)
14	-Research Presentations	Morning: Practice Presentations with Instructors Afternoon: Finalize work on presentations. Make sure all your data and presentations are uploaded to Google Drive. Evening: <i>**STUDENT PRESENTATIONS**</i>
15	-Departure Day	Morning: Final departure related items. Have a great trip home and we hope to see you at Shoals next year!

*****The schedule above and procedures in the course are subject to change*****

During the schedule, depending on timing and availability, there may be additional opportunities that arise during the week, and these will be slotted in as we go along. We will keep everyone up-to-date if the schedule changes.