

BIOL 630 / EVSS 722 - Marine Invertebrate Zoology

Grice Marine Laboratory – College of Charleston

Fall Semester 2016

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Office hours: 1-2pm Wednesdays and by appointment

Instructional objectives: This graduate-level course will introduce you to the fantastic diversity of invertebrates in the sea. We will survey a subset of the 30+ extant invertebrate phyla in a traditional “zoology” framework, and demonstrate how structure (morphology) and function (physiology) are inextricably interrelated. The course also focuses on a suite of topics that are of active research interest, including larval dispersal, life history evolution, recruitment, habitat and mate choice, the conservation of biodiversity, and speciation, among other issues. When possible, the phyla and these special topics will be placed into evolutionary contexts in order to understand the roles that phylogenetic history play in organismal biology.

Student learning outcomes: I hope that by the end of this course, you will have gained several practical skills.

- Generate and interpret phylogenies
- Critically examine and discuss the primary literature in front of your peers
- Design, implement and report an experimental study
- Feel comfortable with the features of the major invertebrate phyla found within the southeastern US.

Course pre-requisites: None upon acceptance to the Graduate School.

Lecture and Laboratory: All day on Wednesday. Technically, there are three hours of lecture in the morning (9 am – 12 pm; GRICE 101) and three hours of lab in the afternoon (2 pm – 5 pm; GRICE 202). However, we may have to alter these times somewhat in particular weeks.

Mini-lectures (1 per student): See below

Class projects: We will pursue several projects centered on evolutionary ecology: (*Dispersal, Local adaptation, Phenotypic plasticity, Historical ecology and Invasions*). These are team efforts and will be evaluated as such.

Textbook: I will not be requiring that you purchase a text for the course. I will extensively use Pechenik JA (2015) *Biology of the Marine Invertebrates*. McGraw-Hill, 7th edition if you would like to purchase one for yourself. Previous versions (5th and 6th editions) will also service nicely.

Course Requirements:

- *Attendance (mandatory)*
- *Exam (25%)*. One comprehensive exam with laboratory practical.
- *Special Topics – presentation and participation (35%)*.
- *Laboratories (40%)*

Tentative Grading Scale: A: 93-100, A-: 90-92; B+: 87-89, B: 83-86, B-: 80-82, C+: 77-79, C: 73-76, C-: 70-72, D+: 67-69; D: 63-66, D-: 60-62, F: <59.

Accommodations for students with disabilities

Any student eligible for and needing accommodations because of a disability is requested to speak with the professor during the first two weeks of class or as soon as the student has been approved for services so that reasonable accommodations can be arranged.

The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying me as soon as possible and for contacting me one week before accommodation is needed.

This College abides by section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act. If you have a documented disability that may have some impact on your work in this class and for which you may require accommodations, please see an administrator at the Center of Disability Services/SNAP, 843.953.1431 or me so that such accommodation may be arranged.

Academic integrity statement

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines the student's actions are related more to a misunderstanding will be handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed both by the instructor and the student, will be forwarded to the Dean of Students and placed in the student's file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student's transcript for two years after which the student may petition for the XX to be expunged. The F is permanent. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

Students should be aware that unauthorized collaboration--working together without permission-- is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone or computer), copying from others' exams, fabricating data, and giving unauthorized assistance. Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor. Students can find the complete Honor Code and all related processes in the Student Handbook at <http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>

Questions/concerns: This course will be challenging, both intellectually and personally...but hopefully it will also be equally rewarding! Please do not hesitate to talk with me with any concerns and to give feedback.

Mini-lectures: the ecology and evolution of dispersal.

You will be generating one mini-lecture (30 minutes each) on a particular topic. The lectures should be thoughtful, organized, and critical of chosen articles. Each lecture should 1) outline the review article that I offer on that topic, 2) provide a in-depth critical review of at least 3 empirical articles on that topic and 3) focus a portion of the lecture on how changing ocean chemistry and temperature may impact the dynamics of that topic. After the lecture, there will be a 30 minute discussion of the topic. **All students in the class should read the review article before the lecture!**

1) Thorson's rule?

- Marshall, D. J., P. J. Krug, E. K. Kupriyanova, M. Byrne, and R. B. Emlet. 2012. The Biogeography of Marine Invertebrate Life Histories. *Annual Review Of Ecology Evolution And Systematics* 43:97–114.

2) Evolution of adult and larval stages

- Marshall, D. J., and S. G. Morgan. 2011. Ecological and Evolutionary Consequences of Linked Life-History Stages in the Sea. *Current Biology* 21:R718–R725.

3) Marine vs. Terrestrial Dispersal

- Burgess, S. C., M. L. Baskett, R. K. Grosberg, S. G. Morgan, and R. R. Strathmann. 2015. When is dispersal for dispersal? Unifying marine and terrestrial perspectives. *Biol. Rev.* 91:867–882.

4) Timing of larval release

- Christy JH (2011) Timing of hatching and release of larvae by brachyuran crabs: patterns, adaptive significance and control. *Integrative and Comparative Biology* 51: 62-72.

5) Predation in the plankton

- Vaughn, D., and J. D. Allen. 2010. The Peril of the Plankton. *Integrative and Comparative Biology* 50:552–570.

6) Larval settlement - hydrodynamics

- Koehl, M. A. R., and M. G. Hadfield. 2010. Hydrodynamics of Larval Settlement from a Larva's Point of View. *Integrative and Comparative Biology* 50:539–551.

7) Dispersal and climate change – acidification

- Kroeker, K. J., R. L. Kordas, R. Crim, I. E. Hendriks, L. Ramajo, G. S. Singh, C. M. Duarte, and J. P. Gattuso. 2013. Impacts of ocean acidification on marine organisms: Quantifying sensitivities and interaction with warming. *Glob. Chang. Biol.* 19:1884–1896.

8) Dispersal and climate change – warming

- O'Connor, M. I., J. F. Bruno, S. D. Gaines, B. S. Halpern, S. E. Lester, B. P. Kinlan, and J. M. Weiss. 2007. Temperature control of larval dispersal and the implications for marine ecology, evolution, and conservation. *Proc. Natl. Acad. Sci. U. S. A.* 104:1266–1271.

9) Dispersal and climate change – circulation

- Wilson, L. J., C. J. Fulton, A. M. Hogg, K. E. Joyce, B. T. M. Radford, and C. I. Fraser. 2016. Climate-driven changes to ocean circulation and their inferred impacts on marine dispersal patterns. *Glob. Ecol. Biogeogr.* 1–17.

10) The role of genetic tools in dispersal

- Selkoe, A. K. A., C. C. D. Aloia, E. D. Crandall, and M. Iacchei. 2016. A decade of seascape genetics : contributions to basic and applied marine connectivity. *554:1–46.*

11) Bringing it all together – coral recruitment

- Ritson-Williams, R., S. N. Arnold, N. D. Fogarty, R. S. Steneck, M. J. Vermeij, and V. J. Paul. 2009. New perspectives on ecological mechanisms affecting coral recruitment on reefs. Smithsonian Contributions to the Marine Sciences.

12) Bringing it all together – estuarine recruitment

- Wolanski, E. 2016. Bounded and unbounded boundaries – Untangling mechanisms for estuarine-marine ecological connectivity: Scales of m to 10,000 km – A review. Estuar. Coast. Shelf Sci. 1–15. Elsevier Ltd.

Marine Invertebrate Zoology (BIO 630 / EVSS 722)

	9am-noon	Special Topic	2-5pm	low tides (ft)
24-Aug	Introduction; Why phylogeny matters; History of life		Phylogenies; mapping trait	0718 (-0.3)
31-Aug	Local adaptation; sponges & cnidarians		Collect <i>Diopatra</i>	1357 (-0.1)
7-Sep	Ctenophora; Larval dispersal		Set out crab zooae traps; barnacle plates	0616 (0.9)
14-Sep	Nemertean; Polychaetes	YES	Transplant <i>Diopatra</i>	1231 (0.2)
21-Sep	Plankton day (Breach Inlet)	YES	Plankton day	0603 (-0.3)
28-Sep	Arthropods	YES	Score traps & plates	1251 (0.3)
5-Oct	Molluscs	YES	Whelks & Oysters: museum	1741 (1.1)
12-Oct	Polychaetes	YES	Whelks & Oysters: museum	1109 (0.9)
19-Oct	Arthropods	YES	Score traps & plates; redeploy	1732 (0.0)
26-Oct	Arthropods	YES	Barnacle plasticity	1140 (0.6)
2-Nov	Misc. phyla	YES	Invasive Synidotea isopod	1634 (0.7)
9-Nov	Echinoderms	YES	Urchin Fertilization	0839 (0.8)
16-Nov	No lecture		Breakdown <i>Diopatra</i> experiment	1521 (-0.5)
23-Nov	Thanksgiving			
30-Nov	No lecture		Class project wrap-up (<i>Diopatra</i> ; crab; plates)	
11/28-12/1	Florida keys			

COLLEGE of CHARLESTON

SCHOOL OF SCIENCES
AND MATHEMATICS

SAFETY POLICY AND PROCEDURES

The School of Sciences and Mathematics of the College of Charleston understands that the safety of our students, staff and faculty is of paramount importance. Engendering a safety culture is an important part of our mission in teaching and doing science. Each department, course of instruction, or research lab may require higher standards or procedures. The policies and procedures set forth below are understood to be minimum requirements across our departments.

In this document, the term “laboratory” is meant for a work space/facility where chemicals, biological agents, or equipment is used for research and/or instruction.

No one (student, staff, faculty, or visitor) will be allowed in a laboratory (teaching or research) to perform experiments or where experiments may be in progress unless these regulations are followed.

Students dismissed from a teaching lab due to violations of the safety procedures will not be allowed to re-enter the laboratory until authorized to do so by their supervisor (instructor) and, in the case of research laboratories, by the department chair or designee. Any course work missed because of a violation of these guidelines cannot be made up at another time (or by an extension of the lab period) and will be treated as an unexcused absence.

1. You are responsible for knowing the biological, chemical, electrical, ergonomic, mechanical, and physical hazards associated with the equipment and materials that are being utilized in the laboratory. Listen to all instructions and ask questions about that which you do not understand.
2. Know the location of safety equipment: telephones, emergency shower, eyewash, fire extinguisher, fire alarm pull.
3. Know the appropriate emergency response procedures. If there is an injury or emergency, call 953-5611.
4. Do not work alone in the laboratory if you are working with hazardous materials or equipment.
5. Use hazardous chemicals, equipment, and biological agents only as directed and for their intended purpose.
6. Do not engage in horseplay, pranks or other acts of mischief while in lab.
7. Drinking, eating, and application of cosmetics is forbidden in laboratories where chemicals or biohazards are present. Smoking is forbidden in all College buildings.
8. Appropriate personal protective equipment shall be worn. The dress code for laboratory work when using chemicals, biological or physical hazards, or when instructed to do so by the laboratory supervisor is as follows:
 - a) Wear safety glasses or goggles at all times.
 - b) No exposed skin on arms, legs or torso.
 - c) Wear lab coats or other approved protective garments.
 - d) Wear gloves or other personal protective equipment (PPE) as directed by the instructor or mandated by prudent practices based on the chemicals being handled. If in doubt, wear appropriate gloves. Latex is not permitted. Avoid cross-contamination.
 - e) Remove PPE (gloves and lab coat) when exiting the laboratory.
 - f) Wash your hands, even if gloves were used, before leaving a lab where you did any lab work.

- g) Closed toe shoes are required. The heel and top of foot must be covered. High heeled shoes, sandals, and perforated shoes are not permitted.
- h) Confine long hair and loose clothing.

9. Inspect equipment or apparatus for damage before adding chemical reagents or biological samples or energizing electrical equipment. Do not use damaged equipment.

10. Never remove chemicals, biological samples, or laboratory equipment from a lab without proper authorization.

11. Presume that all chemicals and biological samples used in the laboratory are hazardous for you and the environment, unless instructed otherwise.

12. Never leave an experiment unattended unless proper safety precautions are in place.

13. Read all labels on chemicals twice before using them in the lab. Read all instructions twice for the operation of any equipment or machinery.

14. Properly and safely dispose of all waste materials.

15. Treat sharps and broken glassware containers carefully.

a) Broken glass should be disposed of in properly marked safety containers. All sharps (needles, razor blades, etc.) used for any purpose must be disposed of in specially labeled SHARPS containers.

b) Do not place contaminated glass in the broken glassware container. Consult your supervisor.

c) Waste chemicals and contaminated PPE should be discarded as directed.

16. When using a reagent, replace the lid immediately. Never return unused reagents to stock bottles. Take only the amount needed for your experiment.

17. All chemicals and biological samples/media are to be disposed of in appropriately labeled containers. Specific instructions for each material will be provided. Pay attention to waste container labels before adding the material to be discarded.

18. Use good personal hygiene. Keep your hands and face clean. Wash hands thoroughly with soap and water after handling any chemical or biological agent.

19. Keep the work area clean and uncluttered with chemicals and equipment. Clean up the work area on completion of an operation or an experiment. Before leaving the laboratory, you are responsible for making sure your lab area is clean and organized.

20. Never store a chemical or biological specimen in an unlabeled container.

20. Always have your College of Charleston identification and insurance information with you when working in a laboratory. MedicAlert identification must be worn if you have any potential life-threatening chemical sensitivities or medical conditions.

21. Report any accident or injury, however minor, to your teaching assistant, instructor, or lab supervisor immediately. An accident report form must be completed and forwarded to the department chair, dean, and to the Director of Environmental Health and Safety.

If you have questions/concerns about safety in the lab please first consult your instructor. If these are not answered, please see the department chair. Finally, you may consult the director of Environmental Health and Safety, Randy Beaver at 3-6802 or beaverr@cofc.edu

Adopted: March 7, 2012

CougarAlert

The College of Charleston has an agreement with the Blackboard Connect Inc. [formerly The NTI Group, Inc. (NTI)] to use its Connect-ED communication software to provide an emergency notification system that is capable of reaching students, faculty, staff and parents within minutes of a campus crisis. This system is called **CougarAlert**.

Information for Students

The CougarAlert emergency notification system will contact up to six phone numbers for the student. Students may include family member numbers in their address and phone number information.

All students should log onto [MyCharleston](#) to review their address and telephone information and update as needed.

To access the address and telephone information, follow these steps:

1. Log on to [MyCharleston](#)
2. Click on the Academic Services tab
3. Click on the Banner Self-Service link in the third column
4. Click on the Personal Information link
5. Click on the Update Address and Phones and Cougar Alert link

The CougarAlert system will pull the phone number in the following order – cell phone with text messaging option, cell phone without text messaging option, residence hall room phone number, mailing phone number, home phone number, parent phone number and parent 2 phone number.

If you do not have one of these numbers in your student record, the system will select the next number on the list. To avoid issues related to timely communication of emergency messages to the proper places, every student must update his or her contact information in [MyCharleston](#) with current accurate information.

CougarAlert Display Information

When you receive an emergency message from the College of Charleston's CougarAlert System, the return e-mail address will be displayed as cougaralert@cofc.edu, and Caller ID will be displayed as 843.725.7246 (this is the College's Emergency Information Hotline).

Testing and Implementation

Testing will be conducted each semester to verify all systems are operating properly. The campus community will be notified via e-mail and web page postings when testing of the system will be conducted.

Blackboard Connect Software

[Blackboard Connect](#) is an emergency communication software that sends notification before, during and after an emergency. With this new system, the College will be able to communicate in many modes, including voice messages to home, work and cell phones; text messages to cell phones, PDAs and other devices; written messages to e-mail accounts; and messages to teletypewriters and telecommunication devices (TTY/TDD) for the hearing impaired. In combination with our existing communications methods and emergency response plans, this new notification system will significantly enhance the College of Charleston's ability to maintain a learning environment in which students are safe, secure and comfortable.

In an emergency, communications to the campus will be issued in the following priority order:

1. Message to the [Blackboard Connect](#) Emergency Notification System (phone and e-mail).
 2. Recorded message to the College's Emergency Information Hotline, 843.725.7246.
 3. Update to the Website.
 4. Printed update sheets to be distributed and posted on campus (if necessary).
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The CougarAlert system will only be used to notify you in the event of a campus crisis or emergency.