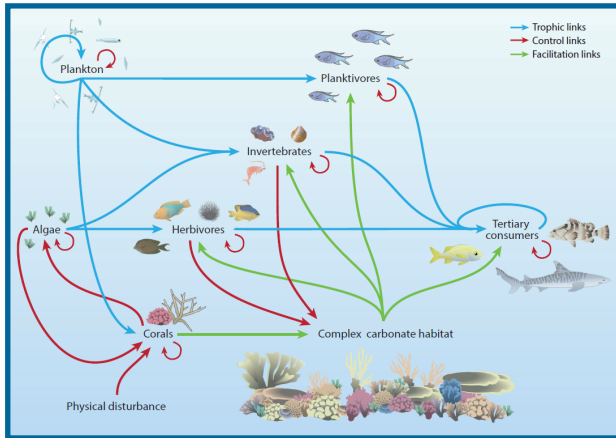


# Marine Ecology

Meeting time: M, W, F 9:05-9:55 am  
Meeting place: 120 Brackett Hall  
Office hours: By appointment



Harborne et al. 2017. Annu. Rev. Mar. Sci.



Photo by M.J. Childress

## Course Description

Marine ecology is the study of the relationships between marine organisms and their ocean environment. Although the ecological processes that govern the transfer of nutrients and energy are similar to those in terrestrial ecosystems, the ocean environment presents many unique challenges for marine communities and the organisms that live there. Students in Marine Ecology will (1) explore the relationships of marine animals to the marine environment, (2) understand the relationships of organismal form, function, ecology, and evolution, and (3) engage in discussions about the impact of humans and climate change on the sustainability of the planet. Marine ecology is also a course in critical thinking where we will examine the complex challenges of marine conservation and human impacts on both local and global scales. In this course you will (4) explore the multi-dimensional challenges of the physical, chemical and biological processes that influence the structure of marine communities, (5) synthesize alternative solutions to the greatest challenges our oceans face today including overharvesting, habitat destruction, and global climate change, and (6) effectively communicate the complex conservation strategies essential for the preservation of our oceans.

## Student Learning Objectives

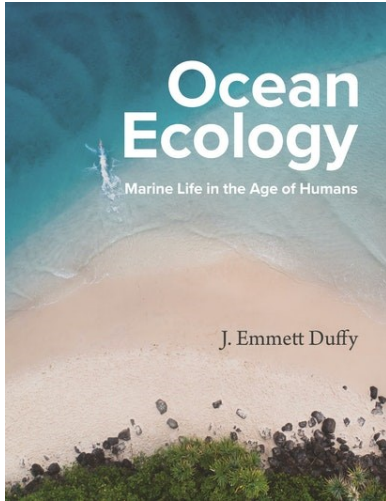
1. Demonstrate the ability to increase critical thinking skills (Application)
2. Identify the limitations of one's own hypotheses, interpretations, or positions. (Analysis)
3. Integrate information/data to solve a problem. (Synthesis)
4. Distinguish and summarize the problem/question at issue (and the source's position). (Analysis)
5. Validate evidence and identify both reasonable and inappropriate conclusions. (Evaluation)
6. Interpret quantitative relationships in graphs, tables, charts, etc. (Application)
7. Criticize the appropriateness of procedures for investigating a question of causation. (Evaluation)
8. Evaluate hypotheses for consistency with established facts. (Evaluation)
9. Assess data for consistency with established facts, hypotheses, or methods. (Evaluation)
10. Prioritize alternative solutions and implement the optimal one(s). (Evaluation)
11. Develop and justify one's own hypotheses, interpretations, or positions. (Synthesis)

## Inside this syllabus

Course expectations.....	2
Grading policy .....	2
Critical thinking rubric.....	3
Course schedule.....	4
About the instructor .....	5
University policies.....	5
Honors/grad assignments .....	6

## Special points of interest

- Ecology is the study of the interaction between the environment and the organisms that live there.
- Critical thinking is a systematic and analytical approach to the evaluation of data, ideas, and concepts.
- Marine science is the study of the physical, chemical, and biological processes of ocean



## Textbook, Readings, and Course Expectations

Each week you will be expected to read one assigned chapter in the textbook, *Ocean Ecology*, along with additional outside readings from the primary literature. Monday and Wednesday of each week will be spent covering the material presented on that week's topic and Friday will be a help session for that week's homework assignment that will evaluate your understanding of the material through group discussion, essays, problem solving, mini-presentations, data analysis, critiques, inquiry activities, and journal writing.

The weekly homework assignments are worth 20 points each. There are no make-up homework assignments, but there will be 12 total and your participation score will be based on the 10 highest scores. Thus, the maximum

number of points you can earn for homework assignments is 200 points. Homework assignments turned in before the end of the week will also be accepted when an absence cannot be avoided.

You will be expected to understand the material presented in lecture and the assigned readings. Each unit exam (I, II, III) will cover only the material presented since the previous exam. Exams are multiple-choice and short answer closed-book tests to be completed during the 50-minute class period. Missed exams are not considered excused exams without consultation with the instructor and may be averaged in as a zero grade. **If you miss a unit exam and have an excused absence, you will take the cumulative final exam as your make-up exam.**

*Duffy, J.E. 2021. Ocean Ecology: Marine Life in the Age of Humans. Princeton University Press. [ISBN 9780691161556](https://doi.org/10.1017/9780691161556)*

### Do I really need to read the assigned readings?

Since this course is essentially a graduate course, I will assume that you are familiar with the lecture topics and have already completed all assigned readings before coming to class. The lectures will then primarily be a critique and synthesis of what you have already learned in the textbook and assigned readings.

Lectures presentations will be available in Canvas before each class, but the presentation will only include the diagrams and illustrations. The critical text will not be included so you can fill it in while you attend lecture. Videos of each lecture will be posted after class to help you keep up with the material if you miss a class or need more time for note taking.

## Grades and Grading Policy

Grades will be determined by the total number of points earned and the section of the course you are enrolled in.

Section	<u>4480-001 (regular)</u>	<u>4480-002 (honors)*</u>	<u>6480-001(grad)*</u>
Exam I – Unit I	50	50	50
Exam II – Unit II	50	50	50
Exam III – Unit III	50	50	50
Homework assignments (10 @ 20 pts)	200	200	200
Discussion Group		50	50
Literature Review Paper			50
<b>Total points</b>	<b>350</b>	<b>400</b>	<b>450</b>
A grade	315-350	360-400	405-450
B grade	280-315	320-360	360-405
C grade	245-280	280-320	315-360
D grade	210-245	240-280	
F grade	< 210	< 245	< 315

\*Honors section will be required to complete either the discussion group or literature review paper while the graduate section will be required to complete both the discussion group and literature review paper. See page 6 for more details about these assignments.

### What Happens if I Miss A Unit Exam?

There are two options. If you know you will miss an exam or if you provide a notice of absence the day of the missed exam, you may either take the unit exam early or as soon as you return to campus. For all other circumstances, you will be allowed to make up your missed unit exam by completing a comprehensive final exam covering all three units and administered during the final exam period.

## Strong 4 -- Consistently does all or almost all of the following

- ✦ Accurately interprets evidence, statements, graphics, questions, etc.
- ✦ Identifies the most important arguments (reasons and claims) pro and con.
- ✦ Thoughtfully analyzes and evaluates major alternative points of view.
- ✦ Draws warranted, judicious, non-fallacious conclusions.
- ✦ Justifies key results and procedures, explains assumptions and reasons.
- ✦ Fair-mindedly follows where evidence and reasons lead.

## Acceptable 3 -- Does most or many of the following:

- ✦ Accurately interprets evidence, statements, graphics, questions, etc.
- ✦ Identifies relevant arguments (reasons and claims) pro and con.
- ✦ Offers analyses and evaluations of obvious alternative points of view.
- ✦ Draws warranted, non-fallacious conclusions.
- ✦ Justifies some results or procedures, explains reasons.
- ✦ Fair-mindedly follows where evidence and reasons lead.

## Unacceptable 2 -- Does most or many of the following:

- ✦ Misinterprets evidence, statements, graphics, questions, etc.
- ✦ Fails to identify strong, relevant counter-arguments.
- ✦ Ignores or superficially evaluates obvious alternative points of view.
- ✦ Draws unwarranted or fallacious conclusions.
- ✦ Justifies few results or procedures, seldom explains reasons.
- ✦ Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.

## Weak 1-- Consistently does all or almost all of the following:

- ✦ Offers biased interpretations of evidence, statements, graphics, questions, information or the points of view of others.
- ✦ Fails to identify or hastily dismisses strong, relevant counter-arguments.
- ✦ Ignores or superficially evaluates obvious alternative points of view.
- ✦ Argues using fallacious or irrelevant reasons, and unwarranted claims.
- ✦ Does not justify results or procedures, nor explain reasons.
- ✦ Regardless of the evidence or reasons, maintains or defends views based on self-interest or preconceptions.
- ✦ Exhibits close-mindedness or hostility to reason.

[Holistic Critical Thinking Scoring Rubric. \(Facione and Facione 2009\)](#)

## Class Activities and Critical Thinking Rubric

Marine Ecology is a critical thinking course developed as part of Clemson's CT2 initiative. These courses share a common theme of developing critical thinking skills essential to addressing today's most pressing issues. Critical thinking courses strive to align course assessments with process-oriented student learning outcomes such as those presented on page 1 of the syllabus.

In Marine Ecology, we will accomplish this through the weekly homework (HW) activities such as debates, film critiques, case study analysis, guided inquiry data analysis, essays, and development of management strategies. Each weekly homework activity is worth 20 points and will be evaluated using the critical thinking grading rubric presented above. Strong = 19-20 pts, acceptable = 16-18 pts, unacceptable = 12-15 pts, weak = 0-11 pts. For some of the homework activities, you will evaluate yourself, for other activities your classmates will evaluate you, and the remainder will be evaluated by Dr. Childress.

Since Marine Ecology also requires a significant amount of content knowledge, traditional content exams will also be used to evaluate your critical thinking and quantitative problem solving. Multiple choice questions will explore your understanding the processes of marine ecology but also how well existing data confirms or refutes alternative hypotheses. The problem sets will explore your ability to evaluate how well data fit the predictions of specific ecological models.

Finally, you will take the Ocean Knowledge Survey twice, once at the beginning and once at the end of the course, to measure how much your critical thinking about the ocean has improved.

## What is critical thinking?

Critical thinking is a systematic and analytical approach to the evaluation of data, ideas, and concepts. It has been broadly defined by experts as "the process of purposeful, self-regulatory judgement" (1990, The Delphi Report). Mostly critical thinking is about having good judgement. Critical thinking is something we all possess, but like other skills it can be improved with practice and constructive feedback.

Critical thinking plays an important role in the sciences. Scientists employ critical thinking in the development and interpretation of their hypotheses. They utilize their critical thinking skills in the design of their experiments and the analysis of their data. But even more importantly, scientists must also develop their critical thinking skills when it comes to sharing their findings with the public and communicating with policy makers.

Critical thinking is more important today than ever. The overload of conflicting information that is flooding society often leads one to ask "who should I believe"? Much of the debate over issues, such as climate change, are so charged with emotion that critical thinking is all but lost. So it is essential that you hone your critical thinking skills and apply it to your pursuit of scientific knowledge. That is why our traditional methods of teaching science as content, rather than as process, must also evolve. In this course, the methods of gathering, analyzing, interpreting, and sharing of the principles of marine ecology are as important as the details about individual marine communities.

## How should I prepare for the exam?

The exams will cover the lecture material presented only for that unit. Material presented in the textbook, lecture, and outside readings are fair game, but the emphasis will be on what we discussed in lecture. The week of the exam will begin with an in-class review on Monday & Wednesday, where we will spend the entire period answering your lecture review questions and working sample problems. The exam will be on Friday and there may be a take-home portion as well. On Friday following the exam, we will have a debriefing where we discuss the exam and go over any questions or problems you had on the exam. If you know you will miss an exam, you may request to take it early. If you miss an exam, you will be required to take a cumulative final exam as your make-up exam.



## Course Schedule and Reading Assignments

<b>Lecture 1 – Introduction</b>	
Wed Jan 11	Chapter 1
Fri Jan 13	Chapter 2
<b>Lecture 2 – Life in the Ocean</b>	
Mon Jan 16	No class
Wed Jan 18	Chapter 2
Fri Jan 20	Chapter 2
<b>Lecture 3 – Geography of Marine Life</b>	
Mon Jan 23	Chapter 3
Wed Jan 25	Chapter 3
Fri Jan 27	*No class Chap 3
<b>Lecture 4 – Anthropocene Ocean</b>	
Mon Jan 30	*No class Chap 4
Wed Feb 1	*No class Chap 4
Friday Feb 3	*No class Chap 4
<b>Unit I Exam Prep Week</b>	
Mon Feb 6	Chap 4 review
Wed Feb 8	Unit I Review
Fri Feb 10	Unit I Exam
<b>Lecture 5 – Organisms</b>	
Mon Feb 13	Chapter 5
Wed Feb 15	Chapter 5
Fri Feb 17	Chapter 5
<b>Lecture 6 – Populations</b>	
Mon Feb 20	Chapter 6
Wed Feb 22	Chapter 6
Fri Feb 24	Chapter 6
<b>Lecture 7 – Species Interactions</b>	
Mon Feb 27	Chapter 7
Wed March 1	Chapter 7
Fri March 3	Chapter 7
<b>Lecture 8 – Ecological Communities</b>	
Mon March 6	Chapter 8
Wed March 8	Chapter 8
Fri March 10	Chapter 9
<b>Lecture 9 – Ecosystems</b>	
Mon March 13	Chapter 9
Wed March 15	Unit II Review
Fri March 17	Unit II Exam

<b>Spring Break</b>	
Mon March 20	No Class
Wed March 22	No Class
Fri March 24	No Class
<b>Lecture 10—Open Ocean</b>	
Mon March 27	Chapter 10
Wed March 29	Chapter 10
Fri March 31	Chapter 10
<b>Lecture 11 – Estuaries &amp; Coasts</b>	
Mon April 3	Chapter 11
Wed April 5	Chapter 11
Fri April 7	Chapter 11
<b>Lecture 12 – Coral Reefs</b>	
Mon April 10	Chapter 12
Wed April 12	Chapter 12
Fri April 14	Chapter 12
<b>Lecture 13 – Ocean 2.0</b>	
Mon April 17	Chapter 13
Wed April 19	Chapter 13
Fri April 21	Chapter 13
<b>Unit III Exam Prep Week</b>	
Mon April 24	Unit III Review
Wed April 26	No class
Fri April 28	No class
<b>Final Exam Week</b>	
Fri May 5	Unit III Exam

\* From Jan 27th to Feb 3rd Dr. Childress will be out of the country. Lectures scheduled for these days will be pre-recorded videos which will be required viewing as the material will be covered on the first unit exam. Upon his return, there will be an opportunity to re-view this material with him prior to the first unit exam on Fri, Feb 10th.

# University Policies

## Accessibility Services:

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu), or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen if at all possible, but there could be a significant wait due to scheduled appointments. Students who have accommodations are strongly encouraged to request, obtain and send these to their instructors through their AIM portal as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester.

You can access further information at the [Student Accessibility website](#). Other information is at the university's [Accessibility Portal](#).

## Non-Discrimination:

The Clemson University Title IX statement: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This [Title IX policy](#) is located on the Campus Life website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 223 Brackett Hall, 864.656.0620. Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

*Clemson University aspires to create a diverse community that welcomes people of different races, cultures, ages, genders, sexual orientation, religions, socioeconomic levels, political perspectives, abilities, opinions, values and experiences.*

## Academic Integrity:

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. All infractions of academic dishonesty by undergraduates must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism instructors may use the Plagiarism Resolution Form.

See the [Undergraduate Academic Integrity Policy](#) website for additional information and [the current catalogue](#) for the policy.

For graduate students, [see the current graduate student handbook](#) for all policies.

## Copyright Statement:

Materials in some of the courses are copyrighted. They are intended for use only by students registered and enrolled in a particular course and only for instructional activities associated with and for the duration of the course.

## Emergency Preparedness:

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>),

Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)

Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

# Resources

The Department of Biological Sciences is committed to providing a supportive learning environment for all students. If you are facing tough times, please utilize these resources. You may also reach out to me directly.

Financial Assistance: Clemson Student Financial Aid (<http://www.clemson.edu/financial-aid/index.html>), and Anderson Interfaith Ministries (<https://www.aimcharity.org/>)

Food Insecurity: Clemson Paw Pantry (<http://facebook.com/CUpawpantry>)

Textbook Assistance: Clemson Library FAQs (<https://clemson.libanswers.com/fag/100017>) and Clemson Bookstore Open Education Resources copies (<https://clemson.bncollege.com/shop/clemson/page/find-oer>)

General Resources: (<https://www.clemson.edu/studentaffairs/advocacy-success/resources/index.html>)

Multicultural Resources and Support: Gantt Multicultural Center (<https://www.clemson.edu/centers-institutes/gantt/multicultural-programs>)

LGBTQ Support: Gantt Multicultural Center –LGBTQ Programs (<https://www.clemson.edu/centers-institutes/gantt/lgbtq-programs/resources.html>)

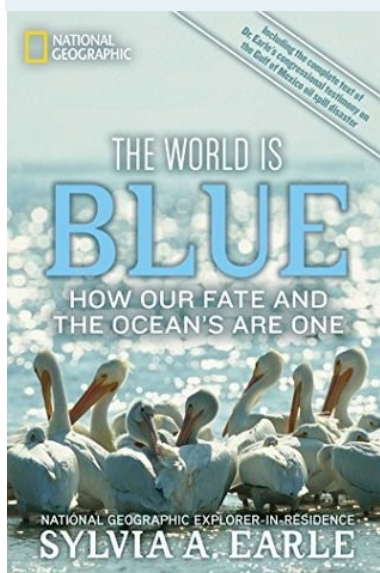
Adjustment and Transition: Counseling and Psychological Services (<https://www.clemson.edu/campus-life/student-health/caps>) and Student Transitions and Family Programs (<http://www.clemson.edu/studentaffairs/stfp/index.html>)

Interpersonal Violence: Healthy Campus (<https://www.clemson.edu/campus-life/healthy-campus/interpersonal-violence/index.html>)

Addiction and Recovery: SC: (<https://www.daodas.sc.gov/>), Web: (<https://addictionresource.com/>) and Vaping (<https://vapingdaily.com/health/>).

## How do I lead a group discussion?

Groups discussion is a common format for many graduate courses. The assigned group discussion leader assumes responsibility for assigning the readings, writing and distributing a set of discussion questions, and facilitating the discussion. This does not mean the discussion leader is expected to talk all the time, but it does require that the leader be able to get the discussion started, and answer questions about the topic that may be inhibiting or derailing productive discussion by the group. A good discussion leader encourages all group members to contribute to the discussion, evaluates the topic critically but fairly, points out logical inconsistencies, and suggests alternative interpretations. Evaluation of the discussion leader is based on the critical thinking rubric 10 pts for the discussion questions, 20 pts for effective discussion leadership, and 20 pts for your participation when others are leading the discussion.



## Special Assignments for Honors / Grad Students

Honors students will complete one of these two extra assignment for the course worth 50 additional points, while graduate students will complete both extra assignments worth 100 additional points. For our reading group we will read and discuss Dr. Sylvia Earle's book "The World is Blue: How Our Fate and the Ocean's are One". [ISBN 978-1-4262-0639-9](https://www.nationalgeographic.com/books/9781426206399/)

### Weekly Book Discussion Group

Honors undergraduate and graduate students selecting this option will be required to meet one additional class meeting (60 min) with the instructor. At the first meeting, you will sign-up for which week you wish to lead the discussion on a particular chapter in the book. You will prepare 5-10 discussion questions covering the topic of your chapter and will submit your questions to Dr. Childress a week before your discussion. When it is your week, you will lead the discussion group by encouraging your classmates to discuss the questions you posted. Your grade for this assignment will be based equally on your weekly participation (20 pts), discussion questions (10 pts), and discussion leadership (20 pts).

### A Literature Review Paper on Climate Change Impacts on the Ocean

Honors undergraduate and graduate students selecting this option will be required to write a literature review paper (worth 50 pts) on a topic related to climate changes impacts on the ocean. The purpose of this literature review paper is to synthesis what we currently know, and do not yet know, about how our changing climate is impacting some aspect of ocean ecology. (1) Select a topic for your literature review paper. See the list of suggested topics below. (2) Read journal articles on your topic (minimum of 20 journal articles). (3) Organize your notes on the topic into an organized outline. (4) Write a review of your topic that summarizes your ideas using examples from your 20 primary sources as supporting literature. The review should be 5-10 double spaced pages with standard scientific citations (references should not be counted in your page total). Be sure to distinguish what we know from what needs additional research on each particular topic. (5) Submit your paper by e-mail to Dr. Childress (mchildr@clemson.edu) before the due date on **Friday, April 21st**.

### Suggested Topics for your Literature Review Paper

- What are the impacts of ocean acidification and potential adaptations of marine life?
- How will sea grass communities change in response to climate change?
- Are hard corals destined to become extinct and will it matter to reef communities?
- How will loss of shallow marine communities impact deep ocean communities?
- Can commercial fishing actually help address the climate crisis?
- Can marine life behaviorally adapt to changes in ocean temperature?

*Earle, S.A. 2010. The World is Blue: How Our Fate and the Ocean's Are One. National Geographic Press*  
[ISBN 9781426205583](https://www.nationalgeographic.com/books/9781426205583/)