



# Coral Reef Ecology, Health, and Conservation

## Spring 2025- Graduate

**EVPP 566-001/BIOL 508-002**  
**Lecture (3 credits)**

### **Course Information**

Instructor: Dr. Jennifer Salerno  
Lecture Time: Tuesdays, Thursdays 12:00 – 1:15 PM  
Lecture Location: Innovation Hall 323  
Office Location: Potomac Science Center 3113  
Office Hours: Thursdays, 10:30 – 11:30 AM in David King Hall or online by appointment  
Email: [jsalerno@gmu.edu](mailto:jsalerno@gmu.edu)  
Text: \*see under Readings section in syllabus

### **Prerequisites**

Permission of the instructor (contact Dr. Salerno)

### **Course Description/Overview**

Current coral reef ecology and conservation science and efforts will be examined in this course, with a focus on environmental and anthropogenic stressors threatening coral reefs and the organisms that inhabit them. Students will examine how environmental impacts affect coral reefs, the direct and indirect effects of these impacts on human society, and current and potential reef restoration solutions that may mitigate the current decline in the health of coral reef organisms, biodiversity, and ecological functions. During the twice-a-week lecture sessions, students will be encouraged to engage in open dialogue regarding many different aspects of coral reef conservation including the biology and health of corals in relation to other animals and people as well as ocean policy at the state, federal, and international levels. An optional 1-credit laboratory and field experience course is offered concurrently with international travel to Roatán, Honduras to observe coral reefs and their inhabitants and to implement field-based methods learned in laboratory sessions; separate registration and an additional fee is required.

### **Learning Outcomes**

On completion, students will:

1. Understand and describe the anatomy, physiology, ecology, and pathology of corals and differentiate the aforementioned between different coral taxa in different reef zones/locations and under varying environmental conditions



2. Understand and differentiate the ecology and geology of coral reef ecosystems and their relationship to other tropical ecosystems such as mangroves and sea grass beds; compare and contrast ecological benefits by, and threats to, these different ecosystems
3. Identify and classify different species of corals, fish, reef invertebrates, and algae and understand and explain the symbiotic and ecological relationships they have with one another; apply this knowledge to organisms observed in videos and the field
4. Understand and evaluate the ecological goods and services provided by coral reef ecosystems and compare and contrast the conservation measures implemented to help protect and restore them
5. Identify and describe global and local threats to corals, evaluate how they impact the greater ecosystem and society, and examine how they are linked to human health (as related to the 'One Health' concept)
6. Design and present a one-page policy or educational memo on a current topic/issue/problem in coral reef ecology and/or conservation; Identify a knowledge gap and formulate a policy recommendation for your intended audience
7. Analyze and critique a peer-reviewed scientific journal article related to coral reef ecology and/or conservation and present your analysis in written form

### **Instructor Expectations**

Students are expected to read books and journal articles, study supporting materials, and prepare assignments outside of class. Students are required to organize material logically and communicate effectively orally and in writing. Class participation, as well as a project and presentation, will be required of each student. Students should come to class ready to participate in all activities with assignments and readings completed prior to class, behave in a mature and professional manner, and abide by the GMU honor code.

### **Participation and make-up work**

Attendance is required as we will use class time for discussions, to go over project ideas, and for other in class activities. If a schedule conflict arises preventing you from attending class, please let me know prior to the start of class. Lectures will be posted as pdfs on blackboard after class so please come prepared to take notes. If you anticipate being unable to turn in an assignment on time, please contact me. I recognize that "life happens" and with ample notice, I can offer flexible solutions that are reasonable and within my limits.

### **Lecture Assignments**

#### **(1) Quizzes (ALL STUDENTS):**

Five (5) quizzes will be given at the start of lectures throughout the semester (see course schedule below). Graduate students will have extended questions to cover the additional required readings. The lowest quiz grade will be dropped at the end of the course and the remaining four (4) will be counted towards your final grade.



**(2) Exams (ALL STUDENTS):**

A mid-term and final exam will be given in the format of multiple choice, fill-in-the-blank, matching, short-, and long-answer questions. Exams will be timed, but open note. The mid-term will take place during a normal class period (refer to course schedule) and the final will be given during finals week. Graduate students will have extended questions to cover the additional required readings.

**(3) Research One-Pagers and Presentations (ALL STUDENTS):**

More than ever, it's important for students in the sciences to be able to communicate technical scientific information to diverse audiences with clarity and accuracy. Students will prepare a "one-pager," essentially a policy brief, on a topic of their choosing related to coral reef ecology, or coral reef conservation, and with an intended audience of relevant stakeholders (e.g. elementary school students, college students, resource managers, policymakers, NGOs, the public). We will discuss this over the course of the semester, but check out <https://writingcenter.unc.edu/policy-briefs/> for the general idea and structure of a policy brief. It is intended that you will select a subject relevant to this class that interests you and probe that subject deeply – become "experts" on that subject. Undergraduates may work in pairs, but graduate students will work individually.

As evidence of that expertise each student/group will write/design a one-page policy brief. Ideas of such topics could include educating stakeholders on a point of interest (e.g. marine plastic debris, climate change affecting weather patterns, underwater research methods, biomedical compounds derived from coral reef ecosystems, a specific coral disease, etc.), or identifying a specific problem and proposing a solution (policy, conservation issues, or community programs; consider including different points of view, i.e., why is this problem a problem? And what could be a solution?). **Each student must submit a draft title and outline of their one-pager by the date listed on the course schedule on Blackboard.**

You will also be required to present a 4-minute lightning talk on your topic (allowing an additional 3 minutes to field questions). The one pager and presentation are worth 20% of your lecture grade so working on that diligently during the semester is important.

A required list of literature cited will also be provided by each student and included in the one-pager. Use Zotero (<http://www.zotero.org/>). Instruction is available in the library. The literature cited may include references like newspaper articles and books, but at least 3 sources need to be from the primary literature (i.e. scientific journals). I want to see that you can use the tool to help with your research and writing. You can get individual help in the library if you need it.

Dr. Salerno will post the one-pager guidelines, rubric, and citation formatting instructions on Blackboard. The one-pager will be submitted via Blackboard (see course schedule for due date).



**(4) Critical Review of Scientific Articles (GRADUATE STUDENTS ONLY):**

Students completing the course for graduate credit will be required to submit two (2) critical reviews of scientific articles related to coral reefs or marine conservation. At least one article should come from a recent (2017-2018) peer-reviewed scientific journal; The 2nd can come from a scientific journal, news article, or the popular press. Each critique should be no more than 300 words (not including references), should be backed with at least 3 references including the original source, and should be written in the style of Science Letters.

Example from Rogers and Miller (2013) Science Letters posted on Blackboard

Identify specific issues/critiques you have with an article of your choice from a refereed journal or popular magazine (not a literature review or book chapter). This can be something that you found problematic, interesting, ridiculous, missing, etc. and then compare and support your arguments with other sources in the literature. Make your critiques explicit and clear, e.g.: "I have three main issues with the way this argument was presented", then elaborate in 3 subsequent paragraphs. Give a very brief overview of the important points with the majority of the paper focused on your own opinion. Consider ending with possible solutions based on your critique. Be concise and clear with your points and mind the word limit. References should be primary literature (e.g., peer-reviewed journal articles) and reports from reputable sources. Use Science Letters for citation style but include all authors in the Literature Cited portion of the paper. Sources should be designated by numbers within the body of the text to correspond with a numbered and alphabetized Literature Cited section.

Each grad student must submit their critical reviews to Dr. Salerno via Blackboard (see schedule below). When the instructor receives your critical review, you will receive an email confirmation. If you do not receive a confirmation, it is YOUR responsibility to either resubmit or check-in with the instructor to confirm receipt of the review PRIOR to class.

**\*Late policy** – Please communicate with me regarding late assignments and we will work it out.

## **Readings**

**(1) Required Books (ALL STUDENTS):**

1. Goldberg, Walter M. 2013. *The Biology of Reefs and Reef Organisms*. Chicago: University of Chicago Press.
2. Dubinsky, Zvy and Stambler, Noga (editors). 2011. *Coral Reefs: An Ecosystem in Transition*. New York: Springer. \*This book is available for online access through GMU libraries.



3. Precht, William F. (editor). 2006. *Coral Reef Restoration Handbook*. Boca Raton: Taylor and Francis Group. \*This book is available for online access through GMU libraries.

**(2) Weekly Assigned Readings (ALL STUDENTS):**

- All assigned readings are listed in the course schedule, posted on Blackboard, and should be completed PRIOR to class.
- Undergraduate students are required to read the first reading listed in bold but are encouraged to read all readings listed.

**Grading**

Undergraduate Level:

|                             |            |
|-----------------------------|------------|
| Mid-Term Examination        | 20%        |
| Final Examination           | 20%        |
| Quizzes (4 total)           | 20%        |
| One-pager/Presentation      | 20%        |
| <u>Critical Reviews (2)</u> | <u>20%</u> |
| Total                       | 100%       |

For graduate students: the final grade will be based on this scale: A = 100–90%, B = 89–80%, C = 79–70%, F < 69%.

**Course Materials**

See required textbooks under Readings, above.

**ACADEMIC INTEGRITY**

Mason is an Honor Code university; please see the Office for Academic Integrity (<https://oai.gmu.edu/>) for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using the appropriate format for this class. Plagiarism is the equivalent of intellectual theft and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.



Another aspect of academic integrity is the free play of ideas. Discussion and debate are encouraged in this course, with the expectation that **all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions**. When in doubt (of any kind) please ask for guidance and clarification.

### **BASIC COURSE TECHNOLOGY REQUIREMENTS**

Activities and assignments in this course will regularly use the Blackboard learning system (<https://mymason.gmu.edu>) as well as web-conferencing software (Blackboard Collaborate / Zoom). Therefore, a desktop or laptop computer with a functional camera, microphone, and reliable internet access (consistent 1.5 megabits per second download speed or higher) are required to participate in this course. In an emergency, students can connect through a telephone call, but video connection is the expected norm. A mobile phone with a camera may also enhance student learning in terms of photographing lab activities and sharing them with the class.

### **STUDENT USE OF ELECTRONIC DEVICES**

Please be respectful of your peers and your instructor and do not engage in activities that are unrelated to the class during synchronous meeting times.

### **COURSE RECORDINGS**

Any synchronous meetings in this class will be recorded to provide necessary information for students in this class. Recordings will be stored on Blackboard and will only be accessible to students taking this course during this semester.

### **PRIVACY**

Student privacy is governed by the Family Educational Rights and Privacy Act (FERPA). Students must use their MasonLive email account to receive important University information, including communications related to this class. I will not be able to respond to messages sent from or send messages to a non-Mason email address. <https://registrar.gmu.edu/ferpa/>

### **DIVERSITY AND INCLUSION**

Diversity is one of George Mason University's core values (Mason Diversity Statement: <https://stearnscenter.gmu.edu/knowledge-center/general-teaching-resources/mason-diversity-statement/>). As instructors of this course, we seek to create a learning environment that fosters respect for all people. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own.



## **GENDER IDENTITY AND PRONOUN USE**

If you wish, please share your name and gender pronouns with us and how best to address you in class and via email. You may also choose to update your chosen name and pronouns here: <https://registrar.gmu.edu/updating-chosen-name-pronouns/>

## **DISABILITY ACCOMMODATIONS**

Disability Services at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit <http://ds.gmu.edu/> for detailed information about the Disability Services registration process. Then please discuss your approved accommodations with your instructor. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: [ods@gmu.edu](mailto:ods@gmu.edu) | Phone: (703) 993-2474

## **SEXUAL HARASSMENT, SEXUAL MISCONDUCT, AND INTERPERSONAL VIOLENCE**

Clearly, none of the above will be tolerated in this course. George Mason University is committed to providing a learning, living and working environment that is free from discrimination and a campus that is free of sexual misconduct and other acts of interpersonal violence in order to promote community well-being and student success. We encourage students who have been sexually harassed, assaulted or subjected to sexual misconduct to seek assistance and support. [University Policy 1202: Sexual Harassment and Misconduct](#) speaks to the specifics of Mason's process, the resources, and the options available to students.

As a faculty member and designated "Responsible Employee," I am required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's [Title IX Coordinator](#) per [university policy 1412](#). If you wish to speak with someone confidentially, please contact the [Student Support and Advocacy Center](#) (703-380-1434) or [Counseling and Psychological Services](#) (703-993-2380). You may also seek assistance from [Mason's Title IX Coordinator](#) (703-993-8730; [titleix@gmu.edu](mailto:titleix@gmu.edu)).

## **OTHER USEFUL GMU RESOURCES:**

ACADEMIC ADVISING

<https://advising.gmu.edu/>

ASSISTIVE TECHNOLOGY INITIATIVE

<https://ati.gmu.edu/>

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): (703) 993-2380

<https://caps.gmu.edu/>

DISABILITY SERVICES

<https://ds.gmu.edu/>

INTERNATIONAL PROGRAMS AND SERVICES

<https://oips.gmu.edu/>

LEARNING SERVICES



<https://learningservices.gmu.edu/>

LESBIAN, GAY, BISEXUAL, TRANSGENDER, QUEER, AND QUESTIONING RESOURCES

<https://lgbtq.gmu.edu/>

OFFICE OF DIVERSITY, INCLUSION, AND MULTICULTURAL EDUCATION

<https://odime.gmu.edu/>

OFFICE OF THE OMBUDSMAN: (703) 993-3306

<https://diversity.gmu.edu/>

The Office of the Ombudsman is a confidential, impartial, informal and independent problem-solving and conflict resolution resource for all students at George Mason University.

POLICE CADET SAFETY ESCORTS: (703) 993-2810

<https://police.gmu.edu/programs-and-services/police-cadets/escorts/>

STUDENT HEALTH SERVICES

<https://shs.gmu.edu/>

STUDENT SUPPORT AND ADVOCACY CENTER

<https://ssac.gmu.edu/>

UNIVERSITY CAREER SERVICES

<https://careers.gmu.edu/>

UNIVERSITY LIBRARIES "Ask a Librarian"

<https://library.gmu.edu/ask>

UNIVERSITY WRITING CENTER: (703) 993-1200

<https://writingcenter.gmu.edu/>

UNIVERSITY POLICIES

The University Catalog, <http://catalog.gmu.edu>, is the central resource for university policies affecting student, faculty, and staff conduct in university affairs.

MASON NON-DISCRIMINATION POLICY

<https://universitypolicy.gmu.edu/policies/non-discrimination-policy/>

ADDITIONAL STUDENT SUPPORT RESOURCES

<https://stearnscenter.gmu.edu/knowledge-center/knowing-mason-students/student-support-resources-on-campus/>



**COURSE SCHEDULE AND ASSIGNED READING (to be completed PRIOR to class):**

| Week | Date            | Topics   | Readings for Following Week   |
|------|-----------------|--|---|
| 1    | January 21, 23  | Introduction/discuss syllabus<br>Coral overview (part I) - coral anatomy, physiology, diversity, identification  | <b>Goldberg Ch 6 (Coral reefs and their allies)</b><br><i>No additional graduate student readings for week one only</i>   |
| 2    | January 28, 30  | Coral overview (part II) - reproduction/spawning, calcification, symbiotic relationship with zooxanthellae, sensitivity to environmental conditions  | <b>Goldberg Ch 1 (Structure and formation of modern reefs)</b><br><b>Goldberg Ch 14 (Ecology, diversity and biogeography of coral reefs)</b><br><b>McClanahan - Reconsidering and rescaling climate change predictions for coral reefs (2024)</b> |
| 3    | Feb 4, 6        | <b>QUIZ #1</b><br>Geology of coral reefs, zonation, origins of reefs, bioerosion, biodiversity, connectivity, biogeography<br>Other associated ecosystems - mangroves, seagrass beds, deep water corals ( <a href="#">discuss paper</a> )<br><b>*selection of one pager topic discussed (ALL STUDENTS)</b> | <b>Peters (2015) - Diseases of coral reef organisms</b><br><b>Mullen - Resistance to disease (2004)</b><br><b>Dubinsky p355-367 (Competition among sessile organisms on coral reefs)</b>  |
| 4    | February 11, 13 | Defense mechanisms, competition, immune function, and predation of corals<br><br>Microorganisms – Bacteria/Viruses, Cyanobacteria, Fungi, Protists, Apicomplexans<br><br><b>Critical Review 1 due February 13 (GRAD STUDENTS ONLY)</b>   | <b>Goldberg Ch 4 (Algae and foraminiferans)</b><br><b>Goldberg Ch 3 (Reef cyanobacteria)</b><br><b>Goldberg Ch 5 (Sponges)</b>  |
| 5    | February 18, 20 | <b>QUIZ #2</b><br>Microorganisms – Bacteria/Viruses, Cyanobacteria, Fungi, Protists, Apicomplexans<br><br>Coral diseases (overview)<br><br>Macroorganisms - Algae, sponges, other marine invertebrates   | <b>Dubinsky pp. 292–310 (Invertebrates and their roles in coral reef ecosystems)</b><br><b>Goldberg 10 (Crustacea)</b><br><b>Goldberg 11 (Echinoderms)</b><br><br><b>*students pick an invert and make a slide</b>                                |
| 6    | February 25, 27 | Students present slides<br><br>Saving Atlantis video   | <b>Goldberg Ch 12 (The effect of feeding by reef fishes on corals and coral reefs)</b><br><b>Dubinsky p332-343 (Coral Reef Fishes: Opportunities, challenges and concerns)</b>  |
| 7    | Mar 4, 6        | <b>QUIZ #3</b>   | Study for Mid-Term Exam   |



| Week | Date         | Topics  | Readings for Following Week  |
|------|--------------|---|--|
|      |              | Macroorganisms -Vertebrate species (fishes, elasmobranchs, marine mammals, reptiles)<br><br><b>*students pick a vertebrate and make a slide</b><br><br><b>Turn in outline for one-pager on March 11 via Canvas (ALL STUDENTS)</b>   |  |
| 8    | March 11, 13 | <b>NO CLASS – SPRING BREAK</b>  |  |
| 9    | March 18, 20 | Macroorganisms - continued<br><br>Review for mid-term exam  | <b>Moberg - Ecological goods and services of coral reef ecosystems (1999)</b><br><br><b>Goldberg Ch 15 (Reefs now and the next 100 years)</b><br><b>Graduate students (pick one):</b><br>Hughes et al. Spatial and temporal patterns of mass bleaching of corals (2018)<br>Shiffman et al. - The role and value of science in shark conservation advocacy (2021)<br>Manning - Movement, Space Use, and the Responses of Coral Reef Fish to Climate Change (2022)<br>Patrício - Climate change and marine turtles: recent advances and future directions (2021) |
| 10   | March 25, 27 | <b>Mid-Term Exam (March 25)</b><br><br><b>Students present macroorganism slides</b><br><br>Benefits of corals – Ecological goods and services   | <b>Goldberg Ch 16 (Reef resilience, loss of biodiversity, and the role of conservation)</b><br><b>Dubinsky p 509 (The resilience of coral reefs and its implications for reef management)</b><br><b>Precht p143 (Legal protections for coral reefs)</b>  |
| 11   | Apr 1, 3     | <b>QUIZ #4</b><br><br>Local and global threats to coral reefs: overfishing, invasive species, land development/run off, pollution, climate change, bleaching, ocean acidification, sea level rise, storm damage<br><br>Reef resilience and conservation<br>Policy and legal protection involving coral reefs (MPAs etc.)<br><br><b>Critical Review 2 due April 3 (GRAD STUDENTS ONLY)</b> | <b>Precht p39 (Coral reef restoration - an overview)</b><br><b>Precht p1 (Coral reef restoration - the rehabilitation of an ecosystem under siege)</b><br><b>Precht p315 (Ethical dilemmas in coral reef restoration)</b><br>Fezzi et al. - The economic value of coral reefs: Climate change impacts and spatial targeting of restoration measures (2023)   |



| Week | Date            | Topics  | Readings for Following Week  |
|------|-----------------|---|--|
| 12   | April 8, 10     | Coral reef restoration<br>Ethical considerations of coral reef restoration<br><br><b>Research one-pager submitted via Canvas on April 10</b>    | <b>Zinsstag - From one medicine to one health and systemic approaches to health and well-being (2011)</b><br><a href="#">Myers and Patz - Emerging Threats to Human Health from Global Environmental Change (2009)</a><br><a href="#">Rapport and Maffi - Ecocultural health, global health, and sustainability (2011)</a><br><a href="#">Sweet et al. - Corals as canaries in the coalmine: Towards the incorporation of marine ecosystems into the 'One Health' concept (2021)</a> |
| 13   | April 15, 17    | <b>QUIZ #5</b><br>One Health - integrating human, animal, and ecosystem health<br>The effects of environmental change on reefs and human health | Work on 2-minute lightning talks   |
| 14   | April 22, 24    | Revise lightning talks<br>Student lightning talks presented   |  |
| 15   | April 29, May 1 | Lightning talks presented/submitted<br>Review for Final Exam  |  |
| 16   | May 8           | <b>Final Exam</b><br><b>10:30 AM – 1:15 PM</b>  |  |