# Instructor Information

Jarrett Byrnes, Ph.D.

jarrett.byrnes@umb.edu

Phone (W): 617-867-3145

Office Location ISC-3-3240

Office Hours: Wednesdays 11-12:30

# Course Information

**Course Title:** Marine Biology & Ecology

**Time:** TTh 2-3:30

**Classroom:** W-2-127

**Credits: 3 lecture**

**Online?** [no]

**Course**

**Description:** This course will explore the diversity of biological and ecological processes that shape life in the oceans. It will place a special emphasis on marine life in New England, focusing on the interactions between humans and the sea. This focus will lead to a greater understanding of the consequences of ongoing environmental changes witnessed in the 20th and 21st centuries.

**Context:** This will serve as an upper level course integrating concepts from ecology and environmental biology. It will enable students to think about whole biological systems from a mechanistic standpoint.

**Prerequisites:** I require that you have taken at least one of the following courses, or otherwise obtain my permission. This requirement is to ensure that you have a basic background in Ecology or the biology of Marine Organisms that will be necessary for the course. On day 1, I will review basic biological concepts that are foundational to the course, and then we will dive in from there. The courses that would satisfy the pre-requisite requirements (and ***only one is needed***) are:

Biol 290 – Population Biology

Biol 100 – Coastal Ecology

EEOS 226 – Introduction to Oceanography

EEOS 267L – Introduction to Coastal Biological Systems

**Course**

**Objectives:** By fully participating in this course, you should be able to:

1) Understand how biological systems are structured and function within the world’s oceans.

2) Learn how to understand new scientific information and rapidly incorporate it into one's knowledge of the goods and services produced by our oceans.

3) Gain an appreciation for how changes in the environment alter life in the sea and the concomitant indirect effects to human society.

4) Understand the historic, current, and future links between humans in New England and the ocean around us.

**Core**

**Competencies:** The objectives for this course focus on the following core competencies:

1. Graduates should be able to evaluate primary scientific information about the structure and function of ocean ecosystems.
2. Graduated will be able to apply reason based on biological knowledge to make decisions as citizens about decisions impacting our oceans.
3. Graduates will be able to better communicate their interest and knowledge of how our oceans work to those around them.
4. Graduates will be able to better understand how complex systems work when confronting new questions and problems in biology.

**Required**

**Assignments:**

**Regular Essays:**I realize that for some of you this class is your first encounter to the primary literature, and it can be a bit daunting. As such, we're going to change the weekly assignment to help you make sure you've fully understood the reading and can begin to dig into it intellectually before class.

For each class we have scientific papers assigned, choose **one** of the papers assigned and in 1-1.5 pages, no more, in 12 point single spaced font. Answer the following four questions:

1) Why are the authors writing this paper? What larger body of ideas does it sit within?
2) What were their hypotheses, and how did they test them?
3) What did their findings teach them about their questions or ideas of interest?
4) Are you persuaded by what they have done? Why or why not?

Feel free to also discuss any insights you have about the work presented from outside of class. Many of the papers we read will revolve around the natural history of New England. Were there any particular points of connection that this paper made with your own experiences? Did it make you think about any particular issue differently?

Essays will be marked as completed or not. Essays that provide no more detail than the abstract of the paper will be marked as not completed.

**Midterm Paper:** There are two options.

*Option 1 – I came here for an argument:* Students will select one pair of papers from a list of papers that famously disagreed with one another. Students should read the papers and at *minimum* 3 associated papers from the reference list to understand its context and 2 papers that cite it (use Google Scholar). Students are then asked to write a short persuasive essay (5 pages max.) that 1) summarizes the papers main arguments, 2) states compares and contrasts the differing points of view, 3) argues which one got it right.

*Option 2 – North versus South:* When the first edition of Marine Community Ecology by Bertness et al. came out, a parallel text by Australian researchers was also published. The two differ greatly in focus of examples, papers cited, and authors of chapters. The current edition has much more back and forth between the southern and northern hemisphere. Read one chapter from the first edition, it’s parallel from the Australian Marine Ecology (Connell et al. eds), and write a short essay (5 pages max) that 1) compares and contrasts the two chapters, 2) elucidates what is gained by taking a broader perspective across multiple academic groups, and 3) discusses whether there is generality to the principles in either text or if local examples cannot be generalized. Students may also explore how the 2nd edition of Bertness et al. synthesizes these two points of view. Students should also explore the original references (at least 2-3) cited by the chapters.

Students will be graded equally on their accuracy, understanding of the material discussed, the strength of their argument, and the style of their writing. Grammar and spelling count. Students will be given an opportunity to revise and resubmit.

**Final Project:** Students have the choice of either taking a final written exam during the exam period or presenting a final interdisciplinary project. As students are entering the course with varying backgrounds and interests, the interdisciplinary project is designed for students to address the course material using their own perceived strengths - even if they are outside of the scope of a formal marine science education. Interdisciplinary projects can take several forms: 1) a grant proposal for future work complete with preliminary data from the literature, 2) a film (animation, music video, documentary, etc.) exploring a paper or theme from class,

See <http://www.youtube.com/user/iambient33> and <http://creaturecast.org/> for examples 3) a piece of original research with accompanying writeup ranging from taking data in the field, from online databases (e.g., <http://marinexplore.org>), building a new sensor or marine tool (e.g., SeaPerch ROV), a survey of people regarding attitudes or knowledge of relevant issues, etc. 4) other piece of creative work. Projects falling outside of these areas but demonstrating a connection between the course material and the students' knowledge are essential. Projects other than the grant proposal can be done in groups. All projects must be approved by the Professor by November 1st. Projects will be graded on a demonstration of mastery and understanding of topic material in the context of the work. Projects will be presented to the class at large on the last day of classes.

**Leading a Discussion**: Throughout the semester students will be asked to lead 1-2 discussions of academic papers.

**Course Rubric:**

|  |  |  |
| --- | --- | --- |
| **Assignment/Deliverable** | **Number** | **Grade %** |
| **1. Regular Essays** |  | **20** |
| **2. Midterm Paper** |  | **20** |
| **3. Leading a Discussion** |  | **5** |
| **4.** |  |  |
| **5.** |  |  |
| **6.** |  |  |
| **7.** |  |  |
| **Final Project/Presentation** |  | **30** |
| **Group Work** |  |  |
| **Participation** (as defined above) |  | **20** |
| **Attendance** (as defined above) |  | **5** |

**Course**

**Policies:**

* + Participation – Participation includes completing all required reading and writing assignments prior to class, thoughtfully participating in discussions, and taking responsibility for helping create a positive learning environment by arriving promptly, listening respectfully, and participating constructively. In particular, students are expected to participate in discussions of readings, and participation will be noted as a part of your final grade.
	+ Attendance - Students are expected to attend all classes. This class is heavy on discussion, and as such, students are expected to be respectful of each others’ time and effort. Sick students are expected to bring a note from a doctor. Students who are otherwise prevented from coming to class are expected to bring a note from the relevant party (e.g., if your car is towed, a the relevant ticket). Two unexcused absences will reduce your maximum grade to a B. Three to a C. Four or more absences to an F.
	+ Group Work – I encourage students to prepare before class in groups. Final projects are also allowed to be group projects, and collaboration is encouraged.
	+ Late Work – Late work loses 3% point per day late. Exceptions can only be made in the case of a documented emergency.

# Grading

**Grading:** Grade type for the course is a whole or partial letter grade. (Please see table below)

|  |
| --- |
| **Grading Policy**  |
|  | **Letter Grade** | **Percentage** | **Quality Points** |
|  | A | 93-100% | 4.00 |
|  | A- | 90-92% | 3.75 |
|  | B+ | 87-89% | 3.25 |
|  | B | 83-86% | 3.00 |
|  | B- | 80-82% | 2.75 |
|  | C+ | 77-79% | 2.25 |
|  | C | 73-76% | 2.00 |
|  | F | 0-72% | 0.0 |
|  | **INC** | A grade of Incomplete (INC) is not automatically awarded when a student fails to complete a course. Incompletes are given at the discretion of the instructor. They are awarded when satisfactory work has been accomplished in the majority of the course work, but the student is unable to complete course requirements as a result of circumstances beyond his/her control. The student must negotiate with and receive the approval of the course instructor in order to receive a grade of incomplete | N/A |
|  | IF | Received for failure to comply with contracted completion terms. | N/A |
|  | W | Received if withdrawal occurs before the withdrawal deadline. | N/A |
|  | AU | Audit (only permitted on space-available basis)  | N/A |
|  | NA | Not Attending (student appeared on roster, but never attended class. Student is still responsible for tuition and fee charges unless withdrawal form is submitted before deadline. NA has no effect on cumulative GPA.) | N/A |

**Required**

**Text(s):** MCEC: Bertness, M.D., Bruno, J.F., Silliman, B.R., and Stachowicz, J.J. eds. 2014. *Marine Community Ecology and Conservation*. Sinauer Associates. 978-1-60535-228-2

**Other**

**Reading:** MCE: Some readings will be photocopied and distributed from the out of print Bertness, M.D., Gaines, S.D., and Hay, M.H. eds. 2001. *Marine Community Ecology*. Sinauer Associates.

Additional papers will be assigned. See the course bibliography for a complete list. All papers will be provided via the course website.

**-----------------------------------------End of BHE section no more than 5 pages------------------------------------**

**Recommended**

**Texts** If you wish to review relevant material before beginning this course, I recommend Levinton, J.S. 2013. Marine Biology, 4th Edition. Oxford University Press.

# Course Schedule

Week 1. Topic: Physical processes in marine biology, How to read a Scientific Paper

Objective(s): Understand how physics of moving water influence marine biological processes. Demystify reading the scientific literature and provide tools for

Textbook Readings: MCEC Ch. 2

Journal Readings: Siddon and Witman 2003

Week 2. Topic: Dispersal, Leading a Discussion of a Scientific Paper

Objective(s): Evaluate multiple perspectives on the importance of physical versus biological forces in the dispersal of marine larvae; learn what makes for an effective paper discussion

Textbook Readings: MCEC Chapter 4

Journal Readings: Gaines and Roughgarden 1985, Morgan et al 2008

Week 3. Topic: Predation & Herbivory

Objective(s): Discover that the seemingly simple species interactions of predation and herbivory can lead to a variety of non-intuitive effects

Textbook Readings: MCE Chapter 5

Journal Readings: Stachowicz and Hay 1999, Matassa and Trussell et al. 2011

Week 4. Topic: Pelagic Communities

Objective(s): Learn how energy and nutrients move through the open ocean, from phytoplankton to tuna.

Textbook Readings: MCEC Chapters 15-16

Journal Readings: Stibor et al. 2004, Worm et al. 2005

Week 5. Topic: Microbial Processes

Objective(s): In the opinion of some, microbes rule the world. Why have we only begun how important they are in marine processes? What role do they play?

Textbook Readings: Azam and Malfatti 2007, Breitbart 2012

Journal Readings: Bowen et al. 2009, Marston et al. 2012

Week 6. Topic: The Rocky Intertidal

Objective(s): Understand how and why the rocky intertidal is the workhorse model system for testing ideas in marine ecology.

Textbook Readings: MCE Chapter 9

Journal Readings: Paine 1974, Nielsen and Navarette 2004

Other Assignments: Midterm Papers due on Friday

Week 7. Topic: Kelp Forests

Objective(s): Incorporate thinking about the multiple ecosystem functions that foundation species provide.

Textbook Readings: MCEC Chapter 14

Journal Readings: Arkema et al. 2009, Krumhansl and Scheibling 2012

Other Assignments: Final Project Proposals Due

Week 8. Topic: Salt Marshes

Objective(s): Understand differing perspectives on what controls salt marsh zonation. Confront a current controversy into why we are witnessing widespread salt-marsh dieback.

Textbook Readings: MCE Chapter 11

Journal Readings: Deegan et al. 2012, Altieri et al. 2012

Week 9. Topic: Seagrass Beds

Objective(s): Begin to think about coastal ecosystems as complex systems that can be altered from outside impacts.

Textbook Readings: MCEC Chapter 12

Journal Readings: Irlandi and Peterson 1991, Whalen et al. 2012

Week 10. Topic: Coral Reefs

Objective(s): Incorporate an understanding of how complex symbioses and the micro- and macro- level can lead to a fully functional ecosystem.

Textbook Readings: MCEC Chapter 299

Journal Readings: Rowan et al. 1997, Burkepile and Hay 2008

Week 11. Topic: The Deep Ocean

Objective(s): Begin to appreciate how environmental factors shape the biogeography and function of life in the deep ocean.

Textbook Readings: MCEC Chapter 17

Journal Readings: McClain et al. 2012, Glover et al. 2013

Week 12. Topic: Extinction, Biodiversity, and Ecosystem Function

Objective(s): Understand why species diversity and the global extinction crisis matters to the future of functional ocean ecosystems.

Textbook Readings: MCEC Chapter 6

Journal Readings: Duffy et al. 2003, Best et al. 2014

Week 13. Topic: Ocean Ecosystem Services

Objective(s): Build an appreciation for the ways humans benefit from ocean ecosystems.

Textbook Readings: MCEC Chapter 18

Journal Readings: MacLeaod et al. 2011, Barbier et al. 2013

Week 14. Topic: Climate Change

Objective(s): Understand the connections between human activities, changes in climate cycles, and how this is likely to alter the biology of oceans in the future.

Textbook Readings: MCEC Chapter 19

Journal Readings: Harley 2011, Poloczanska et al. 2013

Week 15. Topic: Fisheries and Ocean Management

Objective(s): Debate and arrive at solutions for maintaining functioning ocean ecosystems that provide humans with a wide variety of goods and services.

Textbook Readings: MCEC Chapter 20

Journal Readings: Myers & Worm 2003, White et al. 2012

# Methods of Instruction

**Methods:** The course will be a mixture of lecture and discussion. We will read one chapter per week which we will discuss on Tuesdays. I will lead a short lecture on the topic, and then facilitate discussion of key points and concepts using a Socratic approach as a starting point. On Thursday we will discuss 1-2 papers relevant to the topic of the week. Students are expected to lead the discussions as the semester moves forward.

# Accommodations

The University of Massachusetts Boston is committed to providing reasonable academic accommodations for all students with disabilities. This syllabus is available in alternate format upon request. If you have a disability and feel you will need accommodations in this course, please contact the Ross Center for Disability Services, Campus Center, Upper Level, Room 211 at 617.287.7430. <http://www.umb.edu/academics/vpass/disability/> After registration with the Ross Center, a student should present and discuss the accommodations with the professor. Although a student can request accommodations at any time, we recommend that students inform the professor of the need for accommodations by the end of the Drop/Add period to ensure that accommodations are available for the entirety of the course.

# Academic Integrity and the Code of Student Conduct

***Code of Conduct and Academic Integrity***

It is the expressed policy of the University that every aspect of academic life--not only formal coursework situations, but all relationships and interactions connected to the educational process--shall be conducted in an absolutely and uncompromisingly honest manner. The University presupposes that any submission of work for academic credit is the student’s own and is in compliance with University policies, including its policies on appropriate citation and plagiarism. These policies are spelled out in the Code of Student Conduct. Students are required to adhere to the Code of Student Conduct, including requirements for academic honesty, as delineated in the University of Massachusetts Boston Graduate Catalogue and relevant program student handbook(s).[UMB Code of Student Conduct](http://www.umb.edu/life_on_campus/policies/code/)

You are encouraged to visit and review the UMass website on *Correct Citation and Avoiding Plagiarism:* http://umb.libguides.com/citations

Penalties for academic misconduct in the course, including plagiarism and cheating, are strictly enforced, and the penalties are very serious. Penalties include an F in the assignment or exam, an F in the course, or suspension from the University. If you have questions about what constitutes plagiarism or other forms of academic misconduct, see Prof. Byrnes **before** completing an assignment or exam.

**Ignorance of the rules does not excuse any academic conduct violation.**

**The University defines violations to include, but not be limited to, the following:**

* Submitting as one's own an author's published or unpublished work (e.g. material from a journal, Internet site, newspaper, encyclopedia), in whole, in part, or in paraphrase, without fully and properly crediting the author.
* Submitting as one's own work or materials obtained from another student, individual, or agency without full and proper attribution.
* Submitting as one's own work material that has been produced through unacknowledged or unauthorized collaboration with others.
* Submitting substantially the same work to more than one course (i.e., dual or multiple submission) without prior approval from all instructors involved.
* Using any unauthorized material during an examination, such as notes, tests, calculators, cell phones, or other electronic devices.
* Obtaining answers to examination questions from another person with or without that person's knowledge; furnishing answers to examination questions to another student; using or distributing unauthorized copies of or notes from an examination.
* Submitting as one's own an examination taken by another person; or taking an examination in another person's place.
* Interfering with an instructor's ability to evaluate accurately a student's competence or performance; misleading any person in connection with one's academic work.

# Other Pertinent and Important Information

**Cell Phones: Cell phones must be POWERED OFF during class.**
  Much of this class is discussion, and use of phones in class is disruptive and disrespectful to your fellow students to withdraw from the conversation. I will give you one warning inside or outside of class, and then ask you to please leave in any future classes if it happens again. That class will be counted as an un-explained absence.

**Attendance in WIMBA Sessions:**

* You are responsible for material covered in any class that you do not attend.
* If you miss a WIMBA session you must review the recorded class and write a 1-2-page summary of your understanding of what was covered.
* **Coursework Difficulties:** Please discuss all coursework matters with me sooner than later.

**Withdrawing From This Course**: Please refer to the written policies and procedures on formal withdrawal and add/change dates listed in the Graduate Studies Catalog.

You are advised to retain a copy of this syllabus in your personal files for use when applying for future degrees, certification, licensure, or transfer of credit.

# Bibliography

Altieri, A. H., M. D. Bertness, T. C. Coverdale, N. C. Herrmann, and C. Angelini. 2012. A trophic cascade triggers collapse of a salt-marsh ecosystem with intensive recreational fishing. Ecology 93:1402–1410.

Arkema, K. K., D. C. Reed, and S. C. Schroeter. 2009. Direct and indirect effects of giant kelp determine benthic community structure and dynamics. Ecology 90:3126–3137.

Barbier, E. B., I. Y. Georgiou, B. Enchelmeyer, and D. J. Reed. 2013. The Value of Wetlands in Protecting Southeast Louisiana from Hurricane Storm Surges. PloS one 8:e58715.

Best, R. J., A. L. Chaudoin, M. E. S. Bracken, M. H. Graham, and J. J. Stachowicz. 2014. Plant–animal diversity relationships in a rocky intertidal system depend on invertebrate body size and algal cover. Ecology 95:1308–1322.

Bowen, J. L., B. C. Crump, L. A. Deegan, and J. E. Hobbie. 2009. Increased supply of ambient nitrogen has minimal effect on salt marsh bacterial production. Limnology and Oceanography 54:713–722.

Breitbart, M. 2012. Marine Viruses: Truth or Dare. Annual Review of Marine Science 4:425–448.

Burkepile, D. E., and M. E. Hay. 2008. Herbivore species richness and feeding complementarity affect community structure and function on a coral reef. Proceedings of the National Academy of Sciences of the United States of America 105:16201–16206.

Deegan, L. A., D. S. Johnson, R. S. Warren, B. J. Peterson, J. W. Fleeger, S. Fagherazzi, and W. M. Wollheim. 2012. Coastal eutrophication as a driver of salt marsh loss. Nature 490:388–392.

Duffy, J. E., J. P. Richardson, and E. A. Canuel. 2003. Grazer diversity effects on ecosystem functioning in seagrass beds. Ecology letters 6:637–645.

Gaines, S., and J. Roughgarden. 1985. Larval settlement rate: A leading determinant of structure in an ecological community of the marine intertidal zone. Proceedings of the National Academy of Sciences of the United States of America 82:3707–3711.

Glover, A. G., H. Wiklund, S. Taboada, C. Avila, J. Cristobo, C. R. Smith, K. M. Kemp, A. J. Jamieson, and T. G. Dahlgren. 2013. Bone-eating worms from the Antarctic: the contrasting fate of whale and wood remains on the Southern Ocean seafloor. Proceedings of the Royal Society B: Biological Sciences 280:20131390–20131390.

Harley, C. D. G. 2011. Climate Change, Keystone Predation, and Biodiversity Loss. Science 334:1124–1127.

Irlandi, E. A., and C. H. Peterson. 1991. Modification of animal habitat by large plants: mechanisms by which seagrasses influence clam growth. Oecologia 87:307–318.

Ling, S. D., C. R. Johnson, S. D. Frusher, and K. R. Ridgway. 2009. Overfishing reduces resilience of kelp beds to climate-driven catastrophic phase shift. Proceedings of the National Academy of Sciences 106:22341–22345.

Matassa, C. M., and G. C. Trussell. 2011. Landscape of fear influences the relative importance of consumptive and nonconsumptive predator effects. Ecology 92:2258–2266.

Mcleod, E., G. L. Chmura, S. Bouillon, R. Salm, M. Björk, C. M. Duarte, C. E. Lovelock, W. H. Schlesinger, and B. R. Silliman. 2011. A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO2. Frontiers in Ecology and the Environment 9:552–560.

Morgan, S. G., and J. R. Anastasia. 2008. Behavioral tradeoff in estuarine larvae favors seaward migration over minimizing visibility to predators. PNAS 105:222–227.

Myers, R. A., and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. Nature 423:280–283.

O'Gorman, E. J., R. A. Enright, and M. C. Emmerson. 2008. Predator diversity enhances secondary production and decreases the likelihood of trophic cascades. Oecologia 158:557–567.

Paine, R. T. 1974. Intertidal community structure. Oecologia 15:93–120.

Poloczanska, E. S., C. J. Brown, W. J. Sydeman, W. Kiessling, D. S. Schoeman, P. J. Moore, K. Brander, J. F. Bruno, L. B. Buckley, M. T. Burrows, C. M. Duarte, B. S. Halpern, J. Holding, C. V. Kappel, M. I. O'Connor, J. M. Pandolfi, C. Parmesan, F. Schwing, S. A. Thompson, and A. J. Richardson. 2013. Global imprint of climate change on marine life. Nature Climate Change:–.

Rowan, R., N. Knowlton, A. Baker, and J. Jara. 1997. Landscape ecology of algal symbionts creates variation in episodes of coral bleaching. Nature 388:265–269.

Siddon, C. E., and J. D. Witman. 2003. Influence of chronic, low-level hydrodynamic forces on subtidal community structure. Marine Ecology Progress Series 261:99–110.

Stachowicz, J. J., and M. E. Hay. 1999. Reducing predation through chemically mediated camouflage: Indirect effects of plant defenses on herbivores. Ecology 80:495–509.

Stibor, H., O. Vadstein, S. Diehl, A. Gelzleichter, T. Hansen, F. Hantzsche, A. Katechakis, B. Lippert, K. Loseth, C. Peters, W. Roederer, M. Sandow, L. Sundt-Hansen, and Y. Olsen. 2004. Copepods act as a switch between alternative trophic cascades in marine pelagic food webs. Ecology letters 7:321–328.

White, C., B. S. Halpern, and C. V. Kappel. 2012. Ecosystem service tradeoff analysis reveals the value of marine spatial planning for multiple ocean uses. PNAS 109:4696–4701.

Worm, B., M. Sandow, A. Oschlies, H. K. Lotze, and R. A. Myers. 2005. Global Patterns of Predator Diversity in the Open Oceans. Science 309:1365–1369.