**BIO-196 Introduction to Marine Sciences (BIOL 196A)**

**Spring 2020**

**Course Instructor**

**Laura J May-Collado, Ph.D**.

217 Marsh Life Science Bldg

**Office Hours**: **Fridays @ 10 a.m. via zoom** ~~W& F 1:00-2:30 p.m. Th. 8:30-9:30 a.m.~~

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**Course Description**

Our oceans cover about 70% of earth’s surface with a predicted eukaryotic diversity of about 2.2 million species! Not only do they represent an enormous source for new antibiotics and food, but oceans have a starring role in Earth’s climate. In addition, understanding how oceans work is fundamental to understand the unique conditions that have favored the evolution of life on our planet, including human evolution. The goal of this introductory course is to provide students with an overview of concepts and process in oceanography, geology, ecology, evolution, organismal biology, and conservation. Some of the topics we will discuss in class include tsunamis, El Niño, ocean chemistry and physics, bioluminescence, sharks and whales, coral reefs and deep-sea communities, the state of world’s fisheries, human impact on marine ecosystems, and many more. This semester I will emphasizes the impact of climate change and ocean acidification in marine life.

**The learning goals of this course are:**

* That you can articulate oceanographic and biological processes using the appropriate terminology.
* That you learn to recognize the hierarchical relationships of marine organisms and the threats these organisms face.
* That you learn how to read a scientific paper, interpret figures, and identify patterns.
* That you learn to make connections from lecture to real situations e.g., climate change, ocean acidification, etc.

**Lectures:**

MWF from 9:40 to 10:30 a.m. in Rowell N/A HLTH 118 please be on time; turn off your cell phone; do not leave your seat during a lecture unless is an emergency. PowerPoint slides will be available on BB by the end of the week. Make sure to bring a notebook to take notes. **NOT ELECTRONICS WILL BE ALLOW IN CLASS.**

**Textbooks, Online Resources, and Videos**

lectures are based on the textbook *Oceanography and Marine Biology: An Introduction to Marine Sciences by David W. Townsend* and online resources (see links in calendar). **You do not need to buy the textbook**. If you are interested in pursuing a career in Oceanography or Marine Biology, I recommend having this book as part of your library. The most affordable options are to rent it via Amazon ($22.7) or purchase an **electronic version** ISNB 978-1-60535-436-1 ($85.95) at Vital Source or Redshelf.

**Other Important online resources**

* How to seriously read a scientific paper

<http://www.sciencemag.org/careers/2016/03/how-seriously-read-scientific-paper>

* The National Aeronautics and Space Administration (NASA)

<https://www.nasa.gov/content/water-and-ice>

<https://www.nasa.gov/topics/earth/features/perpetual-ocean.html>

<https://science.nasa.gov/earth-science/focus-areas/oceanography>

<https://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MYD28M>

* National Oceanic and Atmospheric Administration (NOAA): <http://www.noaa.gov/>
* National Centers for Coastal Ocean Science (NOAA)

<https://coastalscience.noaa.gov/research/marine-spatial-ecology>

**Grading:** Your grade will be based on your total points at the end of the semester. We will follow the traditional grading scale: A = 90-100%, B = 80-89%, C = 70-79%, D = 60-69%, F = < 60%. Plus, and minus grades will reflect scores close to these borders.There will be **three** midterm exams and a **cumulative** final exam in this course **(50% new material: 50% old material see calendar)**. The point breakdown is as follows:

|  |  |
| --- | --- |
| 3 Midterm exams (100 pts each; lowest exam will count by half)  **Exam 1 -Monday February 10**  **Exam 2 -Monday March 20**  **Exam 3 -Monday April 20** | 45% |
| ~~Aduio~~  ~~Cumulative Exam (200 pts)~~  **May 4 ~~@ 0730 ROWELL 118~~**  ~~\*\*Students that~~ **~~score above 90~~****~~in~~****~~all three~~****~~midterm exams will be exempt of the cumulative part of the final exam.~~** | 20% |
| Science Blogs (see calendar below) | 15% |
| iClicker (in class activity) | 10% |
| Online quizzes (every Sunday) | 10% |
| **Total** | **100%** |

**Exams:** Each midterm exam will consist of a combination of multiple-choice questions and short. The final exam will consist of 50 questions of old material and 50 questions of new material. All material covered in class including PPT lectures, videos, assigned literature, and any other resource highlighted in class will be part of the exam.

**Do not make travel arrangements to leave campus before the date of the final exam!** Barring ***extraordinary*** circumstances, **There will be no make-up exams** and **exams will not be rescheduled to accommodate travel plans during the semester**. The only legitimate excuse for rescheduling an exam is if you have three exams on one day, you have a documented medical condition or other emergency, or you must be off-campus for a university sponsored event or religious holiday. In such cases you will contact me before the date of the exam to discuss the situation and if granted to discuss the date and time the make-up exam. Discuss such exam conflicts with me as soon as possible!

**BLACKBOARD ASSIGNMENTS: science blogs and online quizzes**

In order to be an active participant during lecture, it is mandatory that you read the assigned material and respond to the weekly lecture assignment. Keeping up with the assigned readings, as well as actively reading and reflecting on the material, is paramount to your success in this course.

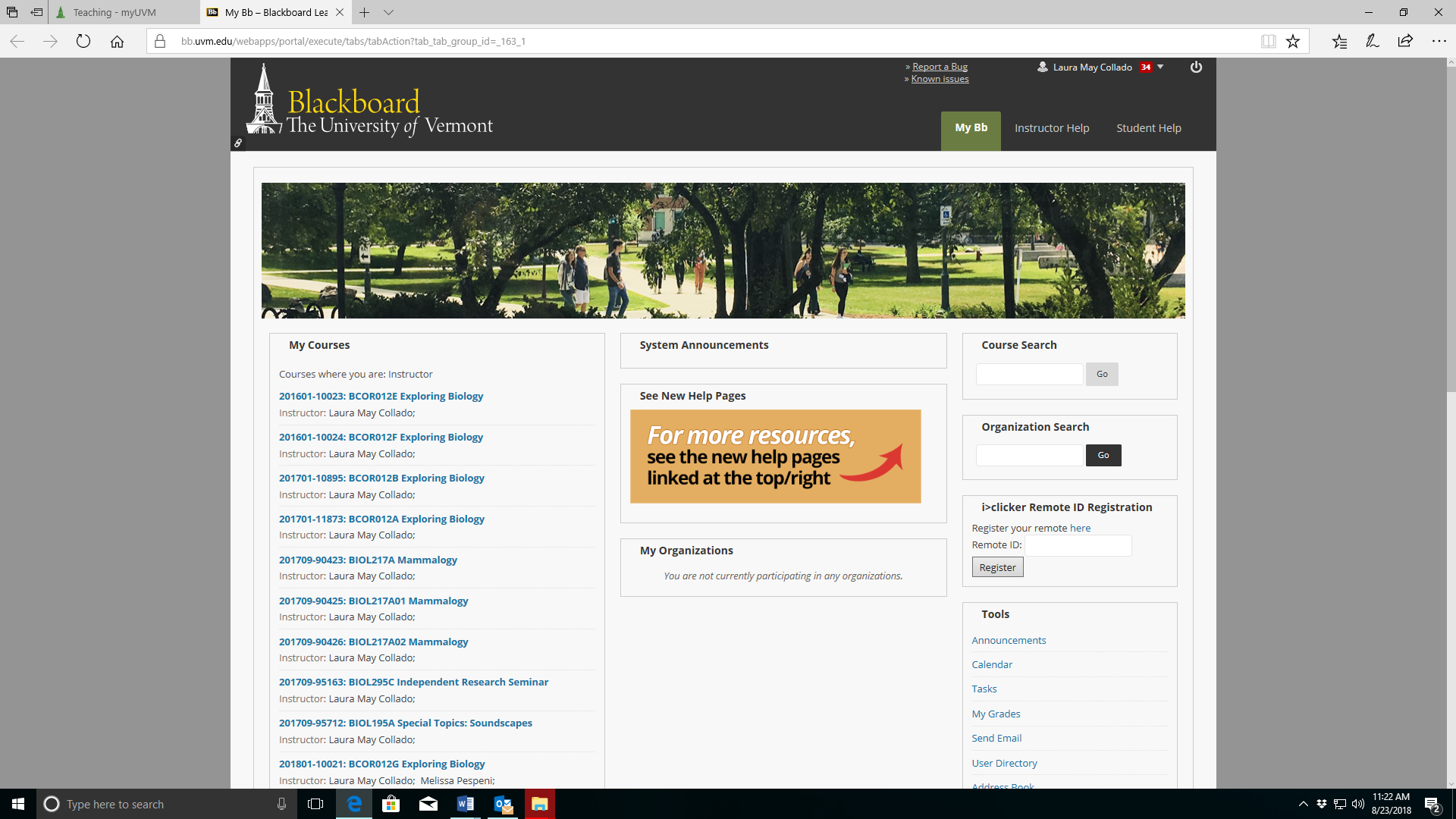
* **Science Blog:**Making connections. On selected dates (see below) I will be posting a link to science news that relates to topics, processes, or concepts discussed in class.
* Write a short summary (~200 words) about the science news. DO NOT COPY AND PASTE. **The University of Vermont has a very strict policy concerning academic honesty and plagiarism (see below).**
* Make connections! Write a short perspective (~300 words) about how the science news relates to concepts or processes discussed in class. **Use the vocabulary and concepts learned in class.**
* See Science Blog Calendar below.

|  |  |
| --- | --- |
| **Science Blog Due on Thursdays** | **Science News & Associated Article**  **To Download full articles go to** <http://library.uvm.edu/research/research_databases#LETTER_W>  Select Web of Science |
| January 23 | Science News: What happens when the Bering Sea’s ice disappears? <https://www.sciencenews.org/article/bering-sea-ice-disappearing-arctic-ecosystems> |
| January 30 | Science News: Climate change may make El Niño and La Niña less predictable <https://www.sciencenews.org/article/climate-change-may-make-el-nino-la-nina-less-predictable>  Article: F. Jia et al. Weakening Atlantic Niño–Pacific connection under greenhouse warming. Science Advances. Published online August 21, 2019. doi:10.1126/sciadv.aax4111. To download article, use UVM Library Web of Science. |
| February 6 | Science News ‘Sunny day’ high tide floods are on the rise along U.S. coasts <https://www.sciencenews.org/article/sunny-day-high-tide-floods-are-rise-along-us-coasts>  Report: U.S. National Oceanographic and Atmospheric Administration. [2018 state of U.S. high tide flooding with a 2019 outlook](https://tidesandcurrents.noaa.gov/publications/Techrpt_090_2018_State_of_US_HighTideFlooding_with_a_2019_Outlook_Final.pdf). Technical Report NOS CO-OPS 090. June 2019. |
| February 13 | Science News: The Southern Ocean may be less of a carbon sink than we thought <https://www.sciencenews.org/article/southern-ocean-antarctica-absorbs-less-carbon-expected>  Article: G. Negrete-García et al. Sudden emergence of a shallow aragonite saturation horizon in the Southern Ocean. Nature Climate Change. <https://www.nature.com/articles/s41558-019-0418-8> |
| February 20 | Science News: Ocean acidification could weaken diatoms’ glass houses <https://www.sciencenews.org/article/ocean-acidification-could-weaken-diatoms-glass-houses>  Article: K. Petrou et al. Acidification diminishes diatom silica production in the Southern Ocean. Nature Climate Change. Published online August 26, 2019. <https://www.nature.com/articles/s41558-019-0557-y>. To download article, use UVM Library Web of Science. |
| February 27 | Science News: Scientists make first observation of fish schooling using bioluminescent flashes <https://phys.org/news/2019-08-flashlight-fish-bioluminescence-school-night.html>  Article: Gruber DF, Phillips BT, O'Brien R, Boominathan V, Veeraraghavan A, Vasan G, et al. (2019) Bioluminescent flashes drive nighttime schooling behavior and synchronized swimming dynamics in flashlight fish. PLoS ONE 14(8): e0219852. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0219852> |
| March 5 | Science News: Climate change may be throwing coral sex out of sync <https://www.sciencenews.org/article/climate-change-throwing-coral-sex-out-sync>  Article: T. Shlesinger and Y. Loya. Breakdown in spawning synchrony: A silent threat to coral persistence. Science. Vol. 365, September 8, 2019, p. 1002. doi:10.1126/science.aax0110.  <https://science.sciencemag.org/content/365/6457/1002> |
| March 19 | Science News: Warmer waters shrink krill habitat around Antarctica <https://news.mongabay.com/2019/01/warmer-waters-shrink-krill-habitat-pushing-them-closer-to-antarctica/>  Article: Atkinson, A., Hill, S. L., Pakhomov, E. A., Siegel, V., Reiss, C. S., Loeb, V. J., … & Sailley, S. F. (2019). Krill (Euphausia superba) distribution contracts southward during rapid regional warming. Nature Climate Change, 9(2), 142–147. |
| March 26 | Science News: Ocean acidification could degrade sharks’ tough skin. <https://www.sciencenews.org/article/ocean-acidification-could-degrade-sharks-tough-skin>  Article: J. Dziergwa et al. Acid-base adjustments and first evidence of denticle corrosion caused by ocean acidification conditions in a demersal shark species. Scientific Reports. <https://www.nature.com/articles/s41598-019-54795-7> |
| April 2 | Science News: Plastics outnumber baby fish 7-to-1 in some coastalnurseries <https://www.sciencenews.org/article/plastics-outnumber-baby-fish-some-coastal-nurseries>  Article: J. Gove et al. Prey-size plastics are invading larval fish nurseries. Proceedings of the National Academy of Sciences. Published online November 11, 2019. <https://www.pnas.org/content/116/48/24143> |
| April 9 | Science News: Emperor penguins could disappear by 2100 if nations don’t cap emissions <https://news.mongabay.com/2019/11/emperor-penguins-could-disappear-by-2100-if-nations-dont-cap-emissions/>  Article: Barbraud, C. (2019). The Paris Agreement objectives will likely halt future declines of emperor penguins. Global Change Biology. doi:10.1111/gcb.14864 |
| April 16 | Science News: Blue whales remember best times and places to find prey <https://news.mongabay.com/2019/02/blue-whales-base-migration-route-on-memories-of-where-to-find-prey/>  Article: Abrahms, B., Hazen, E. L., Aikens, E. O., Savoca, M. S., Goldbogen, J. A., Bograd, S. J., … Mate, B. R. (2019). Memory and resource tracking drive blue whale migrations. Proceedings of the National Academy of Sciences, 201819031. <https://www.pnas.org/content/116/12/5582> |
| April 23 | Nature’s Solution to Climate Change: Can whales save us from climate change? <https://www.imf.org/external/pubs/ft/fandd/2019/12/natures-solution-to-climate-change-chami.htm> |
| April 30 | Science News: How climate change is already altering oceans and ice, and what’s to come <https://www.sciencenews.org/article/ipcc-how-climate-change-already-altering-oceans-ice-future>  Report Intergovernmental Panel on Climate Change. IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC). 51st Session of the IPCC, Principality of Monaco, Monaco, published online September 25, 2019. <https://www.ipcc.ch/srocc/home/> |

**ONLINE QUIZZES**: every Sunday you will take a quiz in Blackboard that covers the material discussed that week.**No makeup of quizzes unless extraordinary circumstances.**

**ICLICKER (IN CLASS ACTIVITY)**

Your iClicker remotes will be used for in-class concept tests and peer instruction. For each question, you will receive 1 point for participating in the iClicker question during class, and 1 additional point for getting the correct answer. If you miss class, you will not be able to make-up for those points. Do not attempt to give your remote to a friend to answer in your absence. This behavior violates the Academic Integrity policy, will not be tolerated and can earn you and your friend an XF fail (i.e., “failure resulting from academic dishonesty”) in this course. **Available at UVM Bookstore, used from other students, or online. Register your iClicker at the main page of your BB.**



**STRATEGIES FOR GETTING A HIGH GRADE IN THIS COURSE**

1. **Come to class AND to office hours.**
2. **Review the material regularly**.
3. **Use provided resources (see course calendar)**.
4. **Ask questions in class**.

**ACADEMIC HONESTY**

Academic honesty is expected of all students. The University of Vermont has a very strict policy concerning academic honesty and plagiarism. Please see the statement on academic honesty http://www.uvm.edu/~uvmppg/ppg/student/acadintegrity.pdf .

If you are caught cheating on an exam, you will receive a zero for that exam.

**Plagiarism constitutes a violation of Academic Honesty.** Plagiarism of ANY sort - e.g., copying part or all of a fellow student's science blog, copying from original references, texts, or websites - will NOT be tolerated. The consequences of plagiarism or cheating range from a score of zero on the assignment or exam, failure in the course, to filing a complaint with the University’s Coordinator for Academic Honesty which can result in expulsion from the University.

**COURSE CONTENT IS THE PROPERTY OF THE INSTRUCTOR**.

Consistent with the University’s policy on intellectual property rights, all teaching and curricular materials (including but not limited to classroom lectures, class notes, exams, handouts, and presentations) are the property of the instructor. Therefore, electronic recording and/or transmission of classes or class notes is prohibited without the express written permission of the instructor. Such permission is to be considered unique to the needs of an individual student (e.g. ADA compliance), and not a license for permanent retention or electronic dissemination to others. For more information, please see the UVM policy on Intellectual Property, sections 2.1.3 and 2.4.1

**CLASSROOM RESPECT**

It is import to maintain a respectful environment in class, and we expect this from all of you as you should expect this from us. You are here to learn and we are here to help you learn with mutual respect. Please **arrive on time** and **do not leave early** without permission. When you come to lecture and lab, please **turn off your cell phone**. We will not tolerate phone conversations or texting or email during lecture or lab. Come prepared to dedicate your full attention to your instructor and TA during lecture and lab. If your cell phone goes off in class, please leave the room and do not come back until the next class period.

**EMAIL ETIQUETTE:** Please address your queries respectfully. “Hey” does not fall in this category, and any such messages risk being ignored (perhaps the best litmus test is to ask the following: “if you were looking for a job, would you greet your prospective new employer in that manner?”). The adequate way to refer to your instructor is Professor May-Collado or Dr. May-Collado. Also, it is important to properly identify yourself and the course you are inquiring about. Instructors often have multiple “Biology” courses and multiple students with the same first name.

**RELIGIOUS HOLIDAYS:** Students should submit in writing to their instructors **by the end of the second full week of classes** their documented religious holiday schedule for the semester. Students who miss work for the purpose of religious observance will be allowed to make up this work.

**STUDENT DISABILITY POLICY**. In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact ACCESS, the office of Disability Services on campus. ACCESS works with students and faculty in to find reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. We request that all students meet with one of us (Dr. May-Collado) to discuss the accommodations they need. Accommodation letters lists those accommodations that will not be implemented until the student meets with their faculty to create a plan; we are happy to help, but do need to know how to assist you, well in advance. Contact ACCESS: Room A170 Living/ Learning Center; 802-656-7753**;** access@uvm.edu**; or** www.uvm.edu/access.

**Calendar Spring 2020**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Day | Lecture | Concepts | Resources |
| 13-Jan | M | Introduction  The Ocean and today's challenges | Understand how you are going to be graded  Marine provinces  Marine sediments  Vocabulary | ***Videos***: How big is the ocean? <https://ed.ted.com/lessons/how-big-is-the-ocean-scott-gass>  Ocean Worlds <https://www.youtube.com/watch?time_continue=20&v=gw_bX0ZQOy0>  Marine Provinces: <http://www.iupui.edu/~g115/mod05/lecture01.html>  Marine Sediments: <http://www.iupui.edu/~g115/mod06/lecture01.html> |
| 15-Jan | W | Continental Drift | History  Key scientists & their contributions | Earth and Plate Tectonics: <http://www.iupui.edu/~g115/mod04/lecture01.html>  ***Video***: <https://ed.ted.com/lessons/the-pangaea-pop-up-michael-molina> |
| 17-Jan | F | Continental Drift | Key scientists & their contributions |  |
| 20-Jan | M | **NO classes** | | |
| 22-Jan | W | Review of the physical-chemical properties of water | light transparency,  high tension and heat capacity,  water phases,  water dissolving power,  latent heat of melting and evaporation | Properties of Water: <http://www.iupui.edu/~g115/mod07/lecture01.html>  Physical Ocean: <https://science.nasa.gov/earth-science/oceanography/physical-ocean> |
| 24-Jan | F | Properties of Saltwater | Salinity, pressure, density, temperature  Vertical structure in the ocean  Light in the sea | Sea change. Why is the ocean salty? <https://oceanservice.noaa.gov/facts/whysalty.html>  Vertical structure: <http://oceanmotion.org/html/background/ocean-vertical-structure.htm>  Why does the ocean get colder at depth? <https://oceanservice.noaa.gov/facts/coldocean.html> |
| 27-Jan  29 Jan | M  W | Atmospheric Circulation | Density of air and atmospheric pressure  Solar radiation  Global atmospheric circulation Coriolis  El Niño and La Niña  El Niño and La Niña | Atmospheric Circulation: <http://www.iupui.edu/~g115/mod08/lecture01.html>  Global Climate Zones <http://www.iupui.edu/~g115/mod09/lecture01.html>  ***Videos***: <https://www.youtube.com/watch?v=7fd03fBRsuU>  <https://www.youtube.com/watch?v=xqM83_og1Fc>  <https://www.youtube.com/watch?v=PDEcAxfSYaI>  What is the Coriolis Effect? <https://scijinks.gov/coriolis/>  El Niño and La Niña <https://scijinks.gov/el-nino/>; <https://scijinks.gov/la-nina/> <http://oceanmotion.org/html/impact/el-nino.htm> |
| El Niño and La Niña <https://youtu.be/UuGrBhK2c7U> ; |
| 31-Jan  3-Feb | F  M | Ocean circulation | Ekman currents  Major Ocean gyres  Western Boundary Currents  Equatorial currents  Density-driven thermohaline circulation  Upwelling/Downwelling | Ocean Circulation: <http://www.iupui.edu/~g115/mod10/lecture01.html>  <https://www.youtube.com/watch?v=6vgvTeuoDWY>  Ekman currents: <http://oceanmotion.org/html/background/ocean-in-motion.htm>  Ocean gyres: <http://oceanmotion.org/html/background/wind-driven-surface.htm>  Equatorial currents: <http://oceanmotion.org/html/background/equatorial-currents.htm>  Western Boundary Currents: <http://oceanmotion.org/html/background/western-boundary-currents.htm>  Gulf Stream <https://scijinks.gov/gulf-stream/>; <http://oceanmotion.org/html/background/rings.htm>  Ocean conveyor belt: <http://oceanmotion.org/html/background/ocean-conveyor-belt.htm>  Upwelling and Downwelling: <http://oceanmotion.org/html/background/upwelling-and-downwelling.htm> |
| 5-Feb | W | Tides | Understanding the forces at work  Combined influences of the Sun and Moon  Tides in ocean basins  Tides in the Gulf of Maine and Bay of Fundy  The importance of tides | <http://www.iupui.edu/~g115/mod12/lecture01.html> <http://oceanmotion.org/html/background/tides.htm> |
| 7-Feb | F | Summary Oceanographic aspects of climate change | | |
| **Exam I Review** | | |
| 10-Feb | **M** | **Exam I (Jan 13-Feb 5)** | | |
| 12-Feb | W | Ocean Productivity | Photosynthesis/Respiration  Nutrients and limiting factors  Phosphorus and Nitrogen cycles  Carbon-Biological pump | Biological pump: <https://www.us-ocb.org/biological-pump/>  Energy and Productivity: <http://www.iupui.edu/~g115/mod16/lecture01.html> |
| 14-Feb | F | Ocean productivity | Coastal upwellings  Winter convective mixing  Seasonal vertical stratification  Distribution with depth  Distribution with latitude  Distributions with salinity and distance from shore | <https://oceanservice.noaa.gov/facts/upwelling.html>  <https://eesc.columbia.edu/courses/ees/climate/lectures/o_strat.html>  <http://www.oceanmotion.org/html/background/ocean-vertical-structure.htm> |
| 17-Feb | M | Primary producers | Phytoplankton  Macroalgae (seaweeds)  Seagrasses | What is phytoplankton? <https://oceanservice.noaa.gov/facts/phyto.html>  Diatoms: <http://www.iupui.edu/~g115/mod17/lecture03.html>  Sargassum algae: <http://www.iupui.edu/~g115/mod17/lecture04.html>  ***Video***: The secret life of plankton <https://www.ted.com/talks/the_secret_life_of_plankton> |
| 19-Feb | W | Primary producers | Ecological challenges faced by phytoplankton: light and nutrients | <https://www.sciencelearn.org.nz/resources/141-environmental-conditions-affecting-the-sea> |
| 21-Feb | F | Bioluminescence | Harmful algal blooms and ‘red tides’  Defense  Communication | The bioluminescence web page: <https://biolum.eemb.ucsb.edu/>  Harmful algal blooms: <https://coastalscience.noaa.gov/research/stressor-impacts-mitigation> & <http://www.iupui.edu/~g115/mod17/casestudy01.html> |
| 24-Feb | M | Marine fauna | Marine animal tree of life  Introduction to Nektoplankton | <https://www.pnas.org/content/97/9/4453>  Nektoplankton: <http://www.iupui.edu/~g115/mod17/lecture05.html> |
| 26-Feb | W | Marine Invertebrates | Choanoflagellates, Porifera and Flatworms | <https://ucmp.berkeley.edu/protista/choanos.html> |
| 28-Feb | F |  | Cnidaria and Ctenophora  Biology and Conservation of Coral Reefs | <http://marinebio.org/oceans/coral-reefs/> |
| 2-Mar | M | Major groups of mollusks | ***Video***: Octopuses: <https://youtu.be/VLkKiVIBxXU> |
| 4-Mar | W | Horseshoe crabs, sea spiders, and Major groups of crustaceans | <http://web.augsburg.edu/~capman/bio152/arthropods/crustaceans.html>  <https://www.nwf.org/Educational-Resources/Wildlife-Guide/Invertebrates/Horseshoe-Crab> |
| 6-Mar | F | Echinoderms | ***Video***: Zombie sea starts <https://youtu.be/KrfcglOmBYw> |
| 9-13 Mar | **M-F** | **Spring break** | | |
| 16-Mar | M | Continuation of invertebrates | Tunicates, Hemichordates, Cephalochordates | <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/cephalochordate> |
| 18-Mar | W | The impact of climate change in phytoplankton and invertebrates | | |
| Exam II Review | | |
| 20-Mar | **F** | **Exam II (Feb 12-Mar 16)** | | |
| 23-Mar | M | Marine Fish | Jawless Fishes: hagfishes and Lampreys | <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/jawless-fish> |
| 25-Mar | W | Cartilaginous Fishes: Major groups of sharks and relatives |  |
| 27-Mar | F | Biology of Cartilaginous Fishes:  Respiration  Osmoregulation  Movement  Reproduction  Migrations  Behavior | ***Video***: Why sharks are so awesome? <https://youtu.be/svlEfxTyJQE> |
| 30-Mar | M | Major groups of bony fish |  |
| 1-Apr | W | Biology of Bony Fishes  Respiration  Osmoregulation  Movement  Reproduction  Migrations  Behavior | ***Video***: Evolution of fish bodies <https://youtu.be/Cd-artSbpXc>  Electric fish <https://youtu.be/z0M7_HPSi14> |
|  |  | Climate change effects in fish populations | | |
| 3-Apr | F | Marine Reptiles | Sea snakes  Marine iguanas  Saltwater crocodiles  Sea turtles | Sea snaks: <https://www.thenakedscientists.com/articles/science-news/how-urban-sea-snake-lost-its-stripes>  Marine Iguanas: <https://www.livescience.com/7294-iguanas-die-find.html>  Salt crocs: <https://www.bbc.com/news/science-environment-36197656>  Sea turtles: <https://www.sciencedaily.com/releases/2018/12/181214124052.htm> |
| 6-Apr | M | Marine Birds | Major groups  Penguins  Albatrosses | Penguin: <https://www.sciencemag.org/news/2019/04/emperor-penguins-flee-unsteady-ice-after-unprecedented-failure-breed>  Albatros: <https://www.eurekalert.org/pub_releases/2017-11/bas-api112017.php> |
| 10-Apr | W | Marine Mammals | Polar bears, sea otters, walruses and seals | Polar bear: <https://www.sciencedaily.com/releases/2018/02/180201173314.htm>  Walrus <https://www.eurekalert.org/pub_releases/2019-09/uoct-eoi091319.php> |
| 8-Apr | F | Manatees and Dugongs | Manatees: <https://www.sciencedaily.com/releases/2019/09/190930114733.htm>  Dugongs: <https://www.nhm.ac.uk/discover/news/2019/september/dugongs-could-be-more-endangered-than-we-thought.html> |
| 13-Apr | M | Baleen Whales | <https://www.sciencedaily.com/releases/2019/01/190122104555.htm> |
| 15-Apr | W | Toothed Whales | <https://www.sciencedaily.com/releases/2018/11/181115145018.htm> |
| 17-Apr | F | Climate change effects in marine vertebrates | | |
| Exam Review | | |
| 20-Apr | M | **Exam III (March 23-April17)** | | |
| 22-Apr | W | Marine communities | Intertidal Zone  Estuaries  Salt Marshes  Mangroves Forests  Coral Reefs  Hydrothermal vent communities | Coastal waters: <http://www.iupui.edu/~g115/mod14/lecture01.html>  Mangroves: <https://ocean.si.edu/ocean-life/plants-algae/mangroves>  Intertidal shores: <https://www.nps.gov/subjects/oceans/intertidal.htm> **&** <http://www.iupui.edu/~g115/mod18/lecture03.html>  **NPR:** <https://www.sciencefriday.com/segments/what-is-the-future-of-coral-reefs-in-warming-ocean-waters/> |
| 24-Apr | F | Threats to marine organisms and their habitats | Overfishing& Whaling | C.M. Free et al. Impacts of historical warming on marine fisheries production. Science. Vol. 363, , 2019, p. 979. doi: 10.1126/science.aau1758. <https://www.sciencenews.org/article/oceans-are-warming-due-climate-change-yield-fewer-fish> |
| 27-Apr | M | Invasive Species  Diseases | Lionfish: <https://www.livescience.com/64533-lionfish.html>  Climate change and marine diseases: <https://www.annualreviews.org/doi/abs/10.1146/annurev-marine-010213-135029> |
| 29-Apr | W | Nutrient enrichment  Coastal eutrophication  Shipping  Oil pollution  Plastics  noise | How Radioactive are our oceans? <http://ourradioactiveocean.org/> <http://www.whoi.edu/cmer>  ***Video***: The complicated journey of marine pollution <https://ed.ted.com/featured/hiGIPdFs>  ***Video***: What really happens to the plastic you throw away <https://youtu.be/_6xlNyWPpB8>  ***Video***: Noise <https://www.youtube.com/watch?v=t0DHEldqfIc>  <https://www.ted.com/talks/triona_mcgrath_how_pollution_is_changing_the_ocean_s_chemistry>  Marine animal sounds and noise <https://dosits.org/>  <https://www.sciencedaily.com/releases/2019/03/190313143307.htm> |
| 1-May | F | Climate Change  Sea levels  Ocean acidification, | Melting Ice Sheets: <http://oceanmotion.org/html/impact/ice-sheets.htm>  Antarctica is melting: <https://www.nytimes.com/2018/06/13/climate/antarctica-ice-melting-faster.html>  ***Video***: A vanishing island off the Louisiana coast <https://youtu.be/qbW6KBI3Z2g>  ***Video***:The oceans are suffocating <https://www.livescience.com/61338-ocean-losing-oxygen.html?utm_source=notification> |
| 4-May | **Final Exam** | | | |

**\*\*Note: Instructor reserves the right to make changes to the above calendar as she sees fitting.**