BIOL 466 FRONTIERS IN MARINE BIOLOGY

ECOLOGICAL EFFECTS of OCEAN CLIMATE CHANGE

Instructor: Dr Graham Epstein. Teaching Assistants: Matt Csordas
Monday and Thursdays | 1 – 2:20pm | MacLaurin D114
No textbook required. Readings and other materials will be provided.

How are warming seas impacting the ocean along with its populations and communities?

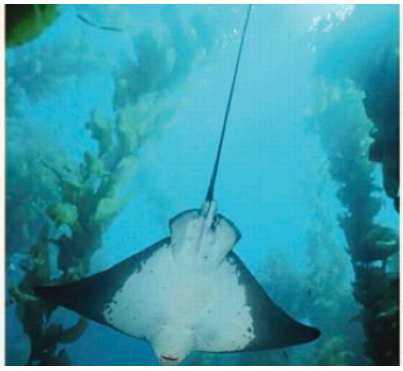
Are marine heatwaves going to wipe out coral reefs and kelp forests?

Will marine fisheries still be as productive under climate change?

What are the solutions to ensure healthy future oceans and how can they contribute to climate mitigation?

If these questions keep you up at night, this is the class for you! This course will focus on understanding how climate change is altering the ocean, primarily concentrating on the effects of marine species and ecosystems. There is no text book, because we're focusing on the frontiers of this field (primarily discoveries made in the past 5-10 years), and it is an exciting and rapidly evolving one.

New discoveries about the ecological effects of climate change in the ocean are being made all the time. They appear regularly in the news, and help to inform (we hope) public discourse and policy about climate change mitigation and adaptation. Given science's central role in our society, learning ***1)*** critical-thinking skills to evaluate evidence, ***2)*** how to do science, and ***3)*** how to communicate science, should play a central role in any scientist's training. Yet, for many of you, your exposure to science so far has been restricted to learning the core ideas and facts that underpin your chosen fields. This course aims to change that by making you active participants in your learning, as we evaluate and discuss scientific discoveries, analyze data, synthesize the literature, and interact with real ocean climate change scientists. In the process of this scientific training, you'll become better readers, thinkers, analysts, communicators, and collaborative scientists – all skills that will set you apart on whatever path you choose.


Instructional Team

Instructor:

Dr. Graham Epstein
(pronouns: he/him)
Please call me: Graham
Contact: On slack or by email: grahamepstein@uvic.ca

Student Support Hours: Th. 3-5pm in Cunningham 105, or by appointment. Please note I have a shared office so if you would like to meet privately, please schedule a Zoom/Teams call via slack.

I will teach the course and be your primary contact. Trained as a benthic marine ecologist and conservationist, I am a postdoctoral research fellow in Dr. Julia Baum's lab. My research focuses on blue carbon – the ability of marine habitats to capture and store carbon. I have also worked across academia, non-profit and government sectors on topics including marine invasive species, MPAs, kelp ecology and fisheries management.

Teaching Assistant:

Matt Csordas
(pronouns: he/him)
Please call me: Matt
Contact: On Slack or by email: csordas.matthew@gmail.com

Matt will lead the R components of our course. Matt is a 3rd year PhD student in the Baum Lab, whose research examines changing distributions of kelp species under climate change and their drivers. Matt did his B.Eng. at McMaster University in Chemical / Bioengineering and is now applying the statistical and coding skills he gained in that degree to the field of marine ecology. He has experience in a variety of coding languages and is no stranger to debugging his own occasionally questionable code (so should be able to help you do the same!). Matt loves to spend his free time cycling and in or by the ocean.

Core Principles

We base our teaching and your learning around three core principles:

1. **We're all on the same team:** This statement has two key implications. First, science in the 21st century is highly collaborative, and the best scientists are those that can work well together, even as they encounter inevitable challenges along the way. This course is designed to give you opportunities to practice the skills necessary to work productively and enjoyably in teams, and you'll regularly do so. It is not a competition. Second, even the best teams have coaches. This is how we see our role: to help all of you achieve your learning goals by 'steering the ship', and providing you with a framework, direction and feedback.
2. **Keep it real:** We have designed activities, assignments, and assessments to align as closely as possible with what you'll do, and how your work will be evaluated, in the "real world". For each assignment – be it crafting a short presentation, producing clearly annotated R code, or writing a paper – we will provide you with a set of criteria for what success looks like based on the external standards on which "real" science is judged. We're always impressed by how much students can accomplish when given the chance to join the ranks of a real scientific community, this one focused on confronting the ongoing climate change challenges facing our oceans. We're excited to welcome you to this community.
3. **Equity, inclusion, and empathy:** We endeavor to provide an equitable, inclusive, and accessible learning environment. In turn, we expect everyone in the class to help us to foster

these principles, to contribute to a collegial environment in which all individuals and their rights to learn are respected, and everyone (us included!) is treated with respect, as described in the UVic Student Code of Conduct https://www.uvic.ca/services/advising/advice-support/academic-units/student-code-of-conduct/index.php If you are registered with the Centre for Accessible Learning (CAL) and anticipate or experience any barriers to learning in this course, please feel welcome to discuss your concerns with me. If you are a student with a disability or chronic health condition you can meet with an advisor at CAL to discuss access and accommodations https://www.uvic.ca/accessible-learning/index.php

Goals and Learning Outcomes

This course is designed around four interrelated **learning goals**, each of which is fundamental for modern scientists. These, along with their specific **learning outcomes describe what you will know and be able to do** at the end of the course, are detailed below. We have designed the class activities and assignments around these goals, with the aim of helping you to achieve these outcomes.

Learning Goals	**Learning Outcomes:**
G1. Learn foundational knowledge & improve critical thinking skills	▪ Effective and efficient critical readers of the scientific literature; ▪ Distinguish scientific evidence from interpretation; develop and critique scientific arguments; ▪ Understand how climate change is affecting the ocean, marine species and ecosystems. ▪ Apply relevant knowledge and critical assessment to future work (e.g. discussions, presentations, and papers in the course).
G2. Effective scientific communication and collaboration	*Oral (O):* ▪ Presentations: Use clear communication and modern visual tools to communicate scientific information and assessment effectively to peers; ▪ Discussions: Discuss content and critical evaluations of the scientific literature with peers, including active and respectful listening to peers, and being open to diverse perspectives; *Written (W):* ▪ Demonstrate understanding of the relevant scientific literature; clearly communicate scientific information, synthesis and assessment; *Collaboration (C):* ▪ Work effectively as a team, including identifying roles and responsibilities, setting priorities, giving and receiving feedback that leads to positive change, identifying and resolving interpersonal conflict.
G3. Ecological data analysis and interpretation	*Data Science:* ▪ Write code in R in order to conduct data exploration, apply common statistical tools to analyze data, and produce figures that clearly present data; ▪ Annotate code and produce documents using R Markdown;

	Evidence and Inference: ▪ Interpret the evidence in data sets and make reasonable scientific inference.
G4. Engage with a real scientific community	▪ Pose insightful questions to researchers; ▪ Participate meaningfully in conversations about the primary literature.

Course Components and Evaluation

There will be no midterms or final exam in this course. Instead, you will demonstrate your success by learning and communicating the course material through in-class discussions with peers and scientists, presentations, quantitative assignments, and a literature review. Evaluation of this type is designed to emphasize **new knowledge and the skills that scientists require** – the specific course learning goals (G) that each course component will strengthen are denoted below in blue. Our course structure requires that you commit to being an active participant in your learning, and to doing a steady amount of work each week. The evaluations which must be completed In order to pass the course regardless of their grade are noted by an" M". Evaluation will be as follows:

I. Class Interaction: 45%

Our course will involve active participation and learning collectively in class. You are expected to prepare for in advance, attend, and come ready to contribute to class.

Paper Discussions: We will read and discuss carefully selected scientific reports on the current state of knowledge, and peer-reviewed journal articles describing discoveries at the frontiers of understanding the ecological effects of ocean climate change. We will have a practice discussion in week one. After that, we will have 5 assessed discussion classes (D1-D5 on the course calendar) in which you and your peers will be the leaders.

Here's how D1-D5 will work: Each of you will belong to two different teams, a 'Discussion team' and a 'Presentation/Discussion Lead team', that will remain the same for the semester.

1. **Paper presentation & discussion lead (10%; G1; G2-O,C):** For one of the discussion classes, you will work with your Presentation/Discussion Lead team to prepare a short presentation that introduces the week's discussion paper(s), along with a set of guiding questions that you will use to lead the discussion. After the group presentation, we will split into our Discussion teams, with each team led through the discussion by one of the Presentation/Discussion Lead team members. See full assignment for more details.

2. **Discussion preparation and participation (4 X 6% = 24%; G1; G2-W,O,C):** For the four discussions your team is not leading, you will prepare by reading the assigned paper(s) and answering a short question set (3% each). Participation in the discussion (3% each) will be assessed by self-evaluation and peer-evaluation. See full assignment for more details.

Interacting with Scientists (6%; G4): We are fortunate to have 6 leading ocean climate change scientists joining us for classes interspersed throughout our course themes. These classes will involve a guest lecture followed by a discussion on a topic in the realm of their expertise. You may be assigned one of their papers to read. You will prepare questions in advance, vote on the best questions, and take turns asking them during the session. Questions may focus on our guest's research or their career path. A substantive question is relevant, open-ended, clearly articulated, and describes the intent behind it. This course component will be assessed via your active participation, and your professional and courteous presence in these sessions with our guests.

Overall participation and class contributions (5%; G1, G2, G4): Finally, I will assess your overall course participation outside of the two graded class-types stated above. This will include your attendance to class, your contributions to sessions, and your timely submission of ungraded assignments. I will also look to your active participation in our slack channel #news-sharing-discussion, where you can post, and discuss, up to date news stories and new scientific publications relevant to the class - we may also discuss some of these in class.

II. Analyzing Climate Change Impacts: 20%

You will conduct two assignments (R1 8%; R2 12%; **R2=M**; **G3**), in which you analyze data sets on climate change impacts in the ocean using the open-source programming language R. See full assignment for more details, and the set of posted R tutorials to help you prepare for these assignments.

III. Literature Synthesis: 35%

You will choose a topic relevant to our course and review a small subset of the literature on it. This is <u>not</u> meant to be an exhaustive literature review. Instead, this is your opportunity to read (~8-12 papers, focusing on outputs from the last ~5 years) and think more deeply on an aspect of 'ecological effects of ocean climate change' that you are especially interested in, to synthesize the information and your critical assessment of it, and to practice your scientific writing and presentation skills.

Review Paper (M; 25%; G1, G2-W): You will write a review paper (8-10 pages double spaced text) on your approved topic. Topics must be approved by me by Thurs. 25th Jan. A paper outline (ungraded) is due Mon. 26th Feb; an optional paper draft (for feedback) is due between Mon. 25th and Mon 1st April, and the final paper is due Mon 22nd April.

3-Minute Presentation (M; 10%; G2-O): You will record yourself giving a short talk (max. 3 min.) using Powerpoint, in which you present your literature synthesis; due Thurs. 4th April. We will also watch the videos together in the final class.

****Assignments, projects and assessments will be posted in and submitted through BrightSpace with each due by midnight on the specified date on the course schedule (except discussion session preparation which is due before class)****

Academic Integrity: It is expected that all of us, as members of an intellectual community, will adhere to the values of honesty, trust, fairness, respect, and responsibility. Any action that contravenes this standard, including misrepresentation, falsification or deception, undermines the

intention and worth of scholarly work and violated the fundamental academic rights of members of our community. **You are responsible for creating the entire content of your work.** Plagiarism and other acts against academic integrity, including the use of artificial intelligence software, are serious academic offences, and it your responsibility to understand the University's policy on academic integrity. Nothing in this policy is intended to prohibit students from developing their academic skills through the exchange of ideas and the utilization of resources available to support learning. Please consult https://www.uvic.ca/students/academics/academic-integrity/index.php for more information.

While this class is strongly based around your attendance and participation, I recognise that situations may arise that means you are not able to attend a class or meet a deadline. Please contact me in advance of a class with a reasoning for your absence so I can take this into consideration. If you are unable to meet a deadline, provide a timely explanation of why you need an extension, and I am happy to work with you to accommodate wherever possible. Assignments after any due date without negotiation will drop 10 percentage points per day late and after three days will be graded "0" unless otherwise discussed.

Course Resources and Technology

We will use several different software tools and online platforms used by practicing scientists, with course materials and communication spread across the platforms as follows:

Brightspace: Brightspace (**bright.uvic.ca**) will be the learning hub for the course. This is the main way that you will 1) view course announcements, 2) access course materials, 3) submit assignments, and 4) track your grades.

Slack: We will use the online collaboration tool Slack for general discussions and Q&A about the course, with discussion topics organized into 'channels'. Think you need to send an email? Think again! Please use our #q-and-a channel if you have a general question, and the answer is not in the syllabus (or already answered in the channel!). Many people likely have the same question, and that way the answer can be seen by all. **Note:** Please email me only if you have an urgent or private question or concerns. Please download Slack (https://slack.com/intl/en-ca/) and create an account. You should then be able to join through this link using your UVic email account: Biol466Ocean Climate2024

R: The open source software R has become the program of choice for most practicing ecologists. We will conduct two data analyses using it. Please install R and RStudio: https://posit.co/download/rstudio-desktop/ (RStudio is a GUI (graphical user interface) that makes using R friendlier) and if you are not already comfortable using R, follow the detailed Tutorials on our Brightspace page.

Zoom: If we need to run a class online, it will be announced on Brightspace, and we will use Zoom link: https://uvic.zoom.us/j/2427249686?pwd=NDVXN0ozVTFlWkwvRldpMm9ReEc1dz09

If you any questions or concerns about accessing or using any of these programs, please let us know (ideally through the Q & A channel on Slack).

Course Schedule

****Note: – This schedule is subject to change.**
You will be notified of any alterations to the schedule below as early as possible**

Focal Theme	Date	Topic	Assessments due
0 Introductions & Background	M 8th Jan	Course introduction/overview	
	Th 11th Jan	R Workshop and data assignments overview	
	M 15th Jan	Foundational papers discussion	
1 Why temp matters	Th 18th Jan	GL: Prof. Mary O'Connor (UBC)	
2 Climate change in the ocean – IPCC Overview	M 22nd Jan	IPCC AR6 WG1 – The physical science basis	
	Th 25th Jan	IPCC AR6 WG2 - Impacts on the ocean	Review proposals due
1 Why temp matters cont.	M 29th Jan	D1	D1 prep due
3 Gradual climate change	Th 1st Feb	Range shifts	
	M 5th Feb	Ecosystem tropicalization	R Assignment #1 due
	Th 8th Feb	D2	D2 prep due
	M 12th Feb	GL: Dr. J McHenry (UVic) – Seagrass	
	Th 15th Feb	Protection	
Reading Break (February 19 - 23)			
- News discussion	M 26th Feb	Ocean climate change in the news discussion	Review outlines due
4 Marine Heatwaves	Th 29th Feb	Marine heatwaves (MHW)	
	M 4th Mar	GL: Dr. J. Baum (UVic) – MHW & coral reefs	R Assignment #2 due
	tbc	GL: Dr. S. Starko (UWA) – MHW & Kelp	
	Th 7th Mar	D3	D3 prep due
5 OA and O2	M 11th Mar	Ocean acidification & hypoxia	
6 Changing fisheries	Th 14th Mar	GL: Dr. J. Palacios (UBC) - Fisheries	
	M 18th Mar	D4	D4 prep due
7 Ocean solutions	Th 21st Mar	Ocean climate change mitigation	
	M 25th Mar	GL: Dr. S. Fuller (Oceans North) - Policy	Review draft open
	Th 28th Mar	D5	D5 prep due
	Th 4th Apr	Habitat restoration	3-min talk due
x Closing class	M 8th Apr	Watch your literature synthesis videos	
	M 22nd Apr	NO CLASS	Review Paper due

D = Discussion | GL = Guest Lecture.

Further UVic policies & regulations:

- Course drop and add, and other important dates: https://www.uvic.ca/calendar/dates/
- Academic concessions: https://www.uvic.ca/students/academics/academic-concessions-accommodations/request-for-academic-concession/index.php
- Full undergraduate academic calendar: https://www.uvic.ca/calendar/undergrad/#/home
- Student policies & regulations: https://www.uvic.ca/registrar/students/policies/index.php