Marine Population Ecology and Dynamics

Fall 2020 BMSC Program Online

Course description

Welcome to Marine Population Ecology and Dynamics (MPED)! MPED is a four-week intensive upper-level undergraduate course during the BMSC Virtual Fall Program, designed to provide an immersive experience in marine ecology and research methods from the comfort of your own home. In this course, we will explore key theories about the structure and dynamics of populations, communities, and ecosystems in coastal marine environments. Through examining case studies of changing ocean biodiversity on Canada's west coast, you will have the opportunity to become 'ecological detectives', learning and applying skills from the ecologist's toolbox to determine how and why events like biological invasion, harvesting, and climate change affect marine species. Ecological topics that we will explore include population growth and regulation, species interactions, food webs, and community resilience and recovery. Course activities include virtual field trips and data collection, individual and team-based projects, interaction with experts, and discussions of cutting-edge primary literature. You will also gain some hands-on training in statistical analysis and graphing using R, a powerful, open-source statistical programming language now used by most practicing biologists. Through course activities, you will build analytical, communication, problem-solving, collaboration, and leadership skills that are essential in a research setting and beyond.

Instructional team

Instructor: Dr. Stephanie Green
Email: stephanie.green@ualberta.ca
Twitter: @steph_j_green
About me: I am an Assistant Professor at the University of Alberta, where I lead the CHANGE Lab (www.greenlab.ca). We study biodiversity change in marine ecosystems, in service of developing science-based tools to aid conservation. Ocean ecosystems are changing like never before, and together we'll learn the research tools marine ecologists use to figure out how and why. Motivated, enthusiastic, and dedicated students like you are what inspires me to teach in Bamfield each year. Although this semester is different for all of us, we are still in for a great adventure together!

Teaching Assistant: Noelle Helder
Email: helder@ualberta.ca
Twitter: @nkhelder
About me: I am a graduate student working with Dr. Stephanie Green at the University of Alberta. My research looks at how coral reef fish interact with their reef habitat, and how these interactions affect ecosystem processes like nutrient recycling and herbivory. I also enjoy mapping, science communication, and anything that gets me outside. Looking forward to working with you all!

Course dates

MPED runs Tuesday, Oct 13th - Friday, Nov 6th, 2020 online. Generally, the format is:

- M-F @ 9-11am Pacific (primarily asynchronous; some asynchronous activities)
- M-F @ 1-3pm Pacific (primarily synchronous & some asynchronous activities)

See the detailed course schedule online for specific activity details.

Core principles

We have structured your learning in this course around two core principles:

1. **We're all on the same team:** This statement has two key implications. First, science is a team sport, and the best scientists are those that can work well together 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. Second, even the best teams have coaches. This is how we see our role: to help all of you achieve your learning goals by providing opportunities for regular and specific feedback. Evidence shows that this is one of the most important ways to improve student learning. So, please think of us as the coaches of your team, rather than as referees of the championship tournament.

2. **Keep it real:** We have designed activities, assignments, and assessments to align as closely as possible with what ecologists "do" and how ecological science is evaluated in the real world. For every assignment – be it collecting a new ecological dataset, producing clearly annotated R code, designing figures, or crafting a short presentation – we will provide you with a set of criteria for what success looks like based on the external standards on which science is evaluated.

Goals and learning outcomes

1. Gain foundational knowledge and develop skills of practicing marine ecologists
• Understand and apply relevant content knowledge to a specific marine ecology research question: biodiversity, ecological niche, intertidal zonation, ecosystem function and services, population regulation, shifting baselines, top-down and bottom-up effects
• Understand and apply some common field techniques and skills used by practicing ecologists: marine biodiversity assessment, transect and quadrat sampling, species identification

2. Engage with a real scientific community
• Pose insightful questions to knowledge holders and researchers
• Participate meaningfully in conversations about the primary literature

3. Produce and communicate new scientific knowledge
Scientific thinking
• Formulate testable questions and hypotheses
• Contribute to the design of rigorous scientific studies
• Select appropriate methodology to address a scientific question

• Distinguish scientific evidence from interpretation; develop and critique scientific arguments

Data science
• Create and use a comprehensive data management plan to organize and archive an ecological dataset
• Apply some common statistical tools to analyze data and produce figures using R and RStudio
• Annotate code and produce documents using R or R Markdown

Comprehension and Communication
• Become effective and efficient critical readers of the scientific literature
• Use modern verbal and visual scientific communication skills to reach diverse audiences

Research Collaboration
• Set and achieve shared research goals
• Prioritize tasks and monitor progress towards a shared goal
• Give and receive feedback that leads to positive change
• Identify and resolve interpersonal conflict
• Use basic project management techniques and tools (e.g. work breakdown structures, Gantt charts, critical path analysis) to meet deadlines and achieve project goals

Evaluation

Component	Percent of total grade	Due date
Paper discussions	15%	See dates in schedule
Virtual field trips	10%	See dates in schedule
Practice exercises	15%	Ongoing
Field sampling assignment	30%	Oct 27th
Population assignment	30%	Nov 6th

Grading

Letter Grade	Percentage
A+	90-100
A	85-89
A-	80-84
B+	76-79
B	72-75
B-	68-71
C+	64-67
C	60-63
C-	55-59
D	50-54
F	0-49

View how BMSC grades translate to affiliate universities here.

Course assignments overview

Below we have included brief descriptions of the core assignments designed to assess the learning outcomes described above. Detailed descriptions and rubrics for each assignment will be provided on the course management platform (BMSC Moodle).

Paper discussions (15%- see course calendar for dates)

These assignments are designed to facilitate careful reading of relevant scientific literature. For a set of carefully chosen scientific papers, you'll be asked to read the paper, complete a brief descriptive summary, and then participate in a short paper discussion led by your peers.

For one of the papers, you will work with a group of your peers to prepare background materials and 'lead' the discussion. We'll also have the opportunity to conduct a 30-45 min Q&A with several of the scientists who conducted the research described in these papers:

- Amy Groesbeck (Project Biologist, Confluence Environmental Company)
- Lauren Eckertt (PhD Candidate, University of Victoria)
- Dr. Larry Crowder (Professor, Stanford University)
- Dr. Brett Favaro (Associate Dean, Natural Resources & Environment, BCIT)

You will have the opportunity to prepare questions in advance for the scientist, vote on best questions, and take turns asking questions. These will be interspersed throughout the course. More details will be provided in the first week of class. **See the assignment description and grading rubric on Moodle for more information.**

Practice exercises (15%- ongoing)

Small exercises embedded within lectures and lab sessions are designed to help prepare you for success in other course assignments by reinforcing concepts and practicing skills learned in class. The format will vary from a few online questions about ecological scenarios, to sample calculations for community and population data, to 'field' activities that will have you practice sampling in your own home. **Your grade will be evaluated based on the proportion of each exercise you complete (i.e. participation and effort). Exercises must be completed within 24hrs of their assignment, unless otherwise specified in class.**

Virtual field trips (10%- see course calendar for dates)

The aim of these 'virtual' field trips is to give you the opportunity to interact with knowledge holders and researchers who are applying the concepts we're learning about in class in the real world. **Your grade will be evaluated based on your attendance (5pts) and level of engagement (5pts) in each trip (typically hosted via Zoom), and a 3-5 sentence reflection on the experience that can be shared with the hosts (5pts).** Late or partial attendance without prior permission from the instructor is -2.5pts. To receive 5pts for engagement, you must pose minimum 1 question per field trip in the chat and be willing to articulate your question when called upon by the facilitator. Max points per field trip = 15.

Field sampling assignment (30%- due October 27th)

In this group assignment, you will apply your knowledge of ecological communities and sampling techniques to answer a specific research question related to how intertidal communities are changing. BMSC ecology students have been collecting data on intertidal biodiversity at Wizard Islet since 1997, providing a rich source of information to compare against new data. Using a 360° virtual tour you will explore the field site and "walk" a set of transects. Then, you'll design a sampling scheme (data collection and analyses) to answer a research question of your choosing using historical data from Wizard Islet, and new data that you collect 'virtually' from the site this year. Components of the assignment include i) generating hypotheses and predictions to answer your question with the available data, ii) justification of sampling scheme and analyses for your research question, iii) data collection and management, iv) annotated code in R for your analyses, v) clearly labelled figures of your data and written results, and vi) a brief presentation of your research methods and results for the class. **See the assignment description and grading rubric on Moodle for more information.**

Population modelling assignment (30%- due November 6th)

In pairs, you will apply your knowledge of marine population dynamics to evaluate and predict trends in the abundance of species of conservation concern on the Pacific coast of Canada. First, you will select a focal Pacific species and gather information on historical trends in its population abundance, and stressors and threats the species faces. Next, you will construct a simple matrix population model to forecast how the species' abundance may change into the future. Finally, based on your research, you will propose and test conservation measures that could be taken to sustain the population into the future. Components of the assignment include a brief presentation to the class in which you share: i) background research on the status of and threats to your focal species, ii) a life cycle diagram for the species, iii) data on vital rates and population growth rate for the population, iv) proposed conservation and management actions for the population; and v) clearly labelled graphs that show your predictions for population abundance into the future under a 'business as usual' scenario and for your 'conservation' scenario. You will also submit annotated code in R for population model analyses and graphs. **See the assignment description and grading rubric on Moodle for more information.**

Academic integrity

Academic integrity requires commitment to the values of honesty, trust, fairness, respect, and responsibility. It is expected that you (the student), faculty members and staff at BMSC, as members of an intellectual community, will adhere to these ethical values in all activities related to learning, teaching, research and service. Any action that contravenes this standard, including misrepresentation, falsification or deception, undermines the intention and worth of scholarly work and violates the fundamental academic rights of members of our community. This policy is designed to ensure that the university's standards are upheld in a fair and transparent fashion. Students are responsible for the entire content and form of their work. 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. Students who are in doubt as to what constitutes a violation of academic

integrity in a particular instance should consult their course instructor. Please refer to this policy for more details.

Course Resources

We will use many of the software tools and platforms used by practicing scientists, with course materials and activities spread across the platforms as described below.

Moodle page: https://moodle.bamfieldmsc.com/
We will use Moodle to 1) upload key course documents (syllabus, assignment descriptions, rubrics, papers), 2) submit assignments, 3) complete knowledge reviews, and 4) track grades throughout the course.

Google Drive folder: https://drive.google.com/drive/folders/1i7cIJYw-wT-4rDba8nzkWpfKcGHK6e7B?usp=sharing
We will use Google Drive to 1) store and share files (assignment descriptions and rubrics, scientific papers for discussion, images and video for analysis, spreadsheets for collaborative data entry), 2) view filmed lecture modules, and 3) access living documents such as the detailed course calendar/schedule, which will be updated as the course progresses.

Slack workspace: 2020fallprogram.slack.com
We will use Slack for all day to day communication about course activities and content. Think you need to send an email? Think again! Please use Slack instead. We will review the variety of channels in our Slack workspace and their use on the first day of class, such as a form to ask questions and stay in touch. You will also be asked to create channels to coordinate collaborative work on course projects with other students during the course.

Zoom
We will be conducting synchronous class activities together using Zoom video conferencing software. The online classroom environment this term is a different space to what most of us are used to. We will discuss best practices and etiquette for our virtual classroom in the first week of the course to help ensure it is a comfortable, engaging, and positive place for all of us. Links to join for synchronous activities on Zoom will also be found in the Slack workspace channel called #zoom-meeting-links.

Other tools:
R: https://www.r-project.org/
Q-GIS: https://www.qgis.org/en/site/forusers/download.html

An excellent source of beginner R tutorials:
Coding club: https://ourcodingclub.github.io/

Draft detailed schedule

https://docs.google.com/spreadsheets/d/1OnRT8eLRUuocdynv5qpNAuVS4TsAitw5i_eIXdeAqBY/edit?usp=sharing