SEA EDUCATION ASSOCIATION

The Ocean and Global Change
CAS NS 326 OGC (4 credits)

Instructor: SEA Faculty

Course Philosophy & Approach:
Humanity depends upon and extracts value from the ocean for food, transport, climate, personal wellbeing, and other ecosystem services. Ours is the first generation to truly appreciate that the global ocean ecosystem is not immutable but instead has and continues to undergo rapid shifts caused by unsustainable human practices. Collectively these anthropogenic changes to the ocean (plus terrestrial/atmospheric ecosystems) have led to the designation of a new geologic time period – the Anthropocene.

Warming, acidification, fisheries depletion, and pollution are but a few examples of human pressures that influence natural patterns in ocean characteristics as well as the distribution, diversity, and abundance of marine organisms. It is important to note that human extraction from the ocean and corresponding negative environmental impacts are not shared equally among all socio-political or cultural groups. This course examines the Anthropocene ocean with emphasis on observed pressures, ecological responses, and potential solutions; it complements other Climate & Society program coursework that brings social science & human-centered lenses.

We build a foundation of global principles by first reviewing ocean circulation, seawater chemistry, nutrient dynamics, and biological production. We then consider ways humanity extracts value from and influences the global ocean through New Zealand-focused case studies. Examples of questions this course may explore on a regional-to-global scale include: Is marine productivity diminishing? Will open-ocean plankton communities change in response to the acidification of seawater? Does depletion or migration of top predators impact lower food web structure and interactions? Will increased nutrient loading shift coastal ecosystem composition and health? Can plastic marine debris serve as a vector for non-native introductions? How can the best available science inform and guide future use of marine resources?

Learning Outcomes:
1. Understand, from a scientific perspective, human value of ocean ecosystems.
2. Understand, from a scientific perspective, anthropogenic pressures on ocean ecosystems.
3. Foster ocean literacy, to encourage a commitment to securing ocean health.
4. Gain practical experience in oceanographic data collection and analysis.

Evaluation:

OGC Sheet Anchor	30% (25% onshore entries & 5% at sea entries)
NZ Case Study Presentation	5% (one presentation)
At Sea Project	25% (10% preparatory steps onshore & 15% data-based synthesis at sea)
At Sea Watchstanding	40% (30% engagement in lab & 10% at sea practical exam)

Assignments:
OGC Sheet Anchor onshore: Traditionally, a "sheet anchor" was the most reliable anchor aboard a sailing vessel, the "go to" anchor for in difficult and uncertain conditions. At SEA, the goal of your Sheet Anchor is

to create a resource of accurate, useful information that you need to commit to memory, easily access to while standing watch, or consult for your research. Therefore, you are strongly encouraged to include nautical science as well as oceanographic content in your Sheet Anchor, although in this class only science entries will be evaluated. We hope it will be a source of pride and a record of your SEA experience as well.

The OGC Sheet Anchor will become your personal guide to New Zealand's oceans. Daily entries will include synthesized notes, diagrams, responses to discussion prompts, and lingering questions, each of which assesses your individual understanding of and engagement with the topics introduced in this course. Think of these as equivalent to the preparation required to ace an in-class exam. Use available resources such as class notes, textbooks, readings, and discussion with peers; application of illustration skills is expected.

In practice, one journal page should be dedicated to the summation of your notes from most OGC class sessions, with emphasis placed on identifying the most important concepts, figures, and new terminology as they specifically relate to our New Zealand destination. You are encouraged to organize your Sheet Anchor with a Table of Contents so it can be used as a reference for yourself and is easier for faculty to evaluate periodically during the program. Assessment will be based on organization, neatness, and depth of content; a provided rubric will define which OGC meetings should be included in your Sheet Anchor.

OGC Sheet Anchor at sea: Your scientific journey and continued acquisition of knowledge during our voyage will be documented in your Sheet Anchor through at minimum these entries: Scientific Equipment Diagram, Creature Feature, and Final Reflection. Additional details about each will be posted on the ship.

NZ Case Study Presentation: Student teams will research and present information on selected climate issues specific to New Zealand. Presentations provide the entire class a glimpse into the challenges and implications arising from anthropogenic changes to New Zealand's weather, environments, and resources. Each student will give one presentation; the entire class is expected to do the required readings, engage in discussion, and respond to one OGC Journal prompt for each presentation session.

At Sea Project: Student teams will collaboratively take a data-based approach to investigating temporal and/or spatial changes in New Zealand's oceanographic conditions. Leveraging data collected along our cruise track, we'll explore how natural variability shapes our understanding of long-term change. Research questions and basic background knowledge will be developed during the shore component. The entire class will be responsible for data collection through lab watchstanding, but each team will be responsible for data analysis/mapping within their particular focus topic. Project findings will be shared with the ship's company at the end of the voyage.

At Sea Watchstanding: Each student is an essential crewmember on the ship. Excellent watchstanders follow directions, work effectively as part of the team, show independence, demonstrate good judgment/leadership, and are supportive, reliable shipmates. Teamwork is particularly important in this course, so much so that a student's attitude and participation directly affect the physical progress of the voyage. During the sea component, you will develop proficiency with scientific procedures including safety protocols, lab operations, data management, equipment deployment and recovery, and sample analyses. Over the voyage you'll progress through three phases of responsibility: Phase One actively learning skills, Phase Two actively applying skills to achieve our voyage mission, and Phase Three leadership in lab/deck watch activities.

Inclusivity and Classroom Culture:

Our SEA community embraces diversity of age, background, beliefs, ethnicity, gender, gender identity,

gender expression, national origin, religious affiliation, sexual orientation, and other visible and nonvisible categories. We expect each one of you (and you should expect the same from us) to contribute to a respectful, welcoming, and inclusive environment. If you feel that you are not being welcomed, included, or accepted here, please reach out to one of your teachers or one of the deans at SEA to share your concern.

Academic Integrity:
SEA expects all students to actively participate in program discussions and activities. Punctual attendance is required at every class meeting and watch session. **Late assignment submissions are not accepted** – please talk with Deb in advance if you anticipate a concern.

The policy on academic accuracy below will be strictly followed in this class.

> The assignments/papers that you submit in this course are expected to be your original work. You must take care to distinguish your own ideas and knowledge from wording or substantive information that you derive from one of your sources. The term "sources" includes not only published primary and secondary material, but also information and opinions gained directly from other people and text that you cut and paste from any site on the Internet.
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> **The responsibility for learning the proper forms of citation lies with you.** Quotations must be placed properly within quotation marks and must be cited fully. In addition, all paraphrased material must be acknowledged completely. Whenever ideas or facts are derived from your reading and research, the sources must be indicated.
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> As you browse websites, assess their usefulness very critically. Who posted the information and why? Can you trust them to be correct? Authoritative? Unbiased? Your annotation should include the name of the author or organization originating any material that you reference. If you can't identify the source, don't use it!

Readings:
Assigned readings from Segar's Introduction to Ocean Sciences textbook, other books, and scientific journals are posted on Google Classroom. Additional textbooks are available in the SEA library and may be useful resources as you prepare for presentations or research projects. Please do not remove any material from the SEA library.

OGC Course Calendar:

DATE/TIME/TOPIC	**ASSIGNMENTS** (LISTED ON DUE DATE)
Week 1: Ocean Fundamentals	
Monday 2 October 1545 SEA Welcome & Orientation	
Tuesday 3 October 0900 Climate & Society Program Introduction *Wednesday 4 October 1045* OGC Course Introduction Atmospheric Dynamics	1. Submit oceanography survey by 1700 2. Read Segar: ch7 p. 145 (budgets) – 155 (end)
Thursday 5 October 1400 Surface Currents	1. Read Segar: ch8 p. 175 – 186 (upwelling)
Friday 6 October 1400 Deep Circulation & the Southern Ocean RCS Scientific Capabilities	1. Read Segar: ch8 p. 190 (thermohaline) – 200 (end) 2. Submit NZ case study topic preferences by 1700
Week 2 *Monday 9*	
October No Classes *Today! Tuesday 10*	
October **Deadline!**	1. Submit at sea oceanography project interests by 0900
Wednesday 11 October 1045 Nutrients & Primary Productivity	1. Read Segar: ch5 p. 89 – 99 (pH), 106 (light) – 109 & ch12 p. 285 (primary production) – 291 (nutrients) 2. Watch: www.youtube.com/watch?v=23mrtGCkAH8
Friday 13 October 1400 Food Webs At Sea Project Work Session #1	1. Read Segar: ch12, p. 291 (food webs) – 294 & 298 (plankton) – 312 (end) 2. Submit Research Questions by 1700
Week 3 *Monday 16 October 1400*	
New Zealand's Marine Landscape Introduction to OceanDataView	1. Read (with images) all sections of https://teara.govt.nz/en/geology-overview 2. Install ODV and download data files before class
Wednesday 18 October 0900 Climate Change & the Ocean	1. Preparatory reading on Google Classroom
Thursday 19 October 0900 **Deadline!**	1. Submit Sheet Anchor for review by 0900

Friday 20 October 0900 NZ Case Study Presentations #1 Marine Debris	1. Review the most current annual and seasonal summaries (https://www.niwa.co.nz/climate/summaries)
Week 4	
Monday 23 October 0900 Beach Cleanup & Data Collection	1. Dress to be outside all morning!
Wednesday 25 October 0900 At Sea Project Work Session #2	1. Submit Background & Methods Outline by 1700
Friday 27 October 1400 NZ Case Study Presentations #2 Marine Debris Data Visualization	1. Preparatory reading on Google Classroom
Week 5	
Monday 30 October 1400 Zooplankton Labs *Wednesday 1*	1. Watch: www.youtube.com/watch?v=otgMoBmEEFk 2. Bring Sheet Anchor to class for use during labs
November 1045 At Sea Project Work Session #3	1. Submit Data Analysis Plan by 1700
Friday 3 November 0900 NZ Case Study Presentations #3	1. Preparatory reading on Google Classroom
Week 6 *Monday 6 November*	
0900 High Seas & Coastal Conservation *Tuesday 7*	1. Preparatory reading on Google Classroom
November 0900 **Deadline!**	1. Submit Sheet Anchor for review by 0900
Wednesday 8 November 1045 S312 At Sea Science Plan Discussion	1. Be prepared to share your oceanography project

Weeks 7 & 8: New Zealand Shore Component & Auckland (no OGC)	
Week 9: Introduction to Science Under Sail	
Watchstanding Phase I Introduction to Lab and Safety Procedures Begin Data Collection	Complete Equipment Diagram in OGC Sheet Anchor
Week 10: Long Voyage Leg – South to Napier	
Watchstanding Phase I Lab Skills Development Continue Data Collection Napier Port Stop	Complete Creature Feature in OGC Sheet Anchor Lab Practical Exam Submit OGC Sheet Anchor for review
Week 11: Long Voyage Leg – North from Napier	
Watchstanding Phase II Continue Data Collection	Begin data synthesis for At Sea Project
Week 12: Final Ship's Mission	
Watchstanding Phases II and III Continue Data Collection End of Voyage in Auckland	Complete and Present At Sea Project Complete Final Reflection in OGC Sheet Anchor Submit OGC Sheet Anchor for review

At-sea OGC assignment descriptions & deadlines will be posted onboard the ship.