



Practical Oceanographic Research (POR)

XAS NS 226 (4 credits)

Course Catalog Description (max. 40 words):

Introduction to oceanographic research. Design a collaborative, hypothesis-driven project following the scientific process. Collect original data. Conduct analysis and interpretation, then prepare a written report and oral presentation.

Instructors: Sea Education Association Oceanography and Nautical Science Faculty

Location: At sea onboard SEA's sailing school vessel *Robert C. Seamans*, preceded by completion of four online training modules during an initial shore preparation period.

Prerequisites: Admission to the SEA Semester.

Course Philosophy and Approach:

The goal of this course is to provide students with a foundation of knowledge and practical experience to explore the central Pacific Ocean as a mariner and an oceanographer. When you step aboard the *SSV Robert C. Seamans*, you will learn to tune your senses to life upon the ocean. An initial focus will guide you toward developing as effective members of a ship's crew. Throughout your time aboard, you are active members of the crew, engaged in all aspects of ship's operations including practical hands-on introduction to oceanographic research and coral reef survey methods.

Essential to the success of our sailing and scientific mission onboard the *SSV Robert C. Seamans* is the completion of four training modules, one for each week of the shore preparation period. Training modules (TMs) are designed to orient you to the central Pacific Ocean, the ship and traditional navigation practices, our reef-based and oceanographic research missions, the crew, your shipmates and the culture of life onboard a sailing, research vessel. Training modules involve a combination of live webinars, online discussion forums, reading assignments, and homework. Each TM requires approximately 1 hour of homework reviewing online content and contributing to discussion forums and 1-2 hours participating in live webinars with your professors and shipmates. Participation in the sea component is dependent upon the successful completion of all shore-based training modules.

While standing watch on deck, you will gain hands-on experience in executive and supporting roles required to operate a research sailing vessel in an environment of true consequences. Aboard ship, a phased assumption of responsibility culminates in the role of Junior Watch Officer (JWO), where routine operation of the vessel becomes the responsibility of the student team, under the guidance of senior staff.



While standing watch in the lab, you will operate standard oceanographic equipment and employ recognized methodologies involved in the collection, reduction, analysis, and presentation of oceanographic data. Students will collaborate in interpreting scientific data, and preparing detailed scientific reports and oral presentations summarizing their findings and conclusions.

This course is an intensive learning experience, and we are embarking on an ambitious undertaking. It is crucial that you take responsibility not only for your own learning, but that you also help one another. Additionally, the staff, at sea, is an ever-present source of assistance and advice. Motivation, teamwork, and cooperation are essential to completing our program and to the successful operating of a sailing vessel on our voyage through the central Pacific Ocean.

The course requires participation in and successful completion of approximately 10 hours of training modules (live webinars, discussion forums, and associated homework) prior to sailing. At sea, the course consists of 18 lecture/discussion sessions (1.5 hours each), 1 research poster session (3 hours), guided reef surveys at three coral atolls (24 hours), and about 180 hours of laboratory and deck watch participation (active learning/laboratory) across 25 underway days at sea.

Learning Outcomes:

By the end of the course, you should be able to:

1. Contribute as an effective team member and leader.
2. Develop action plans that are adaptable to circumstances and situations.
3. Function as an essential crew member through demonstrated proficiency in shipboard skills including scientific deployments and analysis.
4. Identify central Pacific reef fish, coral, and other invertebrates and conduct snorkel-based survey techniques.
5. Critically analyze and interpret authentic oceanographic and reef survey data.
6. Communicate scientific data with effective visual representation and oral presentation.

Evaluation:

Watch Standing Assessment	30%
Shipboard Skills and Practical Exam	10%
Execution of Final Mission/Exercise	10%
Reef Ecosystem Survey Project	25%
Oceanography Research Project	25%

Course Material and Online Access:

All required course material, including readings, online presentations/lectures, and video tutorials are available through our online course management system – OceanPortal. You will be provided the necessary log-in requirements and password to access the course once you have been accepted into the program.



Assignments:

Watch Standing: Each student is an essential crewmember of the ship. Excellent watch standers follow directions, work effectively as part of the watch team, show independence, demonstrate good judgment and leadership, and are a supportive, helpful, and reliable shipmate. Teamwork is particularly important in this course, so much so that a student's attitude and participation directly affects the physical progress of the voyage. Your success as a shipmate will be assessed through on-watch evaluations by SEA crew.

Shipboard Skills and Practical Exam: During the sea component, you will be required to demonstrate skill proficiency in aspects of shipboard operation including the science lab, deck engineering and accommodations. In the science lab, you will gain a working familiarity with safety protocols, lab operations, data management, equipment deployment and recovery procedures, and sample analyses. On deck, you will gain a working familiarity with safety equipment and response, sail handling, and navigation. Demonstration of skills proficiency will be assessed with a practical exam. This exam will take place at the end of the first training phase at sea. The exam is designed to establish proficiency in the baseline skills of the ship's departments (deck, laboratory, engineering, and accommodations) prior to the assumption of leadership roles.

Multi-Watch Mission/Exercise: Near the end of the training voyage, the class will be presented with an operational objective for the ship that requires coordination between watch teams over a 24-hour period. Students will need to choose an executive and several team leaders, and then to plan, conduct, and debrief the mission, all in coordination with the ship's chief instructional officers. Each watch team will receive a shared grade for this assignment, based partly on execution, and partly on how effectively the team can analyze its performance in review.

Reef Ecosystem Survey Project: Collectively, as a class, we will establish a baseline of coral reef ecosystem condition across the central Pacific Ocean. During our voyage, you will participate in coral reef surveys at each of the coral atolls we reach. In teams you will be responsible for the detailed observation and enumeration of a chosen coral reef ecosystem component: a) Coral Team, b) Fish Team, c) Invertebrate and Environment Team. Each team will write a short (3-5 page) report, contribute 3-5 slides to a collective PowerPoint presentation and create a poster that summarizes their scientific findings comparing the coral atolls we visit.

- Introduce Reef Survey Topic – What aspect of the coral reef ecosystem are you studying and why it is important? Include photos and illustrations as appropriate.
- Describe Reef Survey Locations – Where did you conduct the surveys? Include appropriate metadata for each survey location: date, time, duration, weather / sea conditions, etc.
- Summarize Reef Survey Findings – A detailed quantitative and visually graphic description of observed patterns in your data.



- Discuss Reef Survey Findings – What did you learn? Provide a detailed explanation for the observed patterns. What is similar and different among the three survey sites and what factors are responsible? What are the implications of these findings regarding coral reefs and their resilience to climate change and other human impacts?

Oceanography Research Project: While at sea, in small groups (2-3 students) you will examine trends in oceanographic data across the Central Pacific observed during our voyage and compare your findings to similar data collected by SEA during 2016's unprecedented El Niño. Several mentor meetings/data discussion sessions will help you stay on track and guide the progress of data analysis at sea. Project results will be shared with the ship's company in a short report (3-5 pages) and culminating poster session. Emphasis will be placed on clear visual representation of the research question, methods, data analysis and interpretation, as well as oral explanation of the work. The poster should communicate the following elements of your research:

- Introduce Oceanographic Topic – What aspect of the open ocean ecosystem are you studying and why it is important?
- Describe Data Collection – What equipment did you use and briefly summarize proper deployment procedures. Include photos and illustrations as appropriate. Where was your data collected? Include a map of deployment locations during our voyage.
- Summarize Oceanographic Trends – Produce appropriate tabular, graphical, or other visual representations of your data.
- Discuss Oceanographic Trends – What did you learn? Provide a detailed explanation for the observed patterns. What are the implications of these findings in relation to archived SEA data and the ENSO cycle.

Expectations and Requirements:

- Punctual attendance and active participation is expected at every class meeting.
- Active participation on watch, in all shipboard responsibilities, & in class activities is expected.
- Late assignment submissions are not accepted.
- The policy on academic accuracy, quoted below, will be strictly followed in this class.

The 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.

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. (Harvard *Handbook for Students*, 305)



- Considerations for use of internet sources:
 As you browse websites, assess their usefulness very critically. Who posted the information and why? Can you trust them to be correct? Authoritative? Unbiased? (It's okay to use a biased source as long as you incorporate it knowingly and transparently into your own work.) Keep track of good sources that might be useful for subsequent assignments, and annotate in your bibliography any sites you cite. 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! Understand that we will not have access to the Internet while aboard the ship and out to sea. Bring all of your coursework files with you.

Shore Preparation: April 23 – May 18, 2018

DATE & TIME	TOPIC/ASSIGNMENT(S)
WEEK 1	<i>TM 1: Introduction and Orientation to the Pacific Reef Expedition Program</i>
TBD	<p><u>Live Webinar and Discussion Forum (~2 hours):</u> Program/Course Overview and Logistics Meeting</p> <p>Goals for the week: Program introduction and meet your fellow shipmates, Captain, and Chief Scientist. Confirm packing list requirements.</p> <p>Course Material available online: TBD. ~ 1 hour of homework</p>
WEEK 2	<i>TM 2: Introduction to the Ship and Science of the Central Pacific Ocean</i>
TBD	<p><u>Live Webinar and Discussion Forum (~1 hour):</u> Cruise Track and Regional Oceanography (i.e. ENSO cycle); Research on the ship; Voyaging Sciences (VS): Piloting, Celestial Navigation, and Polynesian Navigation</p> <p>Goals for the week: Choose Oceanography Project teams. Begin background research and literature review. Learn of methods of navigation.</p> <p>Course Material available online: TBD. ~ 1 hour of homework</p>
WEEK 3	<i>TM 3: Introduction to Environment and Coral Reef Survey</i>
TBD	<p><u>Live Webinar and Discussion Forum (~1 hour):</u> Coral Reef Ecology and Survey Techniques; VS - Meteorology, Sail Theory, & Seamanship</p> <p>Goals of the week: Choose Reef Survey teams. Review survey techniques and taxonomic identification of reef community. Learn of the driving forces of nature and how a sailing ship accomplishes a long voyage</p> <p>Course Material available online: TBD. ~ 1 hour of homework</p>



WEEK 4	<i>TM 4: Project Mentorship and Preparing for Sea</i>
TBD	<p><u>Live Webinar and Discussion Forum (~2 hours)</u>: Oceanography and Reef Survey Mentor Meeting; Life at Sea – Watch Standing, Safety at Sea, Ship Understanding, Phased Assumption of Responsibility</p> <p>Goals of the week: Understand common shipboard nomenclature and culture. Submit Draft Introduction for Oceanography Project (Question, Hypothesis, Relevance)</p> <p>Course Material available online: TBD. ~ 2 hours of homework</p>

Sea Component: May 23 – June 22, 2018

DATE	TOPIC	ASSIGNMENT
WEEK 1	<i>Introduction and Orientation to the Ship</i>	
	Safety Training, Shipboard Orientation, Watch Standing, Snorkel Training	Revised Intro and draft Methods section of OC Project
WEEK 2	<i>Project Implementation and Watch Standing Development</i>	
	Watch Standing, Coral Reef Surveys, Survey Debriefs and Discussion, Oceanographic Sample Collection	Draft Results section of Reef Project Deck & Lab Practical Exam
WEEK 3	<i>Project Implementation and Leadership Development</i>	
	Watch Standing, Coral Reef Survey, Survey Debrief and Discussion, Oceanographic Sample Collection	Reef Survey Reports and Poster Session
WEEK 4	<i>Project Conclusion and Leadership Demonstration</i>	
	Watch Standing, Ship Mission Planning and Implementation	Oceanography Reports and Poster Session Self-Assessment