



Practical Oceanographic Research

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 Faculty

Location: At sea onboard SEA's sailing school vessel *Robert C. Seamans*, preceded by several on-line discussion forums at various locations convenient to student participants.

Prerequisites: Admission to the SEA Semester.

Course Philosophy and Approach:

This course is part of the suite of required courses in the *SEA Semester: Pacific Reef Expedition (PRE)*. Collectively, the *PRE* courses provide the context, tools, and opportunity for students to make authentic contributions to the international effort to understand and protect remote Pacific reef systems.

This course is comprised of a 4-week on-line shore component followed by a 5-week sea component designed to provide students with a foundation of knowledge and practical experience to explore the Central Pacific Ocean as an oceanographer and coral reef ecologist. When you step aboard the SSV *Robert C. Seamans*, you will learn to tune your senses to life above and below the sea surface. 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.

Success at sea begins with guided preparation onshore facilitated by weekly online presentations and online discussion forums. Program orientation, foundational concepts in ocean science, pre-cruise planning and development of oceanographic and reef survey projects will occur during these weekly, online classes and discussion forums.

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.

During our port stops you will employ well-established snorkel survey techniques and implement a comparative study of three distinct coral reef ecosystems. Survey teams will visually document reef fish and benthic invertebrate abundance, diversity, and trophic structure, as well as coral cover, diversity, and general health characteristics. Students will collaborate to interpret reef



survey data, and prepare detailed reports comparing and contrasting each reef ecosystem in relation to observed human impacts and El Niño Southern Oscillation (ENSO) phase.

This course is a rigorous learning experience, and our scientific mission is 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 achieving our scientific goals and successfully completing our voyage through the central Pacific Ocean.

The course requires completion of a minimum of 4 hours of on-line coursework and an additional 4 hours of participation in on-line discussion forums prior to sailing, with additional optional discussion forums as student pre-program schedules permit. At sea, the course consists of 8 lecture/discussion sessions (1.5 hours each), 2 research poster sessions (6 hours), and about 100 hours of laboratory watch participation (active learning/laboratory) across ~25 underway days at sea.

Learning Outcomes:

1. Contribute as an effective team member and leader.
2. Function as an essential crew member in lab through demonstrated proficiency in shipboard skills including scientific deployments and snorkel survey techniques
3. Critically analyze and interpret authentic oceanographic and reef survey data.
4. Communicate oceanographic and reef survey data with effective visual representation and oral presentation.

Evaluation:

On-line component	10%
Reef Ecosystem Survey Report	25%
Oceanography Research Project	25%
Watch Standing Assessments	30%
Lab Skills Practical Exam	10%

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:

On-line component: Active participation in all on-line modules.

Reef Ecosystem Survey Report: During our voyage, you will participate in reef surveys at each of the coral atolls we visit. You will be responsible for detailed observation and enumeration of various coral reef ecosystem components (e.g. temperature, nutrients, coral cover, fish, invertebrates, etc.). Collectively, as a class, you will establish a baseline of coral reef ecosystems



across the Central Pacific. You will summarize your observations in a brief written report (3-4 pages) and poster presentation:

- 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?

Oceanographic Research Project: While at sea, in small groups (2-3 students) you will examine trends in oceanographic data across the Central Pacific during the ongoing La Niña event 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 brief written report (4-5 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.

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. SEA crew will assess your success as a shipmate through on-watch evaluations.

Lab 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. You will gain a



working familiarity with safety protocols, lab operations, data management, equipment deployment and recovery procedures, and sample analyses. 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 prior to the assumption of leadership roles.

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.



Course Calendar:

Shore Preparation: April 23 – May 18, 2018

(Online Course Material & Live Discussion Forums)

Topic	Readings/Assignment(s) Due
<i>Week 1 (2 hrs)</i>	
PRE Program Goals and Expectations	Required Course Material on OceanPortal: <ul style="list-style-type: none"> • Read Syllabus, SEA Student Manual, Travelers' Advisory, and Packing List
	<p><u>REQUIRED Live-Online Discussion Forum:</u> S280 Program/Course Overview and Logistics Meeting</p> <p>Come with questions to our first Live Discussion Forum where you can meet fellow shipmates and your chief scientist.</p> <p>(Dates and times are flexible to accommodate student needs)</p>
<i>Week 2 (2 hrs)</i>	
Introduction to Oceanography and marine environment of the central Pacific Ocean	Required Course Material on OceanPortal: <ul style="list-style-type: none"> • View presentation: <i>S280 Cruise Prospectus and Regional Oceanography</i> <p>Submit Discussion Questions online by Sunday night.</p>
	<p><u>REQUIRED Live-Online Discussion Forum:</u> S280 cruise track & regional oceanography (i.e. ENSO cycle)</p> <p>Goals for the week: Choose Oceanography Project teams, begin background research and literature review</p> <p>(Dates and times are flexible to accommodate student needs)</p>
<i>Week 3 (2 hrs)</i>	
Introduction to Coral Reefs and Survey Techniques	Required Course Material on OceanPortal: <ul style="list-style-type: none"> • View presentation: <i>Coral Reef Ecology and survey techniques</i> <p>Submit Discussion Questions online by Sunday night.</p>
	<p><u>REQUIRED Live-Online Discussion Forums:</u> Coral Reef Ecology and survey techniques</p> <p>Goals of the week: Choose Reef Survey teams – review survey techniques and taxonomic identification of reef community.</p> <p>(Dates and times are flexible to accommodate student needs)</p>



<i>Week 4 (2 hrs)</i>	
Project Mentorship and Preparing for Sea	<p>Required Course Material on OceanPortal:</p> <ul style="list-style-type: none"> View presentation: <i>S280 Research Plan</i> Submit Draft Introduction Oceanography Project (Question, Hypothesis, Relevance) <p>Submit Discussion Questions online by Sunday night.</p>
	<p><u>REQUIRED Live-Online Discussion Forums:</u> Oceanography and Reef Survey Mentor Meeting</p> <p>Goal of the week: Oceanography and Reef Survey research proposals refined.</p> <p>(Dates and times are flexible to accommodate student needs)</p>

Sea Component: May 23 – June 24, 2018

Topic	Assignments Due
<i>Week 1 (20 hrs)</i>	
<p>Introduction and Orientation to Reef Surveys and Science at Sea:</p> <p>Safety Training, Shipboard Orientation, Watch Standing, Reef Survey Training, Oceanographic Deployment Training</p>	<p>Science Skills development: conduct reef surveys and oceanographic equipment</p> <p>Revised Intro and draft Methods section of OC Project</p>
<i>Week 2 (20 hrs)</i>	
<p>Project Implementation and Watch Standing Development:</p> <p>Watch Standing, Coral Reef Surveys, Survey Debriefs and Discussion, Oceanographic Sample Collection</p>	<p>Science Skills development: conduct reef surveys and oceanographic deployments</p> <p>Draft Results section of Reef Project, Lab Skills Practical Exam</p>
<i>Week 3 (20 hrs)</i>	
<p>Project Implementation and Watch Standing Development:</p> <p>Watch Standing, Coral Reef Survey, Survey Debrief and Discussion, Oceanographic Sample Collection</p>	<p>Science Skills development: conduct reef surveys and oceanographic deployments</p> <p>Reef Survey Reports and Poster Session</p>
<i>Week 4 (20 hrs)</i>	



Project Implementation and Leadership Development: Watch Standing, Oceanographic Sample Collection	Science Skills development: oceanographic sample processing and reef data analysis Reef Survey Reports and Poster Session
<i>Week 5 (20 hrs)</i>	
Project Conclusion and Leadership Demonstration Watch Standing, Ship Mission Planning and Implementation	Science Skills development: oceanographic data analysis Oceanography Reports and Poster Session