

Directed Oceanographic Research

XAS NS 325 (4 credits)

Course Catalog Description (max. 40 words):

Design and conduct original oceanographic research. Collect data and analyze samples. Compile results in peer-reviewed manuscript format and share during oral or poster presentation session. Emphasis on development of research skills and written/oral communication abilities.

Instructor(s): Sea Education Association Oceanography Faculty

Location: SEA campus in Woods Hole, MA, and at sea onboard one of SEA's sailing school vessels.

Prerequisites: Admission to SEA Semester. Three lab science courses (one at the 300-level or higher) or consent of instructor.

Course Philosophy and Approach:

Field research is central to the study of the marine environment. Throughout the shore component we will explore the scientific process as students develop research inquiries, plan experiments, and craft a thorough yet concise project proposal. This student-generated suite of scientific objectives will define much of the subsequent research cruise's sampling program.

A critical educational goal of the Directed Oceanographic Research course, however, is the transfer of "what sounded good on shore" to "what really works at sea," and the evolution of each scientific project to the real world occupies much of our time while underway.

Students will complete independent/semi-independent research projects in oceanography under the guidance of the Chief Scientist aboard the vessel. Essential project components include the collection, analysis and presentation of data; a formal scientific manuscript will be written per the guidelines of a selected high impact scientific journal. Each submission will also be subject to peer-review by faculty and fellow students.

This course consists of 11 project preparation seminars on shore (3 hrs each), 8 discussion/mentoring sessions (1.5 hrs each), 1 research poster session (3 hrs), and 40 hrs of laboratory watch participation (active learning/laboratory) across 30 underway days at sea.

Learning Outcomes:

1. Read, analyze and evaluate scientific literature and data sources in relevant disciplines.
2. Recognize, formulate and employ the scientific method through the development of a collaborative research project and completion of a proposal.
3. Demonstrate ability to critically analyze and interpret authentic oceanographic data.
4. Demonstrate ability to generate clear visual representations of oceanographic data.
5. Compose a professional-quality manuscript and deliver a professional presentation.

Evaluation:

Research Project Preparation Assignments	15%
Research Project Written Proposal	20%
Revised Introduction and Methods	5%
Intro/Methods Critique & Final Manuscript Peer Review	10%
Data Discussions (Participation and Assignments)	5%
Draft Results	5%
Poster Presentation	15%
Written Manuscript	25%

Assignments:

Research Project Preparation Assignments: Through a series of research-focused seminars on shore, students complete five such assignments (reading journal articles, gathering essential background information, crafting hypotheses to be investigated, describing field methods and data analysis plans, for example). Thoughtful, well-prepared participation during research seminars is expected of each student and essential to successful project development.

Research Project Written Proposal: A thoroughly researched and carefully written explanation of the scientific work to be undertaken at sea, including an introductory literature review, intended methods and sampling locations, data analysis plan, and references. All collaborative projects will result in one Proposal; for joint work, all students earn the same grade.

Revised Introduction and Methods Sections: Revisions of Proposal text will be necessary based on method testing at sea.

Intro/Methods Critique: Scientific research is subject to peer-review prior to publication. Students will practice these skills by critiquing the Introduction and Methods sections for another student's project.

Data Discussions: Two Data Discussion Sessions will guide the progress of data analysis. For the first session, research teams will be required to retrieve relevant data from current cruise archives and plot station locations. For the second session, research teams will generate two figures that begin to address the hypothesis being tested.

Draft Results: Research teams will draft a Results section for their final manuscript, including text, figures, and captions.

Poster Presentation: Research teams will present their research in a 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. There is an expectation of mastery of supporting literature to contextualize current research results.

Manuscript: Research teams will produce a written manuscript following guidelines for a selected high impact journal. There is an expectation of senior thesis/professional quality work. The final manuscripts will be archived at SEA.

Peer-Review: Each manuscript submission will be reviewed by three anonymous student reviewers who will make suggestions and recommendations for publication.

Expectations and Requirements:

- Punctual attendance is required at every class meeting.
- Active participation on watch and in class discussion 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)

Course Calendar:

Topic	Readings/Assignments Due
<i>Week 1 (4 hours) – on shore</i>	
Introduction to SEA’s Research Capabilities & Program Tour of MBL Library & Resources	Identification of preliminary interests
<i>Week 2 (6 hours) – on shore</i>	
Research Topic Refinement Hypothesis Development	Project Preparation Assignment 1 due
<i>Week 3 (6 hours) – on shore</i>	
Hypothesis Revision Methods Development Literature Review Research (ongoing)	Project Preparation Assignment 2 due Project Preparation Assignment 3 due
<i>Week 4 (6 hours) – on shore</i>	
Methods Revision Literature Review Research & Writing (ongoing)	Project Preparation Assignment 4 due
<i>Week 5 (6 hours) – on shore</i>	
Literature Review Revision Data Analysis Plan Development	Project Preparation Assignment 5 due
<i>Week 6 (3 hours) – on shore</i>	
Presentation of Research Plans	Research Project Proposal due

<i>Weeks 7 and 8 (17 hours) – at sea</i>	
<p>Methods Refinement Mentoring Sessions Meeting Topic:</p> <ul style="list-style-type: none"> • Making the Most of the Peer Critique Process 	<p>Revised Intro/Methods Due Intro/Methods Critique Due</p>
<i>Weeks 9 and 10 (20 hours) – at sea</i>	
<p>Data Analysis Mentoring Sessions Meeting Topics:</p> <ul style="list-style-type: none"> • Data Discussion I • Data Discussion II 	<p>Data Discussion Assignments Due Draft Results Due</p>
<i>Weeks 11 and 12 (19 hours) – at sea</i>	
<p>Data Analysis Mentoring Sessions Meeting Topic:</p> <ul style="list-style-type: none"> • Abstract Writing 	<p>Poster Presentation Final Manuscript Due Peer Review Due</p>