

SEMESTER AT SEA COURSE SYLLABUS

Colorado State University, Academic Partner

Voyage:	Fall 2019
Discipline:	Natural Sciences
Course Number and Title:	NR 150 Oceanography (Section 3)
Division:	Lower
Faculty Name:	Carl R. Berman, Jr.
Semester Credit Hours:	3

Prerequisites: None

COURSE DESCRIPTION

A young sailor stood by the rail of a whaling ship as she transited the narrow passage from Nantucket out to the Atlantic. As he watched the waves, the Captain appeared and took up a place beside him.

“The ocean is so vast,” the young man said, “makes one feel really small.

“Aye,” the Captain replied, “and that’s only the top o’her!”

There is no better way to understand the many moods of the open sea than to sail out into the ocean and live, every day, dependent on the way the winds blow and how high the seas rise.

Aboard the *World Odyssey*, we have a unique chance to study the oceans first hand. We will traverse many and varied seas, as we cross the North Sea, traverse the Eastern Atlantic to the Mediterranean, then to Africa and across the South Atlantic to the coastal regions of South and Central America. We will end up in the Eastern Pacific before making port in San Diego.

During this time, you will be given insights into the oceans and the shores that border them. You will learn about the origins of ocean water and the ocean basins, the origin of all life. You will learn the chemical and physical factors that create tides and currents and how these, in turn, influence the distribution of life in and above and waves. You will leave the ship with a more complete understanding of the biosphere and man’s impact on the ecosystems that make up this complex web of life. You are invited to take this once-in-a-lifetime journey. It will be my pleasure to accompany and enlighten you.

LEARNING OBJECTIVES

The goal is for students to:

- Explore the interdisciplinary nature of oceanography, including the biological, geological, and chemical and physical components of the sea.
- Describe oceanographic processes and evaluate the ocean's role in climate regulation.
- Examine natural and anthropogenic threats to marine environments and organisms.
- Distinguish among equipment types and techniques used in oceanographic research
- Apply oceanographic fundamentals to the surrounding world and observations made at sea.

REQUIRED TEXTBOOKS

AUTHOR: Trujillo, A. P. and H. V. Thurman

TITLE: Essentials of Oceanography

PUBLISHER: Pearson

ISBN #: 9780134073545

DATE/EDITION: 2017/12th edition

This is a loose leaf edition so you will need a large binder for the book.

REQUIRED (& RECOMMENDED) SUPPLIES

1. A **water proof field notebook is required** for the field class. Students must choose one similar to the 'Rite in the Rain' models No. 351 or 373 (4 5/8" x 7"). For example: https://www.amazon.com/dp/B009F1E28G/ref=twister_B07864WN67?_encoding=UTF8&th=1
2. A **standard composition notebook is required** for the ships log. Students should choose one with lines and at least 9.5" x 6" or 8.5" x 11" page dimensions.
3. For field classes students must pack closed toe shoes suitable for getting wet (no flip flops), swimming gear and a rash guard or light weight long sleeve t-shirt.
4. Students might consider purchasing a clip-on microscope for a tablet/ smart phone or a pocket microscope. These will be used to identify marine organisms living in the water column. Available on Amazon for \$10-20: Carson MicroBrite Plus 60x-120x, Kingmas 60x clip on microscope.
5. Students will need binoculars. A small portable pair is recommended.

TOPICAL OUTLINE OF COURSE

(Items marked "*" will be covered in the Global Studies Lectures – be sure to integrate them into your class notes)

Depart Amsterdam, The Netherlands – September 9

A1–September 11: Course introduction, syllabus, projects, and logistics. How can we link oceanographic fundamentals to life at sea and while in port?

Text book and sections to be covered

What will "be on the test?"

Importance of attendance

A2—September 13: Introduction to Planet Earth – Ch 1

How are Earth's oceans unique?
How was early exploration of the oceans achieved?
What is oceanography?
What is the nature of scientific inquiry?
Prepare for Gdansk

Gdansk, Poland – September 15-20

A3—September 21:

How were Earth and the solar system formed?
How were Earth's atmosphere and oceans formed?
Did life begin in the oceans?
How old is Earth?

A4—September 23: Plate Tectonics and the Ocean Floor – Ch 2

What evidence supports continental drift?
What evidence supports plate tectonics?
What features occur at plate boundaries?
Testing the model: How can plate tectonics be used as a working model?

A5—September 25:

How has Earth changed in the past, and how will it look in the future?

Marine Provinces – Ch 3

What techniques are used to determine ocean bathymetry?
What features exist on continental margins?
What features exist in the deep ocean basins?
Prepare for Lisbon and Cadiz

Lisbon, Portugal – September 26-28

Cadiz, Spain – September 29 – October 1

A6—October 3:

What features exist along the mid ocean ridge?
Research methods in oceanography

Marine Sediments – Ch 4

How are marine sediments collected and what historical events do they reveal?
What are the characteristics of lithogenous sediment?

A7—October 5:

What are the characteristics of biogenous sediment?
What are the characteristics of hydrogenous sediment?
What are the characteristics of cosmogenous sediment?
How are pelagic and neritic deposits distributed?
Prepare for Dubrovnik

Dubrovnik, Croatia – October 6-10

A8—October 12:

What resources do marine sediments provide?

Water and Seawater Ch - 5

Why does water have such unusual chemical properties?

What important physical properties does water possess

How salty is seawater?

A9—October 14:

Why does seawater salinity vary?

Is seawater acidic or basic?

How does seawater salinity vary at the surface and with depth?

How does seawater density vary with depth?

Prepare for Casablanca

Casablanca, Morocco – October 15-20

A10—October 22:

What methods are used to desalinate seawater?

Air-Sea Interaction Ch - 6

What causes variations in solar radiation on Earth?

What physical properties does the atmosphere possess?

How does the Coriolis effect influence moving objects?

A11—October 25:

What global atmospheric circulation patterns exist?

How does the ocean influence global weather phenomena and climate patterns?

How do sea ice and icebergs form?

Can power from the wind be harnessed as a source of energy?

A12—October 27: Ocean Circulation Ch - 7

How are ocean currents measured?

What creates ocean surface currents and how are they organized?

What causes upwelling and downwelling?

What are the main circulation patterns in each ocean basin?

Prepare for Ghana

Tema, Ghana – October 28-30

Takoradi, Ghana – October 31 – November 1

A13—November 3:

How do deep ocean currents form?

Can power from currents be harnessed as a source of energy?

Waves and Water Dynamics Ch - 8

How are waves generated and how do they move?

What characteristics to waves possess?

A14—November 6:

How do wind generated waves develop?

How do waves change in the surf zone?

How are Tsunami created

Can power from waves be harnessed as a source of energy?

A15—November 8: Tides Ch - 9

What causes ocean tides?

How do tides vary during a monthly tidal cycle?

What do tides look like in the ocean?

What types of tidal patterns exist?

Prepare for Salvador

Salvador, Brazil – November 10-15

A16—November 16:

What tidal phenomena occur in coastal regions?

Can tidal power be harnessed as a source of energy?

Beaches, Shoreline Processes and the Coastal Ocean Ch - 10

How are coastal regions defined?

How does sand move on the beach?

A17—November

What features exist along erosional and depositional shores?

How do changes in sea level produce emerging and submerging shorelines?

How does hard stabilization affect coastlines?

What are the characteristics and types of coastal waters?

A18—November 20:

What issues face coastal wetlands?

Marine Pollution Ch - 11* This subject will be covered in Global Studies A-14

PAPER #1 Due

Discussion and question and answer session

A19—November 23:

Marine Life and the Marine Environment Ch - 12

What are living things and how are they classified?

Prepare for Port of Spain

Port of Spain, Trinidad and Tobago – November 24

A20—November 26:

How are marine organisms classified?

How many marine species exist?
How are marine organisms adapted to the physical conditions of the ocean?
What are the main divisions of the Marine Environment?

A21—November 28:

Biological Productivity and Energy Transfer Ch - 13

What is primary production?
What kinds of photosynthetic marine organisms exist?
How does regional primary productivity vary?
How are energy and nutrients passed along in marine ecosystems?

A22—December 1:

What issues affect marine fisheries? **Covered in Global Studies lecture on B-10**

Animals of the Pelagic Environment Ch - 14

How are marine organisms able to stay above the ocean floor?
What adaptations do pelagic organisms possess for seeking prey
What adaptations do pelagic organisms possess to avoid being prey?
Prepare for Guayaquil

Guayaquil, Ecuador — December 2-7

A23—December 9:

What characteristics to marine mammals possess?
An example of migration; why do gray whales migrate?

Animals of the Benthic Environment Ch - 15

What communities exist along rocky shores?
What communities exist along sediment covered shores?
What communities exist on the shallow offshore ocean floor/
What communities exist on the deep ocean floor?
***Coral reefs will be covered in Global Studies lecture on B-16**
Prepare for Puntarenas

Puntarenas, Costa Rica — December 11-15

A24—December 16: The Oceans and Climate Change Ch - 16 *This subject will be covered in Global Studies lecture on A-18

Group Project due - presentations

A25—December 19: Final Exam

Arrive San Diego, California — December 23

ASSIGNED WORK IN NR-150, read carefully!

The Paper:

You will be asked to prepare a paper describing what you consider to be the greatest threat to the oceans and the marine environment based on the knowledge you have accumulated in this course. You can include anything you have learned during the lectures and can suggest what measures that you, as future stewards of the planet, would take to help alleviate these issues. *Your paper should be at least 2 pages, single spaced (the document can be longer, if you wish), and be accompanied by suitable references which relate to your conclusions. APA style is preferred and use 12-point type and MS Word. This paper, together with the final project, see below, will constitute 30% of your final grade. **This paper is due in class on session A-18.***

The Final Project:

During this Semester at Sea, you have been given a general introduction to oceanography. In the academic world, this course would be described as “descriptive oceanography” since the more advanced equations and concepts are left for later, more advanced courses. In groups of 4 to 5, depending upon enrollment, you will prepare a project which will serve to enhance the learning objectives of this course which are:

- Explore the interdisciplinary nature of oceanography, including the biological, geological, and chemical and physical components of the sea.
- Describe oceanographic processes and evaluate the ocean’s role in climate regulation.
- Examine natural and anthropogenic threats to marine environments and organisms.
- Distinguish among equipment types and techniques used in oceanographic research
- Apply oceanographic fundamentals to the surrounding world and observations made at sea.

In your final project, you will be expected to take each of these objectives and produce a project which will demonstrate how you will use the knowledge you have obtained to promote your own role as future stewards of the ocean and the marine environment. This aspect of the project is important as you will be the generation that has to deal with ocean issues to which you have been introduced in this class. You will present your findings in a 3-4-minute video or a PowerPoint presentation. You will also be asked to evaluate the members of your group regarding participation and contribution to the final product. If you have questions about your presentation or the preparation for this project, do not hesitate to ask me during office hours. *This project, and your paper, will count towards 30% of your final grade so do not take this task lightly! **Projects will be presented in session A-24.***

FIELD WORK

Semester at Sea field experiences allow for an unparalleled opportunity to compare, contrast, and synthesize the different cultures and countries encountered over the course of the voyage. In addition to the one required field class, students will complete independent field assignments that span multiple countries.

Field Class:

The field class for this course is on **Friday, 27 September 2019 in Lisbon, Portugal.**

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class.

Field Classes constitute at least 20% of the contact hours for each course and are developed and led by the instructor.

1. Field Class Description (Lisbon):

This field class will encompass three activities:

(1) Visit a local fish market, a window into the marine biology of any coastal area, where we will test our observation skills, interact with local fish mongers and fishers, and possibly purchase a shark to dissect

(2) Visit a local gem: the historically significant Vasco da Gama Aquarium, a small but amazing aquarium with a very, very cool museum of marine specimens, which would be the highlight of the field lab except that we will next

(3) Visit the Lisbon Oceanário, where we will marvel at the beauty and diversity of marine life, at the same time observing and reinforcing concepts learned in class (and eat lunch overlooking the Tagus River).

1. Students will:

- Visit a local fish market and
 - Identify organisms in local fisheries, including major groups of fish and invertebrates
 - Describe the biodiversity and adaptations of local fish and invertebrate fauna on display, and compare to those of fish markets in previous ports
 - Observe the gear and infer methods used by local fishers
 - Assess the importance of fisheries to local economy
 - Possibly dissect a shark/bony fish and learn basic shark anatomy

- Visit the historically significant Vasco da Gama Aquarium/Museum and the Lisbon Oceanário and
 - Identify major groups of mammals, birds, fish, invertebrates, and plants
 - Observe behavior of captive organisms
 - Describe the biodiversity and adaptations of representative faunas
 - Summarize basic methods of captive biology of marine organisms, including capture techniques and maintenance in captivity
 - Reinforce basics of community ecology, including species diversity and richness, predator prey interactions, etc.
 - Reinforce concepts of marine conservation in the region and the roles of marine reserves in preserving biodiversity
 - Reinforce concepts on the impacts of climate change on marine ecosystems, as well as other human impacts

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(3) Visit the Lisbon Oceanário, where we will marvel at the beauty and diversity of marine life, at the same time observing and reinforcing concepts learned in class (and eat lunch overlooking the Tagus River).

Academic Objectives:

- At the local fish market, students will:
 - Identify organisms in local fisheries, including major groups of fish and invertebrates
 - Describe the biodiversity and adaptations of local fish and invertebrate fauna on display, and compare to those of fish markets in previous ports
 - Observe the gear and infer methods used by local fishers
 - Assess the importance of fisheries to local economy

- At the Vasco da Gama Aquarium and the Lisbon Oceanário, students will:
 - Identify major groups of mammals, birds, fish, invertebrates, and plants
 - Observe behavior of captive organisms
 - Describe the biodiversity and adaptations of representative faunas
 - Summarize basic methods of captive biology of marine organisms, including capture techniques and maintenance in captivity
 - Reinforce basics of community ecology, including species diversity and richness, predator prey interactions, etc.
 - Reinforce concepts of marine conservation in the region and the roles of marine reserves in preserving biodiversity
 - Reinforce concepts on the impacts of climate change on marine ecosystems, as well as other human impacts

METHODS OF EVALUATION

- Class participation 20%
- Observation journal 10%
- Group presentations & papers 30%
- Final Exam 15%
- Field Class 25%
 - The field notebook (5%)
 - The field report students generate based on their field notebook. Discussing of findings and observations with peers is encouraged, but each student has to hand in their own report. (15%)
 - A two-page typed synthesis/reflection essay. Potential topics will be announced before the field class and students can choose a topic from the list or propose own topic (5%)

GRADING SCALE

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework. Note that C-, D+ and D- grades are also not assigned on Semester at Sea in accordance with the grading system at Colorado State University (the SAS partner institution).

Pluses and minuses are awarded as follows on a 100% scale:

<u>Excellent</u>	<u>Good</u>	<u>Satisfactory/Poor</u>	<u>Failing</u>
97-100%: A+	87-89%: B+	77-79%: C+	Less than 60%: F
93-96%: A	83-86%: B	70-76%: C	
90-92%: A-	80-82%: B-	60-69%: D	

ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM

Attendance in all Semester at Sea classes is mandatory, but it is at the instructor's discretion to assign a grade to the participation and attendance requirement. Remember to include information concerning the evaluation of Field Assignments and the Field Classes, which must constitute at least 20% of the total grade in a course.

Attendance in all Semester at Sea classes, including the Field Class, is mandatory. Students must inform their instructors prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion. Instructors must make reasonable efforts to enable students to make up work which must be accomplished under the instructor's supervision (e.g., examinations, laboratories). In the event of a conflict in regard to this policy, individuals may appeal using established CSU procedures.

LEARNING ACCOMMODATIONS

Semester at Sea® provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation.

A letter from students' home institutions verifying the accommodations received on their home campuses (dated within the last three years) is required before any accommodation is provided on the ship. Students must submit verification of accommodations to academic@isevoyages.org as soon as possible, but no later than two months prior to the voyage. More details can be found within the Course Registration Packet, as posted to the [Courses and Field Classes page](#) no later than one month prior to registration.

STUDENT CONDUCT CODE

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct.

Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

Depending on the nature of the assignment or exam, the faculty member may require a written declaration of the following honor pledge: "I have not given, received, or used any unauthorized assistance on this exam/assignment."

RESERVE BOOKS FOR THE LIBRARY

AUTHOR: Rachel Carson
TITLE: The Sea Around Us
PUBLISHER: New York: Oxford University Press
ISBN #: 0195147014
DATE/EDITION: 2003

AUTHOR: Mark W. Denny
TITLE: How the ocean works: an introduction to oceanography
PUBLISHER: Princeton: Princeton University Press
ISBN #: 0691126461
DATE/EDITION: 2008

AUTHOR: Herb McCormick and David Thoreson
TITLE: One island, one ocean: Ocean Watch and the epic journey around the Americas
PUBLISHER: San Francisco, CA: Weldon Owen
ISBN #: 978161628171
DATE/EDITION: 2011

AUTHOR: Charles Moore and Cassandra Phillips
TITLE: [Plastic ocean: how a sea captain's chance discovery launched a quest to save the oceans](#)
PUBLISHER: Avery
ISBN #: 978158333501
DATE/EDITION: 2012

FILM REQUEST

Title of Film: Blue Earth (2009)
Distributor: National Geographic

Title of Film: The Blue Planet. Seas of Life (2007)
Distributor: British Broadcasting Corporation (BBC)

Title of Film: Deep Sea (2006)
Distributor: Warner Home Video

Title of Film: Drain the Ocean (2009)
Distributor: National Geographic

Title of Film: The End of the Line (2010)
Distributor: New Video Group

Title of Film: The Jacques Cousteau odyssey the complete series (2005)
Distributor: Warner Home Video

Title of Film: Japans Killer Quake (2011)
Distributor: PBS (NOVA)

Title of Film: Sand Wars (2014)
Distributor: PBS

Title of Film: Tsunami: The Wave that Shook the World (2005)
Distributor: PBS (NOVA)

ELECTRONIC COURSE MATERIALS

Articles

Lebreton et al. 2018. Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. <https://www.nature.com/articles/s41598-018-22939-w.pdf>

Murray CC., Maximenko N., Lippiatt S. 2018. The influx of marine debris from the Great Japan Tsunami of 2011 to North American shorelines. Marine Pollution Bulletin. <https://doi.org/10.1016/j.marpolbul.2018.01.004>

YouTube:

Coral Gardening | South Pacific | BBC Earth
<https://www.youtube.com/watch?v=0UlnRnHWFqU>

Coral Reefs 101 | National Geographic
<https://www.youtube.com/watch?v=ZiULxLLP32s>

El Niño 101 | National Geographic
<https://www.youtube.com/watch?v=d6sOT0m3F8s>

Hurricanes 101 | National Geographic
<https://www.youtube.com/watch?v=IEtxRd9y1c4>

Monsoons; Wet, Dry, Repeat...
<https://www.youtube.com/watch?v=CR7KL6KSIX4>

Ocean Drifters

<https://www.youtube.com/watch?v=ziGtmjiUIJQ>

Oceans of Contrast

<https://www.youtube.com/watch?v=Juw0JijaTrQ&t=1911s>

Penguin Crime Spree | South Africa

<https://www.youtube.com/watch?v=vYHWbl46Q5I>

Rare Video: Japan Tsunami | National Geographic

<https://www.youtube.com/watch?v=oWzdgBNfhQU>

This Incredible Animation Shows How Deep The Ocean Really Is

<https://www.youtube.com/watch?v=UwVNkfCov1k>

Tsunami 101 | National Geographic

https://www.youtube.com/watch?v= oPb_9gOdn4

What is Coral Bleaching | Time

<https://www.youtube.com/watch?v=fA6mpexcyN4>

Webpages

TAMAR Turtle Conservation

<http://exploringtheearth.com/2013/01/09/bahias-sea-citizens/>

Monterey Bay Aquarium

<http://www.montereybayaquarium.org/>

NOAA

<https://www.noaa.gov/>

The Two Oceans Aquarium

<https://www.aquarium.co.za/>

ADDITIONAL RESOURCES

Students will need access to shipboard charts, oceanographic, and weather data.