

SCIENCE DEPARTMENT

OCEANOGRAPHY & MARINE BIOLOGY: COURSE #466

Contact Information

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The Department's Educational Philosophy

We believe that students should be exposed to the process of scientific inquiry so they can acquire and interpret scientific knowledge, and begin to realize the wider applicability of scientific problem-solving methods. By making the laboratory the focal point of learning, we seek to foster students' appreciation for the experience of doing science.

Guiding Principles

- Students must be able to collect and analyze data and formulate hypotheses.
- Inductive and deductive problem-solving skills are central to science education.
- An effective program in science addresses the limitations of data and conclusions.
- Students should be able to use or design a strategy for testing scientific concepts.
- A comprehensive science program will emphasize the delicate checks and balances in man's abiotic and biotic environments and the stresses upon these ecosystems, which could affect the destiny of the world.
- Science is integrally related to mathematics.
- An effective science program builds students' ability to communicate accurately and precisely.
- An effective science program stresses both cooperative and independent learning.

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Course Frequency: Semester course, five times per week

Credits Offered: 2.5 credits

Prerequisites: None

Background to the Curriculum

Oceanography & Marine Biology is an unlevleed semester elective course that will cover the following topics in detail: ocean chemistry and physics, ocean zones, marine invertebrates, fishes, marine mammals, coastal ecosystems, polar biology.

Core Topics/Questions/Concepts/Skills

Core Topics	Questions	Concepts
I. Ocean Chemistry & Physics	<ul style="list-style-type: none">• What groups or individuals have made major contributions to the study of oceanography?• What are the chemical properties of seawater?• What are the physical properties of seawater?• How do scientists measure the properties of seawater?• What causes currents, waves, and tides?• What properties guide ocean circulation and stratification?	History of oceanography; marine tools; properties of seawater; salinity; ocean layers; water physics; currents; waves; tides; ocean circulation
II. Ocean Zones	<ul style="list-style-type: none">• How is the ocean zoned?• Into what ecological groupings are marine organisms classified?• What role do microorganisms play in the sea?• What techniques do scientists employ to study marine sediments?• How do various marine food chains compare?	Ocean life zones; neuston, pelagic, benthic, a deep sea ecosystems; bioluminescence, marine plankton; marine primary productivity; algae; ocean sediment; hydrothermal vents

	<ul style="list-style-type: none"> • How does bioluminescence influence marine life? • Why is the Gulf of Maine an important resource for Massachusetts residents? • What crucial discoveries have scientists made at hydrothermal vents? 	
III. Marine Invertebrates	<ul style="list-style-type: none"> • What characteristics distinguish marine invertebrates from marine vertebrates? • How are marine invertebrates classified? • How do marine invertebrates eat and respire? • What reproductive strategies do marine invertebrates employ? 	Classification, diversity, evolution, anatomy, behavior, and ecology of: sponges, cnidarians, ctenophores, marine worms, mollusks, marine arthropods, and echinoderms
IV. Fishes	<ul style="list-style-type: none"> • What characteristics distinguish cartilaginous fish from bony fish? • How are fish classified? • Why are fins useful tools for swimming? • What is the internal anatomy of a fish? • What reproductive strategies do fish employ? • What myths surround sharks and rays? • What effects do over-fishing and marine pollution have on fish populations? 	Classification, diversity, evolution, anatomy, behavior, and ecology of: sharks, rays, and bony fish; shark attacks; marine conservation; marine policy
V. Marine Mammals	<ul style="list-style-type: none"> • What characteristics distinguish marine mammals from terrestrial mammals? • How are marine mammals classified? • Why is blubber a crucial adaptation? • What effect has whaling had on whale populations? • How is animal husbandry practiced? • What effects has marine mammal conservation had on marine mammal populations? 	Classification, diversity, evolution, anatomy, behavior, and ecology of: cetaceans, pinnipeds, and sirenians; animal husbandry; history and economics of whaling; marine mammal conservation

<p>VI. Coastal Ecosystems</p>	<ul style="list-style-type: none"> • How are beaches composed? • How do coastal zone managers balance human desires with ecological restraints? • What organisms inhabit tidal zones? Coral reefs? Kelp forests? Estuaries? • How are satellites used to study estuaries and coral reefs? • What characteristics distinguish marine plants from terrestrial plants? • Does popular culture depict the ocean realm accurately? 	<p>Beaches; tidal zones; coastal zone management; kelp forests; estuaries; coral reefs; marine ecosystems; marine symbioses; sea birds; marine plants</p>
<p>VII. Polar Biology</p>	<ul style="list-style-type: none"> • What characteristics distinguish polar ocean water from temperate ocean water? • How does the Arctic differ from the Antarctic? • How do polar food webs differ from temperate marine food webs? • What characteristics distinguish penguins from other marine birds? • What characteristics distinguish polar mammals from closely related temperate mammals? • What can scientists learn from ice cores? • How has the Earth's climate changed in the last few centuries? Decades? Years? 	<p>Polar sea chemistry; polar ecosystems; anatomy, ecology, and behavior of: penguins, polar bears, and seals; polar research; climate change</p>

Course-End Learning Objectives:

<u>Learning Objectives</u>	<u>Corresponding state standards*, where applicable</u>
<u>Ocean Chemistry & Physics</u>	
1] How has the history of ocean exploration guided modern marine research?	HSC III.I, II, III
2] What physical and chemical properties of seawater affect marine life?	B 6.4; C 1.1, 4.5, 7.4
3] What are the dynamics of currents, waves, and tides?	ES 1.4, 1.7, 1.8; P 4.1
<u>Ocean Zones</u>	
1] What properties separate the ocean into different life zones?	C 1.1, 4.5
2] How are living things specially adapted for life in each ocean zone?	
3] How are communities organized at different ocean depths?	B 6.3
<u>Marine Invertebrates</u>	
1] What characteristics unify and distinguish the various groups of marine invertebrates?	B 5.1, 5.2
2] What adaptations and behaviors do marine invertebrates use to be successful?	
3] What communities and symbioses do marine invertebrates form?	B 6.3
<u>Fishes</u>	
1] What characteristics unify and distinguish the various groups of fishes?	B 5.1, 5.2
2] What adaptations and behaviors do fish use to be successful?	
3] What communities and symbioses do fish form?	B 6.3
4] What conservation measures are underway to preserve fish diversity and health?	HSC III.IV, V
<u>Marine Mammals</u>	
1] What characteristics unify and distinguish the various groups of marine mammals?	B 5.1, 5.2
2] What adaptations and behaviors do marine mammals use to be successful?	
3] What communities and symbioses do marine mammals form?	B 6.3
4] What conservation and husbandry measures are underway to preserve marine mammal diversity and health?	HSC III.IV, V
<u>Coastal Ecosystems</u>	
1] What features characterize specific coastal habitats?	P 4.1
2] What communities and symbioses are supported by specific coastal habitats?	B 6.3
3] What effect does human activity have on specific coastal habitats?	ES 1.8
4] What conservation measures are underway to preserve specific coastal habitats?	HSC III.IV, V

<p><u>Polar Biology</u></p> <p>1] What physical and chemical properties characterize polar seas? 2] What adaptations and behaviors do polar animals use to be successful? 3] What communities and symbioses are supported at the poles? 4] What can polar research tell us about the health of our planet?</p>	<p>C 1.1, 4.5, 7.4</p> <p>B 6.3</p> <p>HSC III,IV, V</p>
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***B = Biology; C = Chemistry; ES = Earth Science; P = Physics; HSC = Historical & Social Context for Science and Technology/Engineering**

Assessment

- Tests: written based on curriculum covered; focus on terms and concepts and applications of these.
- Quizzes: marine identifications; identify and label.
- Laboratory activities: informal with questions; students work in cooperative lab groups.
- Projects: single course project focusing on in-depth research into one aspect of the course content; counts as a test grade
- Homework: unit packets consisting of vocabulary, readings, and unit objective questions.

Technology and Health Learning Objectives Addressed in This Course

(This section is for faculty and administrative reference; students and parents may disregard.)

<u>Course activity: skills &/or topics taught</u>	<u>Standard(s) addressed through this activity</u>
<p>1] Word processing, PowerPoint presentations, internet-based activities, internet research, computer probes, databases, spread sheets, computer simulations, microscope skills, water testing, laboratory skills</p>	

Materials and Resources

Student text: Life on an Ocean Planet. Current Publishing Corporation (2006).

Numerous audio-visual, web sites, and lab materials to supplement the material taught in this course.