

Marine Biology – Level 1 and 2

Unit: History and Technology

Essential Questions

1. Have humans seen much of the ocean?
2. What effect can human interactions have on the ocean?
3. What is *ocean literacy* and why is it important?
4. Why is oceanography considered to be an interdisciplinary science?
5. What oceanographic influences and resources make the ocean important to all life on Earth?
6. What broad actions can society take with respect to the effects of science and technology on the Earth's environment?
7. What are three reasons to learn the history of oceanography?
8. What were the three primary reasons for early civilization to interact with the ocean?
9. How did ancient explorers navigate near shore and in the open ocean?
10. Who are some of the past and present ocean explorers and what are their accomplishments?
11. What is the purpose of the latitude and longitude mapping system?
12. What accomplishments and discoveries did the H.M.S. *Challenger* make?
13. What changes led to the growth and expansion of modern oceanography in the 20th century?
14. How have submersibles and self- contained diving changed the study of the ocean?
15. What are the three types of submersible that have been used for underwater research?
16. What are the advantages and disadvantages of submersibles and scuba?
17. What is the difference between an *ROV* and an *AUV*?
18. How do *drifters* send their information to marine scientists and what type of information do they collect?
19. What are three types of sea surface observations that satellites can make to benefit oceanographers?
20. How have *Loran-C* and *GPS* benefited seafaring and oceanography?

Framework Standard Learning Objectives/ Content Outcomes	Skills	Resources	Instructional Strategies	Assessments
<p>Reading Standards for Literacy in Science</p> <ol style="list-style-type: none"> 1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 2. Determine the central ideas or conclusions of a 	<p>Define oceanography</p> <ul style="list-style-type: none"> • Describe what <i>ocean literacy</i> is and how it applies to all people on Earth. • Discuss some of the important people and discoveries in the field of oceanography. • Identify various technological developments in the oceanography and 	<p>Level 2 Textbook: <i>Life on an Ocean Planet</i>. Rancho Santa Margarita, CA: Current Pub., 2006. Print.</p> <p>Level 1 Textbook: Sverdrup, Keith A., Alyn C. Duxbury, Alison Duxbury, and Alyn C. Duxbury. <i>An Introduction to the World's Oceans</i>. Seventh ed. Boston: McGraw-Hill, 2003. Print.</p> <p>Ocean Explorer Curriculum</p>	<p>Notes</p> <p>Dip-Sticking</p> <p>Graphic Organizer: History of Oceanography</p> <p>Ticket to Leave</p>	<p>Chapter 1 & 2 worksheets, quizzes and tests</p> <p>WebQuest: Technology for Ocean Exploration</p> <p>Quiz: History of Oceanography</p> <p>Lab Activity: Using navigation techniques in coastal areas</p> <p>Article Summary</p>

<p>text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.</p> <p>4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to <i>grades 11–12 texts and topics</i>.</p> <p>5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.</p>	<p>describe their functions and relevance to exploration.</p> <ul style="list-style-type: none"> • Construct and use tables and graphs to interpret data sets • Measure with accuracy and precision • Convert within a unit • Use common prefixes • Use scientific notation, where appropriate • Use appropriate metric/standard international (SI) units of Measurement • Use Celsius the scale 	<p>Guide Chase, V. C., Keener-Chavis, P., & National Oceanic and Atmospheric Administration (NOAA). (2003). <i>Learning ocean science through ocean exploration: A curriculum for grades 6-12</i>. Retrieved from http://oceanexplorer.noaa.gov</p> <p>Computer Lab</p> <p>WebQuest: Technology for Ocean Exploration</p> <p>Handouts:</p> <ol style="list-style-type: none"> 1. History of the Earth 2. Latitude and Longitude 3. Oceans: Blank Diagram 4. Geology of the Ocean Packet <p>Worksheets:</p> <ol style="list-style-type: none"> 1. What is the world ocean? 2. Discovery: A Highway for Cultural Dispersal (Level 2) 3. Measuring Ocean Properties (Level 2) 4. How are the oceans explored? (Level 2) <p>***Optional***</p> <p>Ocean Explorer Labs</p> <ol style="list-style-type: none"> 1. Lesson Plan 1: Calling All Explorers (pg 4) http://oceanexplorer.noaa.gov/edu/curriculum/section1.pdf 2. Mapping Deep-Sea Features (pg 28) http://oceanexplorer.noaa.gov/edu 	<p>Level 2: Chapter 1 Reading pgs 1-1 - 1-41</p> <ul style="list-style-type: none"> • Chapter 1 Review Questions • Group Work: Marine Science and the Real World Questions <p>Level 2: Chapter 2 Reading pgs 2-1 - 2-62</p> <p>Chapter 1 Review Questions</p> <ul style="list-style-type: none"> • Group Work: Marine Science and the Real World Questions
<p>Writing Standards</p> <p>3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.</p> <ol style="list-style-type: none"> a. Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events. b. Use narrative techniques, such as dialogue, pacing, description, reflection, 			

<p>and multiple plot lines, to develop experiences, events, and/or characters.</p> <p>c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).</p> <p>d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.</p> <p>e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.</p> <p>6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.</p>		<p>u/curriculum/section2.pdf</p> <p>3. Thar She Blows! (Hydrothermal vents) http://oceanexplorer.noaa.gov/explorations/02galapagos/background/education/media/gal_gr9_12_13.pdf</p>		
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Marine Biology – Level 1

<p>Unit: The Biological Make-Up of the Ocean Essential Questions</p> <ol style="list-style-type: none"> 1. How is the system of taxonomy applied to the diverse life in the ocean? 2. What characterizes organisms as “planktonic”? 3. What are some similarities and differences between archaeobacteria and eubacteria?
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4. What can some bacteria do that no other known organisms can do?
5. Why do scientists think the cyanobacteria are crucial to life?
6. Who are marine members of Kingdom Protista?
7. What are the distinguishing characteristics of organisms in Phyla Heterokontophyta (diatoms), Dinoflagellata, Haptophyta (coccolithophores) Why is the genus *Symbiodinium* important to coral reefs?
8. How are diatoms, dinoflagellates and coccolithophores a critical component to the marine ecosystem?
9. How are diatoms responsible for high primary productivity levels in the ocean?
10. What are the distinguishing characteristics of macroalgae in Phyla Rhodophyta, Chlorophyta and Phaeophyta?
11. How do the different pigments found in macroalgae allow them to adapt to different depths?
12. What commercial products are made from some species of brown algae?
13. What evolutionary significance do scientists give the chlorophylls in green algae?
14. What are distinguishing characteristics of *submergent* and *emergent* marine plants?
15. What is the greatest challenge for a plant to adapt to living in the sea?
16. Other than food and oxygen, what do marine plants provide for other marine organisms?
17. What reasons make mangrove swamps important to the environment?
18. What are the distinguishing characteristics of invertebrates in Phyla Porifera, Mollusca, Cnidaria, Echinodermata, Arthropoda and various worms?
19. What are the characteristics that classify an organism in subphylum Vertebrata?
20. What are the distinguishing characteristics of organisms found in Classes Chondrichthyes, Reptilia, Aves and Mammalia?
21. What challenges and adaptations do fish, sharks, rays, reptiles, birds and mammals have that allow them to thrive in a marine environment?
22. How do the reproductive strategies vary among the marine vertebrates?
23. Why is there greater diversity among fish that live on reefs or the bottom than among those that school or live in the open ocean?
24. What roles do birds play in marine ecosystems?

Framework Standard Learning Objectives/ Content Outcomes	Skills	Resources	Instructional Strategies	Assessments
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<p>Writing Standards</p> <p>4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)</p> <p>5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12 on page 67.)</p>	<ul style="list-style-type: none"> State the general characteristics of archaeobacteria, eubacteria, protists, plants and animals including cell type, cell structures, number of cells, mode of nutrition, and examples. Distinguish between phytoplankton and zooplankton. 	<p>Prepared Slides (copepods, zooplankton)</p> <p>Live Specimen: Diatoms</p> <p><i>Worksheets:</i></p> <ol style="list-style-type: none"> (20) Seaweed Adaptations: Red and Green Algae (21) Seaweed Adaptations: Brown Algae <p><i>Handouts:</i></p> <ol style="list-style-type: none"> The Distribution of Life in the Ocean <p>Article “<i>Revealing the Ocean’s Invisible Abundance</i>” http://www.whoi.edu/oceanus/viewArticle.do?id=2473</p>	<p>Drawing: <i>Picture of Specimens</i></p> <p>Dip-Sticking</p> <p>Ticket to Leave</p> <p>Notes</p>	<p>Plankton Microscopy Lab Worksheet</p> <p>Level 2: Chapter 5 Reading pgs 5-4 - 5-24 Chapter 5 Review Questions</p> <ul style="list-style-type: none"> Group Work: Marine Science and the Real World Questions <p>Seaweed Worksheets</p> <p>Article Review “<i>Revealing the Ocean’s Invisible Abundance</i>”</p> <p>WAC Type II with Graphic Organizer: <i>Compare and Contrast Marine Plants to Marine Macroalgae</i></p>
	<ul style="list-style-type: none"> Describe the typical inhabitants within the variety of marine environments. 	<p>The Shape of Life Activity Guide http://www.pbs.org/kcet/shapeoflife/resources/compleguide.pdf</p> <p>The Shape of Life Episodes 1-8 (YouTube.com) http://www.youtube.com/playlist?annotation_id=annotation_800373&feature=iv&src_vid=rqjF7ZYkHp4&list=PL2D417EF7133870ED</p> <p>Computer Lab</p> <p><i>Worksheets:</i></p> <ol style="list-style-type: none"> Horseshoe Crab Web Search 	<p>KWL: 3...2...1... 10-2</p> <p>Notes</p>	<p>Level 2: Chapter 5 Reading pgs 5-26 - 5-60 Chapter 5 Review Questions</p> <ul style="list-style-type: none"> Group Work: Marine Science and the Real World Questions <p>The Shape of Life, Episode Questions: Basic + Advanced Questions (Level 1), Basic Questions only (Level 2)</p> <p>The Shape of Life: Activity 5, “Phylum Comparison Challenge”</p> <p>Horseshoe Crab Web Search</p>

		http://www.dnr.md.state.us/education/horseshoecrab/ 2. Active Reading: <i>The Smartest Invertebrate and Sticking with the Barnacle</i>		
<p>Reading Standards for Literacy in Science</p> <p>1. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.</p>	<ul style="list-style-type: none"> Identify and describe the structures of functions of various body systems within marine specimens. 	<p>Perch Specimens</p> <p>Perch Dissection Student Handout</p> <p>Dissection Tools</p> <p>Dogfish Specimens</p> <p>Dogfish Dissection Student Handout</p> <p>Seastar Specimens</p> <p>Seastar Dissection Student Handout</p> <p>Crayfish Specimens</p> <p>Crayfish Dissection Student Handout</p> <p>Worksheets:</p> <ol style="list-style-type: none"> New England Sharks Activity 1: Baleen Whales Sea Turtles of the World 	<p>Modeling</p> <p>Draw picture of specimen</p> <p>Notes</p>	<p>Level 2: Chapter 5 Reading pgs 5-62 5-93</p> <p>Chapter 5 Review Questions</p> <ul style="list-style-type: none"> Group Work: Marine Science and the Real World Questions <p>Perch Dissection Lab</p> <p>Dogfish Dissection Lab</p> <p>Seastar Dissection Lab</p> <p>Crayfish Dissection Lab</p>

Marine Biology – Level 1

Unit: The Physical and Chemical Make-up of the Ocean
Essential Questions

- How might the properties of water allow it to support ocean life and alter the shape of the Earth?
- How is the salinity of sea water determined using various instruments?
- How do temperature and salinity affect density?
- What factors affect seawater pH at the surface and at depth?

5. What are the major biogeochemical cycles in the oceans?
6. How can diffusion and osmosis affect marine organisms?
7. How does density influence movement of oceanic water masses?
8. How does buoyancy influence vessels and aquatic organisms?
9. How does pressure change with ocean depth?
10. What are major pollutants and how do they affect the ocean?
11. What are the impacts of ocean acidification?
12. How might the various ocean zones influence the marine communities that reside there?
13. What is the difference between haloclines, thermoclines and pycnoclines in different climate zones?
14. What is the Coriolis Effect and how does it influence global ocean currents?
15. How does the ocean influence global weather patterns?
16. How are currents formed?
17. What are the different types of currents?
18. What is El Niño and how does it affect global currents?
19. How does depth of ocean affect light penetration?
20. How does the ocean affect the way sound travels?

Framework Standard Learning Objectives/ Content Outcomes	Skills	Resources	Instructional Strategies	Assessments
<p>Biology 6.4 - Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem and how oxygen cycles through photosynthesis and respiration.</p> <p>Reading Standards for Literacy in Science</p> <p>8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p>	<ul style="list-style-type: none"> • Describe how the carbon and water cycles influence the process of ocean acidification. • Identify and describe the effects of major aquatic pollutants on aquatic ecosystems. 	<p><i>Ocean Acidification Materials (Marine Science Symposium):</i></p> <ol style="list-style-type: none"> 1. Ocean Acidification: the Facts 2. Lab 1 - Is seawater more like lemons or bleach? 3. Lab 2 - Ocean Acidification in a Cup Handout 	<p>10-2</p> <p>Demo: Ocean Acidification in a Cup</p> <p>Think-Pair-Share</p>	<p><i>Ocean Acidification Materials (Marine Science Symposium):</i></p> <ol style="list-style-type: none"> 1. Lab 1 - Is seawater more like lemons or bleach? 2. Lab 2 - Ocean Acidification in a Cup Handout
<p>Chemistry 6.3- Using the Kinetic Molecular Theory, describe and contrast specific properties of gases, liquid and</p>	<ul style="list-style-type: none"> • Compare and contrast the molecular properties (density, freezing point) of salt 	<p>Laboratory Investigation: Making Ocean Water</p> <p><i>Handouts:</i></p>	<p>Modeling: Activity #5 - Layering of Water</p> <p>Think-Pair-Share</p>	<p><u><i>Density & Salinity Lesson Plan Packet</i></u></p> <p>Activity #1 - Sea Ice</p> <p>Activity #3 - Testing for</p>

<p>solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions.</p> <p>Reading Standards for Literacy in Science 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p>	<p>water and fresh water.</p> <ul style="list-style-type: none"> Discuss the sources of, and variations in, the ocean's salinity. 	<ol style="list-style-type: none"> An Inside Look at Water Seawater Density: The Role of Heat & Salt <p><i>Worksheets:</i> <ol style="list-style-type: none"> Sea Water Effects of Temperature and Salinity on water Density with Optional Extra credit Exercise (Level 1) </p> <p>Density & Salinity Lesson Plan Packet: Activity #1 - Sea Ice Activity #3 - Testing for Conductivity Activity #5 – Layering of Water</p>		<p>Conductivity Activity #5 – Layering of Water</p>
<p>Chemistry 1.1- Identify and explain physical properties such as density, melting point, conductivity, malleability and chemical properties (ability to form new substances); distinguish between physical and chemical changes.</p> <p>Reading Standards for Literacy in Science 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p>	<ul style="list-style-type: none"> Define Archimede's Principle and describe how it influences life in the ocean. 	<ol style="list-style-type: none"> Density - Salinity Conversion Chart Modeling Clay Clay Boats Activity Packet Sea salt <i>Lab Handout:</i> Exploring the Concepts of Density and Buoyancy. Density & Salinity Lesson Plan Packet: Activity #2 - A Model Iceberg <p><i>Worksheets:</i> <ol style="list-style-type: none"> What is buoyant force? What is specific gravity? Density Test </p>	<p>One Word Summary 10-2 Notes</p>	<p>Density & Salinity Lesson Plan Packet: Activity #2 - A Model Iceberg</p> <p><i>Lab Handout:</i> Exploring the Concepts of Density and Buoyancy.</p> <p><i>Quiz:</i> Properties of Density, Buoyancy and Specific Gravity</p>
<p>Chemistry 6.1- Using the Kinetic Molecular Theory, explain the behavior of gases and the relationship between Pressure vs. Volume (Boyles), Volume vs. Temperature</p>	<ul style="list-style-type: none"> Describe the effects of temperature and pressure on divers and marine organisms. Explain how aquatic organisms regulate 	<p>Worksheet: Water Pressure and Ocean Depth</p> <p>Lab Activity Handout: Cartesian divers: Experimenting with Pressure and Density</p>	<p>Think-Pair-Share Ticket to Leave Guided Notes</p>	<p>Worksheets</p> <p>Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"</p>

<p>(Charles'), Pressure vs. Temperature (Gay-Lussac's), number of particles in a gas sample (Avogadro's). Use the Combined Gas Law to determine changes in pressure, volume and temperature.</p> <p>Reading Standards for Literacy in Science 8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p>	<p>osmotic pressure.</p>	<p>Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual</p>		
<p>Physics 3.1 - Explain how heat energy is transferred by convection, conduction, and radiation.</p>	<ul style="list-style-type: none"> Describe how heat transfer occurs by: conduction, convection, and radiation. Explain how convection allows for the formation of major global ocean currents. 	<p>Handouts: Distribution of Heat: Inequity Drives Fluid Flow (Find Lava Lamp)</p>	<p><i>Demo:</i> Lava Lamp for Convection Currents Think-Pair-Share</p>	<p>Project: How do currents influence marine organisms? (See BluefinTuna example)</p>
<p>Physics 4.1 - Describe the measurable properties of waves (velocity, frequency, wavelength, amplitude, period) and explain the relationships among them. Recognize examples of simple harmonic motion.</p> <p>Reading Standards for Literacy in Science 9. Synthesize information</p>	<ul style="list-style-type: none"> Describe the properties of light, color and sound as it applies to the ocean. Explain the forces that cause the different kinds of tides. Distinguish between neap and spring tides. Discuss the effects of 	<p>Textbook, "Marine Science", 2nd ed. Thomas F. Greene</p> <ul style="list-style-type: none"> 19.2 Reading Packet "Light and Life in the Sea" Active Reading: "Technology: Sound Surveillance in the Sea" Active Reading, pg 495: "Recreation: The Science of 	<p>Guided Notes from textbook Drawing Picture/ Diagram: <i>Tide Charts</i></p>	<p>19.2 Reading Packet "Light and Life in the Sea" with Questions Active Reading Wkst: "Technology: Sound Surveillance in the Sea" with Questions Lab Activity: "So Far Channels"</p>

<p>from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.</p>	<p>changing tides on marine organisms.</p> <ul style="list-style-type: none"> Describe wave characteristics. Distinguish different types of waves. Define the various ocean currents (global ocean, vertical ocean. deep ocean, wave- and tide-induced) Describe how to use a tide chart. 	<p>Surfing”</p> <ul style="list-style-type: none"> Laboratory Investigation 20: Measuring Ocean Waves Laboratory Investigation 17: “Analyzing Ocean Temperatures” <p>Lab Activity: “So Far Channels”</p> <p>Lab Activity: Timing the Tide</p> <p>Lab Activity: The Moon’s Relation to Ocean Tides http://www.massmarineducator.org/curriculum/tides.shtml</p> <p>WebQuest “The Wave Machine” http://www.pbs.org/wnet/savageseas/multimedia/wavemachine.html</p> <p>Active Reading Worksheet: “Waves and Beach Formation”</p> <p>Worksheet: “What are the Features of a Wave?”</p> <p>Active Reading Article: “Dr. Beach Comes to Town to Caution Swimmers on dangers of Rip Currents” http://www.hampton.com/news/main-articles/8228/dr.-beach-comes-to-town-to-caution-swimmers-of.html</p>		<p>Lab Activity: Timing the Tide</p> <p>Lab Activity: The Moon’s Relation to Ocean Tides</p> <p>Laboratory Investigation 20 “Measuring Ocean Waves”, TF Greene Text</p> <p>Lab Activity: The Moon’s Relation to Ocean Tides http://www.massmarineducator.org/curriculum/tides.shtml</p> <p>WebQuest “The Wave Machine” http://www.pbs.org/wnet/savageseas/multimedia/wavemachine.html</p> <p>Active Reading Worksheet: “Waves and Beach Formation”</p> <p>Worksheet: “What are the Features of a Wave?”</p> <p>Test: Waves and Tides</p> <p>Project: How do currents influence marine organisms? (See BluefinTuna example)</p> <p>Active Reading Article Questions: “Dr. Beach Comes to Town to Caution Swimmers on dangers of Rip Currents”</p> <p>Worksheets: 1. Ocean Currents and</p>
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		<i>Handouts:</i> 1. Earth's Rotation & the Coriolis Effect 2. Prevailing Winds: Making Sense of Zonal Climate <i>Worksheets:</i> 1. Ocean Currents and Global Weather 2. Upwelling and El Nino		Global Weather 2. Upwelling and El Nino
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Unit: The Geological Make-up of the Ocean Essential Questions				
<ol style="list-style-type: none"> How do scientists classify the layers of the Earth? How does the Earth's crust differ from the lithosphere? What links some earthquakes with isostatic equilibrium? What evidence did Wegener use to support the theory of continental drift? How did the invention of sonar contribute to information about the ocean floor? What are the features of the oceanic crust? What evidence supports the theory of seafloor spreading? According to the theory of plate tectonics, what changes might occur to ocean basins and the continents in the future? What are the characteristics and relative abundance of sediments based on their classification of origin? How might sedimentation affect processes located on the continental shelf and deep ocean? Why are calcium carbonate sediments found in some places on the ocean floor, while siliceous sediments are found in other locations? Why are ocean sediments economically important? What are some of the features of a coastline? What forces might influence the composition, shape and appearance of a coastline? What features make up a barrier island? 				

Framework Standard Learning Objectives/ Content Outcomes	Skills	Resources	Instructional Strategies	Assessments
SIS 4 f Communicate and apply the results of scientific investigations	<ul style="list-style-type: none"> Relate the theories of continental drift and plate tectonics to the formation of the continents and oceans. 	Textbook Notes <u>Handouts:</u> 1. Earthquake and Seismic	Guided Notes from text book Draw Picture/Diagram: <i>Formation of a Tsunami</i> Draw Picture/Diagram:	Worksheets <u>Lab Activity: Seafloor Spreading</u> <u>Lab Activity: Evaluation of</u>

	<ul style="list-style-type: none"> Distinguish among seafloor topographical features, such as ridges, rises, seamounts, guyots, islands, basin, continental slope, continental shelf, canyons, trenches and hydrothermal vents. Use and refine scientific models that simulate physical processes or phenomena. 	<p>Waves 2. Plate Tectonics Packet 3. Deep-Sea Hydrothermal Vents</p>	<p><i>Seafloor Topography</i></p>	<p>Beach Sand and Sediments</p>
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Marine Biology – Level 1

<p>Unit: Marine Ecology Essential Questions</p> <ol style="list-style-type: none"> How does the flow of energy through the food web affect an ecosystem? How do the various essential nutrients cycle throughout all ocean zones? Why are the most productive marine ecosystems found in cold, temperate regions? In what way does the euphotic zone ecosystem interact with other ocean ecosystems? Why is there no primary productivity in most of the deep ocean? Why is upwelling critical to coastal ocean ecosystems? Why are coastal ecosystems generally highly productive? Why do human activities have wide-ranging potential effects on coastal ecosystems? How do estuaries contribute to the productivity of surrounding marine ecosystems? What conditions challenge marine ecosystems in the Arctic? What influencing factors contribute to the varying productivity levels among the polar, temperate and tropical zones? Why is eutrophication one of the biggest threats to coral ecosystems? What two deep-sea ecosystems have primary productivity associated with chemicals emerging from the Earth?

Framework Standard Learning Objectives/ Content Outcomes	Skills	Resources	Instructional Strategies	Assessments
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<p>Biology 2.4 Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.</p> <p>Biology 6.4 Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem and how oxygen cycles through photosynthesis and respiration.</p>	<ul style="list-style-type: none"> • Compare and contrast the processes of photosynthesis and cellular respiration. • Explain how the carbon, water and oxygen cycles influence local and global aquatic environments. 	<p><u>Handouts:</u> 1) Primary Productivity in the Ocean 2) Seasonality and Primary Productivity</p> <p><u>Worksheets:</u> 1) Photic Zone</p>	<p>Guided notes from textbook</p> <p>Graphic Organizer: Nutrient Cycles in the Ocean</p>	<p>Worksheets</p>
<p>Biology 5.3 Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population.</p>	<ul style="list-style-type: none"> • Describe adaptations of beach plants, marine grasses, mangrove trees and aquatic organisms. 		<p>Direct Instruction: Notes</p> <p>Think-Pair-Share (Adaptations for Marine Organisms)</p>	
<p>Biology 6.1 Explain how birth, death, immigration, and emigration influence population size.</p> <p>Biology 6.2 Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.</p>	<ul style="list-style-type: none"> • Distinguish between different life zones along a shore. • Discuss the characteristics of a variety of marine environments (local coastal ecosystems, kelp forests, coral reefs, polar seas, salt marshes, estuaries, intertidal zones). • Describe how higher-order consumers, such as sharks, influence the biodiversity of an aquatic ecosystem. 	<p><u>Handouts:</u> 1) Open Ocean (“Blue Water”) Ecosystems 2) Continental Shelf Ecosystems 3) Coral Reef Ecosystems: the Rainforests of the Sea 4) Coastal Ecosystems: Highly Productive but Vulnerable 5) Deltas, Estuaries, and Salt Marshes: Fertile Oases</p> <p><u>Worksheets:</u> 1) Rocky Shores 2) Tide Pool 3) Salt Marsh 4) Tidal Flats 5) Tidal Zonation Patterns 6) Intertidal Zone 7) Estuarine Ecology 8) Marine Ecosystems</p>	<p>Direct Instruction: Notes</p>	<p>Worksheets</p> <p>Group Poster: Aquatic Ecosystems</p>

	<ul style="list-style-type: none"> Describe the formation of coastal features and reef types. 	<p>DVD: <i>Planet Earth</i> series</p> <p>Planet Earth Movie Worksheets</p> <p>Monterey Bay Aquarium Website Resources</p> <p>1) Learning Center Posters http://www.montereybayaquarium.org/lc/activities/poster_ispy.asp</p> <p>2) About the Animals http://www.mbayaq.org/efc/living_species/default.asp</p> <p>3) Aquarium Exhibits Section http://mbayaq.org/efc/</p> <p>4) Video Library http://mbayaq.org/efc/video_library/video_library.aspx</p> <p>5) Live Web Cams http://mbayaq.org/efc/cam_menu.asp</p>		
<p>Biology 6.3 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalisms, and mutualism) add to the complexity of biological communities.</p>	<ul style="list-style-type: none"> Describe the energy flow through food chains and webs in aquatic environments. Explain the importance of plankton in aquatic food chains. Identify and describe the importance of symbiotic relationships in the ocean. 	<p><u>Handouts:</u></p> <p>1) Food Webs & the Trophic Pyramid</p> <p><u>Worksheets:</u></p> <p>1) Marine Ecology (Food Webs & Chains)</p> <p><u>Lab:</u> <i>Energy Flow Through a Marine Ecosystem Worksheets</i></p> <p>Index Cards</p> <p>Internet</p>	<p>Guided notes from textbook</p>	<p>Worksheets</p> <p>Lab: Energy Flow Through An Ecosystem</p> <p>Group Project: Gulf of Maine Ecosystem Food Web</p> <p>Unit Test: Marine Ecology</p>

		Bucket <u>Lab:</u> <ul style="list-style-type: none"> ● Gulf of Maine Ecosystem Food Web Worksheets ● Posterboard (20"x30") ● Colored Construction Paper ● Scissors ● Glue ● Colored Markers/Sharpies 		
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Marine Biology – Level 1

Unit: The Impact of Humans on the Quality of Aquatic Ecosystems

Essential Questions

1. What are some ways humans utilize ocean resources?
2. What changes and problems occur due to human structures intended to protect the coastline?
3. What are the short-term and long-term effects of over-harvesting from the ocean?
4. What are differences between renewable and non-renewable sources of energy from the ocean?
5. How can oceans be used as a renewable and clean source of energy?
6. What are the potential causes and long-term effects of global warming on the ocean?
7. Why are there growing concerns about fresh water as we move through this century?
8. How has ecotourism affected environments both negatively and positively?
9. Why is there so much potential for discovering new drugs among benthic organisms via bioprospecting?
10. What was whaling like historically, and how has it impacted current whale populations and the economy since the 1800's?
11. How have fishery regulations affected organism populations and the economy?
12. How have trends in aquaculture influenced worldwide seafood consumption?
13. What are the effects of non-native species on local ecology?
14. How do primary methods of commercial fishing compare with one another?
15. How is it that the fishing industry thrives as a business despite estimates that the annual fish catch sells for less than it costs to catch?
16. What does the Tragedy of the Commons suggest about the causes of biological crises and international management of marine biological resources?
17. How do greenhouse gases affect the chemical, biological and physical characteristics of the ocean?
18. Why is the ozone layer vital to life on Earth?
19. What is the primary cause of coastal wetland destruction?
20. Why are estuaries particularly at risk of destruction?

21. How might various practices associated with capturing fish be destructive to coral reefs?
22. How have various sources of pollution affected the biological, chemical and physical make-up of the ocean?
23. How do oil spills occur and what impacts do they have on the environment?
24. How can we use new technologies to eliminate oil spills from happening?
25. How might synthetic chemicals concentrate into dangerous levels when they enter the sea in very low concentrations?
26. Why is refined oil more hazardous to the environment than crude oil?
27. How do radioactive materials presently affect marine organisms?
28. How and why would a marine sanctuary be established?
29. What human activities have endangered or may endanger marine mammals?
30. What concerns exist regarding the dumping of munitions in the ocean?
31. Why are scientific research and political, social and economic understanding crucial to sustainable management of ocean resources?
32. What can you do to help preserve and protect the ocean?
33. What are the primary motivations for humans to modify the coastlines?
34. What changes and problems occur due to human structures intended to protect the coastline?
35. What are the likely solutions to the various problems caused by human coastal structures?

Framework Standard Learning Objectives/ Content Outcomes	Skills	Resources	Instructional Strategies	Assessments
<p>Reading Standards for Literacy in Science</p> <p>6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.</p> <p>7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p> <p>10. By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text</p>	<ul style="list-style-type: none"> • Describe what a marine sanctuary is and articulate why we need national marine sanctuaries. • Identify and discuss threats to, and protection of, marine animals. • Identify recent problems in worldwide ocean fisheries • Discuss the effects of overfishing from an economical and ecological perspective • Describe different methods of farming aquatic organisms. • Discuss the impact of sewage pollution on aquatic ecosystems. 	<p>Investigation 1: What Are Marine Sanctuaries? (Handout)</p> <p>www.noaa.gov</p> <p>Ocean Explorer Curriculum http://oceanexplorer.noaa.gov/edu/curriculum/section9.pdf</p> <p><u>Handouts:</u></p> <ol style="list-style-type: none"> 1. Issues of Global Change: Food for Thought 2. Options in the Face of Rising Sea Level 3. Sea Level Rise & Shoreline Retreat: A real Threat <p>Article: Williams, Wendy.(2002) <i>Oil Stains</i>. Boston Globe</p> <p><u>Worksheets:</u></p> <ol style="list-style-type: none"> 1. The History of Whaling 	<p>Guided notes from textbook</p> <p>K-W-L</p> <p>Article Review</p> <p>Dip-Sticking</p>	<p>Investigation 1: What Are Marine Sanctuaries? Activity</p> <p>Worksheets</p> <p>Webquest: <i>Ecotourism</i></p> <p>Lab Activities</p> <p>Article Review</p> <p>Group Project: <i>Fishing for the Future</i></p> <p><i>Type III WAC</i>: Compare and Contrast the ecological impacts aquaculture and commercial fishing</p> <p>Lab Activity: <i>Shifting Sands Beach</i></p>

<p>complexity band independently and proficiently</p> <p>3. Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.</p> <p>Writing Standards</p> <p>1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.</p> <p>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.</p>	<ul style="list-style-type: none"> Explain "Tragedy of the Commons" and discuss how it relates to overfishing and other resource crises. 	<p>2. Webquest: <i>Ecotourism</i></p> <p>Textbook, "Marine Science", 2nd ed. Thomas F. Greene</p> <ul style="list-style-type: none"> Active Reading Activity: <i>Conservation: Keeping the Chinook Chilly</i>, pg 449 Laboratory Investigation 23: Analyzing Fishery Data <p><i>Group Research Project: Fishing for the Future</i></p> <ul style="list-style-type: none"> Project Questions Handout: Fishing for the Future: Fishery Facts Handout: An overview of the World's Fisheries Handout: Overfished Marine Species in the U.S. Handout: Sample Charts and Graphs Computer Lab MHS Oral Presentation School Wide Rubric <p>Lab Activity: <i>Shifting Sands Beach</i></p> <p>Video: <i>Empty Oceans/Empty Nest</i></p>		<p>Video Summary</p> <p>Group Research Project: <i>Fishing for the Future</i> Oral/PPT Presentation on a topic relating to sustainable fisheries, preferably local</p>
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<p>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</p> <p>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>e. Provide a concluding statement or section that follows from and supports the argument presented.</p> <p>2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <p>a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g.,</p>				
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<p>headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <p>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.</p> <p>c. Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</p> <p>d. Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.</p> <p>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g.,</p>				
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<p>articulating implications or the significance of the topic)</p> <p>4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience (Grade-specific expectations for writing types are defined in standards 1–3 above.)</p> <p>5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12 on page 67.)</p> <p>7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>8. Gather relevant information from multiple authoritative</p>				
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<p>print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.</p> <p>9. Draw evidence from literary or informational texts to support analysis, reflection, and research.</p> <p>b. Apply <i>grades 11–12 Reading standards</i> to literary nonfiction (e.g., “Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., <i>The Federalist</i>, presidential addresses]”).</p> <p>10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.</p>				
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Scientific Inquiry Skills Standards			
SIS 1. Make observations, raise questions, and formulate hypotheses.			
FRAMEWORK STANDARD: SIS 1 a			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Make observations, raise questions, and formulate hypotheses.	-Observe the world around them from a scientific perspective.	Density and Salinity Lesson Plan Packet <i>Materials:</i> Sea salt, aquarium tanks, electronic balances, plastic/glass hydrometers, Vernier Handheld Devices, Vernier conductivity and temperature probes, food coloring, ice, beakers and graduated cylinders	<i>Lab Worksheets:</i> Density and Salinity Activities #3 –Testing for Conductivity #5 – Layering of Water
FRAMEWORK STANDARD: SIS 1 b			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Make observations, raise questions, and formulate hypotheses.	-Pose questions and form hypotheses based on personal observations, scientific articles, experiments, and knowledge.	Density and Salinity Lesson Plan Packet <i>Materials:</i> Sea salt, aquarium tanks, electronic balances, plastic/glass hydrometers, Vernier Handheld Devices, Vernier conductivity and temperature probes, food coloring, ice, beakers and graduated cylinders	<i>Lab Worksheets:</i> Density and Salinity Activities #3 –Testing for Conductivity #5 – Layering of Water
FRAMEWORK STANDARD: SIS 1 c			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Make observations, raise questions, and formulate hypotheses.	-Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.	Oceanus Magazine www.oceanusmag.whoi.edu "What is the Sound of 130 Wind Turbines Turning?" http://www.whoi.edu/oceanus/viewArticle.do?id=151131	Article Summary which includes the Who, What, Where, When, Why & How (technology). <i>Level 1: 1 pg</i> <i>Level 2: 2 sentences</i>

SIS 2. Design and conduct scientific investigations.			
FRAMEWORK STANDARD: SIS 2 a			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Articulate and explain the major concepts being investigated and the purpose of an investigation.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	
FRAMEWORK STANDARD: SIS 2 b			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Pose questions and form hypotheses based on personal observations, scientific articles, experiments, and knowledge.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	
FRAMEWORK STANDARD: SIS 2 c			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Identify independent and dependent variables.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	
FRAMEWORK STANDARD: SIS 2 d			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Write procedures that are clear and replicable.	<i>Ocean Acidification Materials (Marine Science Symposium):</i> Lab 2 - Ocean Acidification in a Cup Handout	Lab 2 - Ocean Acidification in a Cup Handout

FRAMEWORK STANDARD: SIS 2 e			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Employ appropriate methods for accurately and consistently -Making observations; -Making and recording measurements at an appropriate level of precision and; -Collecting data or evidence in an organized way.	Density and Salinity Lesson Plan Packet <u>Materials:</u> Sea salt, aquarium tanks, electronic balances, plastic/glass hydrometers, Vernier Handheld Devices, Vernier conductivity and temperature probes, food coloring, ice, beakers and graduated cylinders	<i>Lab Worksheets:</i> Density and Salinity Activities #3 –Testing for Conductivity #5 – Layering of Water
FRAMEWORK STANDARD: SIS 2 f			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Properly use instruments, equipment, and materials (such as scales, probeware, meter sticks, microscopes, computers, etc.) including: set-up, calibration (if required), technique, maintenance, and storage.	Density and Salinity Lesson Plan Packet <u>Materials:</u> Sea salt, aquarium tanks, electronic balances, plastic/glass hydrometers, Vernier Handheld Devices, Vernier conductivity and temperature probes, food coloring, ice, beakers and graduated cylinders	<i>Lab Worksheets:</i> Density and Salinity Activities #3 –Testing for Conductivity #5 – Layering of Water
FRAMEWORK STANDARD: SIS 2 g			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Design and conduct scientific investigations.	-Follow safety guidelines	Dissection Specimens (seastars, yellow perch, dogfish, crayfish) Dissecting Tools Goggles Aprons Tools/Trays	Dissections: Yellow Perch, Seastar, Dogfish, Crayfish

SIS 3. Analyze and interpret results of scientific investigations.			
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FRAMEWORK STANDARD: SIS 3 a			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Analyze and interpret results of scientific investigations	-Present relationships between variables in appropriate forms.	<i>Group Research Project: Fishing for the Future</i> <ul style="list-style-type: none"> ● Project Questions ● Handout: Fishing for the Future: Fishery Facts ● Handout: An overview of the World's Fisheries ● Handout: Overfished Marine Species in the U.S. ● Handout: Sample Charts and Graphs ● Computer Lab ● MHS Oral Presentation School Wide Rubric 	Group Research Project: <i>Fishing for the Future</i> Oral/PPT Presentation on a topic relating to sustainable fisheries, preferably local
FRAMEWORK STANDARD: SIS 3 b			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Analyze and interpret results of scientific investigations	-Use mathematical operations to analyze and interpret data results.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"
FRAMEWORK STANDARD: SIS 3 c			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Analyze and interpret results of scientific investigations	-Identify reasons for inconsistent results, such as sources of error or uncontrolled conditions, and assess the reliability of data.	<i>Ocean Acidification Materials (Marine Science Symposium):</i> Lab 2 - Ocean Acidification in a Cup Handout	Lab 2 - Ocean Acidification in a Cup Handout
FRAMEWORK STANDARD: SIS 3 d			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Analyze and interpret results of scientific investigations	-Use the results of an experiment to develop a conclusion to an investigation that addresses the initial	Life on an Ocean Planet Lab & Activity Manual	Chapter 7 Lab Activity "A Touch of Blue: A

	questions and supports or refutes the stated hypothesis.	Chapter 7 Lab Activity “A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea” "A Touch of Blue" Lab Manual	Series of Studies of Light, Sound, and Pressure in the Sea”
FRAMEWORK STANDARD: SIS 3 e			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Analyze and interpret results of scientific investigations	-State questions raised by an experiment that may require further investigation.	<i>Group Research Project: Fishing for the Future</i> <ul style="list-style-type: none"> ● Project Questions ● Handout: Fishing for the Future: Fishery Facts ● Handout: An overview of the World’s Fisheries ● Handout: Overfished Marine Species in the U.S. ● Handout: Sample Charts and Graphs ● Computer Lab ● MHS Oral Presentation School Wide Rubric 	Group Research Project: <i>Fishing for the Future</i> Oral/PPT Presentation on a topic relating to sustainable fisheries, preferably local

SIS 4. Communicate and apply the results of scientific investigations.			
FRAMEWORK STANDARD: SIS 4 a			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Communicate and apply the results of scientific investigations	-Develop descriptions and explanations of scientific concepts that an investigation focused on.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity “A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea” "A Touch of Blue" Lab Manual	Chapter 7 Lab Activity “A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea”
FRAMEWORK STANDARD: SIS 4 b			

Learning Objectives Content Outcomes	Skills	Resources	Assessments
Communicate and apply the results of scientific investigations	-Review information, explain statistical analysis, and summarize data collected and analyzed from an investigation.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"
FRAMEWORK STANDARD: SIS 4 c			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Communicate and apply the results of scientific investigations	-Explain diagrams and charts that represent relationships of variables.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"
FRAMEWORK STANDARD: SIS 4 d			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Communicate and apply the results of scientific investigations	-Construct a reasoned argument and respond appropriately to critical comments and questions.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"
FRAMEWORK STANDARD: SIS 4 e			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Communicate and apply the results of scientific investigations	-Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (such as presentation software, etc.) and other tools to present findings.	<i>Group Research Project: Fishing for the Future</i> <ul style="list-style-type: none"> • Project Questions • Handout: Fishing for the Future: Fishery Facts • Handout: An overview of the World's Fisheries • Handout: Overfished Marine Species in the U.S. 	Group Research Project: <i>Fishing for the Future</i> Oral/PPT Presentation on a topic relating to sustainable fisheries, preferably local

		<ul style="list-style-type: none"> • Handout: Sample Charts and Graphs • Computer Lab • MHS Oral Presentation School Wide Rubric 	
FRAMEWORK STANDARD: SIS 4 f			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Communicate and apply the results of scientific investigations	-Use and refine scientific models that simulate physical processes or phenomena.	Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"

Mathematical Skills			
Learning Objectives Content Outcomes	Skills	Resources	Assessments
Use Mathematics as a tool in understanding, supporting, and defending scientific concepts.	<ul style="list-style-type: none"> -Construct and use tables and graphs to interpret data sets -Solve simple algebraic expressions -Perform basic statistical procedures to analyze the center and spread of data -Measure with accuracy and precision -Convert within a unit -Use common prefixes -Use scientific notation, where appropriate -Use ratio and proportion in the solution of problems -Determine the correct number of significant figures -Determine the percent error from e -Determine the correct number of significant figures -Determine the percent error from experimental and accepted values -Use appropriate metric/standard international (SI) units of Measurement -Use Celsius the scale 	Density and Salinity Lesson Plan Packet <u>Materials:</u> Sea salt, aquarium tanks, electronic balances, plastic/glass hydrometers, Vernier Handheld Devices, Vernier conductivity and temperature probes, food coloring, ice, beakers and graduated cylinders Life on an Ocean Planet Lab & Activity Manual Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea" "A Touch of Blue" Lab Manual	<i>Lab Worksheets:</i> Density and Salinity Activities #3 –Testing for Conductivity #5 – Layering of Water Chapter 7 Lab Activity "A Touch of Blue: A Series of Studies of Light, Sound, and Pressure in the Sea"