

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Marine Biology Curriculum Guide

<p>Pacing Guide</p> <p>Marine Biology is a full year course that meets on a rotating basis for three (3) 55-minute blocks and one (1) 40-minute block for every five (5) day cycle.</p>	<p>Chapter 1: 1 Week Chapter 2: 1 Week Chapter 3: 1 Week Chapter 4: 2 Weeks Chapter 5: 2 Weeks Chapter 6: 2 Weeks Chapter 7: 8 Weeks Chapter 8: 3 Weeks Chapter 9: 4 Weeks Chapter 10: 1 Week Chapter 11: 2 Weeks Chapter 12: 2 Weeks Chapter 13: 2 Weeks Chapter 14: 2 Weeks Chapter 15: 1 Week Chapter 16: 1 Week Chapter 17: 1 Week Chapter 18: 2 Weeks Chapter 19: 1 Week</p>
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CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Interdisciplinary Connections	<p>HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities</p> <p>HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context</p> <p>HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-PS4-1 & 3, HS-ESS1-2)</p>
21st Century Life and Careers:	<p>9.2.12.C.1 Review career goals and determine steps necessary for attainment.</p> <p>9.2.12.C.3 Identify transferable career skills and design alternate career plans.</p>
Technology Standards	<p>8.2.12.B.2 Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.</p> <p>8.2.12.B.4 Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.</p> <p>8.2.12.B.5 Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review.</p> <p>8.2.12.C.4 Explain and identify interdependent systems and their functions.</p>
<p>NJSLS Career Ready Practices – These practices are demonstrated throughout the curriculum</p>	<p>CRP2. Apply appropriate academic and technical skills.</p> <p>CRP4. Communicate clearly and effectively and with reason.</p> <p>CRP5. Consider the environmental, social and economic impacts of decisions.</p> <p>CRP6. Demonstrate creativity and innovation.</p> <p>CRP7. Employ valid and reliable research strategies.</p> <p>CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.</p> <p>CRP10. Plan education and career paths aligned to personal goals.</p> <p>CRP11. Use technology to enhance productivity.</p> <p>CRP12. Work productively in teams while using cultural global competence.</p>

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Differentiation/Accommodations/Modifications

Gifted and Talented	English Language Learners	Students with Disabilities	Students at Risk of School Failure
<p><i>(content, process, product and learning environment)</i></p> <p>Extension Activities:</p> <ul style="list-style-type: none"> • Conduct research and provide presentation of mathematical topics. • Design surveys to generate and analyze data to be used in discussion. • Use of higher level questioning techniques. • Provide assessments at a higher level of thinking. 	<p>Modifications for Classroom:</p> <p>Modifications for Homework/Assignments</p> <ul style="list-style-type: none"> • Modified assignments. • Extended time for assignment completion as needed. • Use graphing calculator. • Highlight formulas. 	<p><i>(appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)</i></p> <p>Modifications for Classroom:</p> <ul style="list-style-type: none"> • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide regular parent / school communication • Provide oral reminders and check student work during independent work time. 	<p>Modifications for Classroom:</p> <ul style="list-style-type: none"> • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments • Provide regular parent / school communication. • Assign peer helper in the class setting.

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

		<ul style="list-style-type: none"> • Assist student with long and short term planning of assignments <p>Modifications for Homework</p> <ul style="list-style-type: none"> • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. <p>Modification for Assessments</p> <ul style="list-style-type: none"> • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. • Establish procedures for accommodations / modifications for assessments. 	<ul style="list-style-type: none"> • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments <p>Modifications for Homework</p> <ul style="list-style-type: none"> • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. <p>Modification for Assessments</p> <ul style="list-style-type: none"> • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests.
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CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

<p>Unit 1: Chapter 1 The Science of Marine Biology, Chapter 2 The Sea Floor, Chapter 3 Chemical & Physical Features of Seawater & the World Ocean</p>
<p>Content: Principles of Marine Science</p>
<p>Essential Questions: Why is it important to study marine biology? What are the parts of the sea floor? How and why is Earth constantly changing? How does the position of the Earth, Moon and Sun affect the tides? What is the importance of upwelling? How are waves used to transfer energy?</p>
<p>Standards: HS-ESS1-5, HS-ESS2-1, HS-ESS2-5, HS-PS4-1</p>
<p>Time Frame: 3 Weeks</p>
<p>Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Oceanography lab kit, coloring supplies</p>
<p>Content: <i>As a result of this learning segment, students will know...</i> The History and Current State of Marine Biology The Scientific Method Continental Drift Continental Margins Unique Properties of Water Ocean Circulation Waves and Tides</p>
<p>Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i> Explain how scientist collect, analyze, and use data using the scientific method. Tides are a function of the Earth - Sun - Moon system. Surface Currents allow movement of nutrients and are driven by wind. The spin of the Earth and the Coriolis Effect determine the pattern in which surface currents flow. Density Currents allow for upwelling. -The ocean has ridges and subduction zones where the ocean floor grows and shrinks. Water behaves differently depending upon if it is hot or cold and fresh or salty.</p>
<p>Engage: <i>Anticipatory Set</i> Watch video on Biggest Marine Census Complete. http://video.nationalgeographic.com/video/oceans-narrated-by-sylvia-earle/oceans-patagonia?source=relatedvideo Watch video on Development of Ocean Waves (National Geographic Channel) http://channel.nationalgeographic.com/videos/development-of-ocean-waves/</p>

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Watch video on the Ocean Floor Revealed.

<https://www.youtube.com/watch?v=K8bL9Ki2mQ>

Seafloor Spreading Educational Children's Cartoon

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

Exploration: *Student Inquiry*

Oceanography Stations Lab

Explanation: *Concepts and Practices*

Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

ESS1.C: The History of Planet Earth – Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches.

ESS2.B: Plate Tectonics and Large-Scale System Interactions – The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection.

ESS2.C: The Roles of Water in Earth's Surface Processes - The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks.

PS4.A: Wave Properties - The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.

Elaboration: *Extension Activity*

Study Tide Charts and Predict the Moon Phases

Oceanography DVD

Watch video on Sea Floor Spreading with Bill Nye.

<https://www.youtube.com/watch?v=GyMLLxbfa4>

Watch video on Sea Floor Spreading.

<http://www.sciencechannel.com/tv-shows/greatest-discoveries/videos/100-greatest-discoveries-sea-floor-spreading/>

Watch video of Ocean Floor via Sonar.

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

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

CW: Ch 1 & 2 WS

CW: Ch 3 WS

CW: Oceanography DVD

Lab: Oceanography Stations Lab

Test: Ch 1, 2 & 3

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Unit 2: Chapter 4 Fundamentals of Biology, Chapter 5 The Microbial World, Chapter 6 Multicellular Primary Producers: Seaweeds and Plants	
Content: The Organisms of the Sea	
Essential Questions: What mechanisms promote changes in organisms? What evidence supports that life on Earth has changed? What characteristics place an organism into specific phylogenies?	How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms? How do the structures of organisms enable life's functions? How do organisms obtain and use energy they need to live and grow?
Standards: HS-LS1-3, HS-LS1-4, HS-LS1-5, HS-LS1-6, HS-LS2-5, HS-LS3-1, HS-LS4-1, HS-LS4-4	
Time Frame: 6 Weeks	
Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Microscopes, slides, samples of marine organisms, coloring supplies, seaweed products	
Content: <i>As a result of this learning segment, students will know...</i> Building Blocks of Life Cells, Organelles, & Organization Challenges of Life in the Sea Reproductive Strategies Natural Selection & Adaptation Classifying Living Things Viruses, Prokaryotes Unicellular Algae, Protozoans, Fungi Multicellular Algae: Seaweeds Flowering Plants	
Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i> -Recall the biological process of photosynthesis and respiration and relate these processes to the organisms that live in the seas and oceans. -Identify important physical characteristics of a habit that improve an organism's chance of survival. -Gain an understanding of how microscopic life forms are an important part of the marine ecosystem. -List the characteristics of the protist kingdom. -List the characteristics of the plant kingdom.	
Engage: <i>Anticipatory Set</i> Watch evolution of whale video. https://www.youtube.com/watch?v=SAF5VjaYMdE Watch the video clip of "The Birds" movie trailer. Watch the importance of upwelling video. https://www.youtube.com/watch?v=A18WrXkLuL4	

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Watch the kelp forest video clip.

<http://pbskids.org/dragonflytv/show/kelpforest.html>

Exploration: *Student Inquiry*

Classification of Marine Organisms Using Dichotomous Key

Using a light microscope, observe and draw microscopic aquatic organisms. Research which species is the basis of the movie.

Using a light microscope, observe and draw seaweed species.

Explanation: *Concepts and Practices*

Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS1.A: Structure and Function - Systems of specialized cells within organisms help them perform the essential functions of life, which involve chemical reactions that take place between different types of molecules, such as water, proteins, carbohydrates, lipids, and nucleic acids. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.

LS1.B: Growth and Development of Organisms - As successive subdivisions of an embryo's cells occur, programmed genetic instructions and small differences in their immediate environments activate or inactivate different genes, which cause the cells to develop differently—a process called differentiation. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

LS1.C: Organization for Matter and Energy Flow in Organisms - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. The sugar molecules thus formed contain carbon, hydrogen, and oxygen; their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.

LS4.C: Adaptation - Natural selection leads to adaptation—that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment.

Elaboration: *Extension Activity*

Seaweed Products Lab

Coloring Activities

Videos

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

LAB: Classification of Marine Organisms Using Dichotomous Key

CW: Identify, Color and Label Dinoflagelettes

CW: Watch and Discuss Movie on Bioluminescent Marine Plankton

CW: Watch and Discuss Movie on Marine Protista

LAB: Using a light microscope, observe and draw microscopic aquatic organisms

LAB: Using a light microscope, observe and draw seaweed species

LAB: Seaweed Products

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Unit 3: Chapter 7 Marine Animals Without a Backbone
Content: The Organisms of the Sea
<p>Essential Questions:</p> <p>What are the structures, functions and behaviors of a marine organism? How do the structures of organisms enable life's functions? How do organisms obtain and use energy they need to live and grow? What evidence supports that life on Earth has changed? What is the responsibility of Humans for other life forms on Earth? What characteristics place an organism into specific phylogenies? How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms?</p>
Standards: HS-LS1-2, HS-LS1-3, HS-LS2-4, HS-LS4-4, HS-LS4-5
Time Frame: 8 Weeks
<p>Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Microscope, slides, specimens, dissection equipment, squid, blue crabs, diagrams to color, coloring supplies, computers, internet, Library resources, DVD player</p>
<p>Content: <i>As a result of this learning segment, students will know...</i></p> <p>Symmetry Sponges Cnidarians Comb Jellies Bilaterally Symmetrical Worms Mollusks Arthropods Echinoderms</p>
<p>Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i></p> <ul style="list-style-type: none"> -Distinguish between cell growth and development -Describe the ways in which organisms interact with each other and their habitats in order to meet basic needs. -Provide a scientific explanation for the history of life on Earth using scientific evidence such as fossil records. -Account for the evolution of a species by citing specific evidence of biological mechanisms. - Demonstrate an understanding of the most important morphological characters, ecological significance, and economic importance of the major groups of marine invertebrates. -Compare and contrast between the major groups of marine invertebrates in terms of characters such as level of organization, body symmetry, type of body cavity, and presence or absence of segmentation.

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Engage: *Anticipatory Set*

Video clips of unusual marine invertebrate behaviors. (Portuguese man of war, turbellarians, sea cucumbers)

<https://www.youtube.com/watch?v=wn3xluIRh1Y>

<http://video.nationalgeographic.com/video/why-ocean-matters> (Look at related videos)

Exploration: *Student Inquiry*

Students are given examples of marine invertebrates and have to classify them based on physical traits

Eyes of Marine Invertebrates

<http://ngm.nationalgeographic.com/2016/02/evolution-of-eyes-text>

Explanation: *Concepts and Practices*

Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS1.A: Structure and Function - Systems of specialized cells within organisms help them perform the essential functions of life, which involve chemical reactions that take place between different types of molecules, such as water, proteins, carbohydrates, lipids, and nucleic acids. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.

LS1.B: Growth and Development of Organisms - As successive subdivisions of an embryo's cells occur, programmed genetic instructions and small differences in their immediate environments activate or inactivate different genes, which cause the cells to develop differently—a process called differentiation. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

LS1.C: Organization for Matter and Energy Flow in Organisms - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. The sugar molecules thus formed contain carbon, hydrogen, and oxygen; their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.

LS4.C: Adaptation - Natural selection leads to adaptation—that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment.

Elaboration: *Extension Activity*

Sponge Spicules Lab

Flatworm Lab

Shell Lab

Squid Dissection

Arthropod Lab

Coloring Activities

Phylum Videos

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

CW: Draw, Label and Color Sponges

Lab: Sponge Spicules Lab

CW: Draw, Label and Color Jelly Fish

CW: Draw, Label and Color Marine Worms

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

CW: Draw, Label and Color Mollusks
CW: Draw, Label and Color Crustaceans
CW: Draw, Label and Color Echinoderms
CW: View and Discuss: Video on Porifera
View and Discuss: Video on Cnidarians
View and Discuss: Video on Marine Worms
Lab: Shell Lab
View and Discuss: Video on Cephalopods
View and Discuss: Video on Crash, Tail of Two Species (PBS)
CW: Develop a Topic Review Chart on Invertebrate Marine Organisms
Test: Sponges, Cnidarians, and Ctenophores
Test: Marine Worms
Lab: Dissection of a squid
CW: Classification Poster Activity
Test: Mollusks, Arthropods and Echinoderms

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Unit 4: Chapter 8 Marine Fishes, Chapter 9 Marine Reptiles, Birds, and Mammals	
Content: The Organisms of the Sea	
Essential Questions: What characteristics place an organism into specific phylogenies? What evidence supports that life on Earth has changed? What mechanisms promote changes in organisms? What is the responsibility of humans for other life on Earth?	How do the structures of organisms enable life's functions? How do organisms obtain and use energy they need to live and grow? How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms?
Standards: HS-LS1-2, HS-LS1-3, HS-LS2-4, HS-LS2-8, HS-LS4-4, HS-LS4-5	
Time Frame: 7 Weeks	
Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Diagrams to color, coloring supplies, computers, internet, library resources, DVD player	
Content: <i>As a result of this learning segment, students will know...</i> Vertebrate introduction Jawless fishes Cartilaginous Fishes Bony fishes Biology of Fishes Sea Turtles Sea Snakes Other Marine Reptiles Penguins Tubenoses Pelicans Gulls Shorebirds Seals, Sea Lions, Walrus Sea Otter and Polar Bear Manatees and Dugong Whales, Dolphins, and Porpoises Biology of Marine Mammals	
Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i> -Identify the four basic characteristics of chordates. -Describe the classification scheme of fishes. -Compare and contrast bony fish and cartilaginous fish	

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

- Recognize the behavior patterns which are adaptations for survival.
- Relate the body shape of a fish to its habitat.
- Differentiate warning coloration, cryptic coloration, disruptive coloration and counter shading.
- Identify major organs of the various systems of marine fish.
- Represent marine fishes based upon distinguishing features including habits and environment.
- Identify traits of each species of sea turtles.
- Describe examples and the importance of seabirds.
- Identify examples and traits of the four groups of marine mammals.

Engage: *Anticipatory Set*

Show students pictures of all different species of fish to show diversity.

<http://video.nationalgeographic.com/video/why-ocean-matters> (Look at related videos)

Watch Video on Types of Marine Organisms

<http://study.com/academy/lesson/types-of-marine-organisms.html>

Show video on Great White Shark airborne.

<https://www.youtube.com/watch?v=XCWT-tBLnD8>

Show video on saltwater crocodile invading the Florida everglades. (Nile Crocodiles Captured in Florida)

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

Man-eating Nile crocs newest threat to Everglades

<https://www.youtube.com/watch?v=GcVSvZrN360>

Show video on orca whales hunting in packs to drown a baby grey whale.

<https://www.youtube.com/watch?v=bCAW6HGeQIE>

Exploration: *Student Inquiry*

Watch the below video for background information:

<https://www.youtube.com/watch?v=DzuSx4b2RAM>

Create a Fish Activity

Rank shark species in order from most dangerous to least dangerous and defend their ranking to the class.

Structure of beaks of shorebirds related to function.

Students will time how long they can hold their breath and compare it to marine reptiles and marine mammals. All the data will be analyzed and graphed.

Interview a Marine Vertebrate

Explanation: *Concepts and Practices*

Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS1.A: Structure and Function - Systems of specialized cells within organisms help them perform the essential functions of life, which involve chemical reactions that take place between different types of molecules, such as water, proteins, carbohydrates, lipids, and nucleic acids. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

LS1.B: Growth and Development of Organisms - As successive subdivisions of an embryo's cells occur, programmed genetic instructions and small differences in their immediate environments activate or inactivate different genes, which cause the cells to develop differently—a process called differentiation. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

LS1.C: Organization for Matter and Energy Flow in Organisms - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. The sugar molecules thus formed contain carbon, hydrogen, and oxygen; their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.

LS4.C: Adaptation - Natural selection leads to adaptation—that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment.

LS2.D: Social Interactions and Group Behavior - Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives.

Elaboration: *Extension Activity*

Complete Shark Chart
Classify Marine Turtles
Turtle Poster
Complete Marine Mammals Chart
Coloring Activities
Worksheets
Videos

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

CW: Draw, Label and Color a shark, a ray and a skate
CW: Draw, Label and Color Bony fish
Lab: Create A Fish Activity
View and Discuss: Video on Sharks
View and Discuss: Video on Bony Fish
Test: Ch 8
Lab: Classify Marine Turtles
Project: Marine Turtle Poster
Test: Ch 9
CW: Interview Marine Vertebrate

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Unit 5: Chapter 10 An Introduction to Marine Ecology, Chapter 11 Between the Tides, Chapter 12 Estuaries: Where Rivers meet Seas
Content: Structure and Function of Marine Ecosystems
Essential Questions: How does energy flow in a marine environment? What adaptations exist in tidal organisms? What adaptations exist in estuarine organisms? How do organisms interact with the living and non-living environment to obtain matter and energy?
Standards: HS-LS2-2, HS-LS2-4, HS-LS2-6, HS-LS2-7, HS-ESS2-5, HS-ESS2-7
Time Frame: 5 Weeks
Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Diagrams to color, coloring supplies, computers, internet, library resources, DVD player
Content: <i>As a result of this learning segment, students will know...</i> The Organization of Communities The Flow of Energy and Materials Rocky Shore Intertidal Communities Soft Bottom Intertidal Communities Origins & Types of Estuaries Physical Characteristics of Estuaries Estuaries as Ecosystems Human Impact on Estuaries The Meadowlands – Our Back Yard
Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i> -Organisms are dependent on other organisms and on their environment for survival. -Demonstrate an understanding of how species interact: the concepts of competition, competitive exclusion, predator-prey interactions, and symbiosis. -Demonstrate an understanding of the concepts of trophic levels and trophic pyramids as applied to the marine environment. -Explain the essential steps in the most important nutrient cycles (carbon, nitrogen, and phosphate) in the marine environment. -Demonstrate an understanding of how physical factors, primarily exposure to air and wave action, affect intertidal communities. -Explain the factors determining zonation in intertidal organisms. -Describe some of the typical organisms inhabiting the characteristic zones of rocky intertidal communities. -Demonstrate an understanding of the most important physical characteristics of estuaries.
Engage: <i>Anticipatory Set</i> Marine Food Web Videos http://www.turtlediary.com/video/food-chain.html

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
MARINE BIOLOGY

Video on Intertidal Zone

<https://www.youtube.com/watch?v=ybPUcuVeMP0>

<https://www.youtube.com/watch?v=u64ppKBY3cM>

<https://www.youtube.com/watch?v=DR1gP5S6Bsk>

Exploration: *Student Inquiry*

Research Marine Food Webs

http://www.ck12.org/earth-science/Marine-Food-Chains/lesson/Marine-Food-Chains-MS-ES/?referrer=featured_content

Create a marine food web.

Build a model to demonstrate how much energy is lost between trophic levels.

Build the intertidal zone.

<https://www.youtube.com/watch?v=aV7gG1GrhAM>

Explanation: *Concepts and Practices*

Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

LS1.C: Organization for Matter and Energy Flow in Organisms - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. The sugar molecules thus formed contain carbon, hydrogen, and oxygen; their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems - Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web, and there is a limit to the number of organisms that an ecosystem can sustain.

LS4.C: Adaptation - Natural selection leads to adaptation—that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment.

ESS2.C: The Roles of Water in Earth's Surface Processes - The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks.

ESS2.E: The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Elaboration: *Extension Activity*

Marine Food Web Worksheet

Marine Food Web Videos

<http://www.turtlediary.com/video/food-chain.html>

<http://nationalgeographic.org/media/marine-food-webs/>

<https://www.youtube.com/watch?v=fSx4GUPg8Nw>

<https://www.youtube.com/watch?v=4HrIeZtIH6g>

Video on Intertidal Zone

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<https://www.youtube.com/watch?v=DR1gP5S6Bsk>

Beach Zonation

Students will prepare a PowerPoint presentation on a specific ocean ecosystem to include the conditions of the ecosystem and the adaptations required to live there.

Worksheets

Videos

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

Lab: Create a Marine Food Web

CW: Ch 10 WS

Test: Ch 10

CW: Ch 11 WS

Test: Ch 11

CW: Ch 12 WS

Test: Ch 12

CW: Student Powerpoint Presentations

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SCIENCE DEPARTMENT
MARINE BIOLOGY

Unit 6: Chapter 13 Life on the Continental Shelf, Chapter 14 Coral Reefs, Chapter 15 Life Near the Surface, Chapter 16 The Ocean Depths	
Content: Structure and Function of Marine Ecosystems	
Essential Questions: What adaptations exist in continental shelf organisms? What adaptations exist in coral reef organisms? What adaptations exist in surface organisms?	What adaptations exist in deep ocean organisms? How does energy flow in a marine environment? How do organisms interact with the living and non-living environment to obtain matter and energy?
Standards: HS-LS2-2, HS-LS2-4, HS-LS2-6, HS-LS2-7, HS-ESS2-5, HS-ESS2-7	
Time Frame: 6 Weeks	
Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Diagrams to color, coloring supplies, computers, internet, library resources, DVD player	
Content: <i>As a result of this learning segment, students will know...</i> Physical Characteristics of the Subtidal Environment Continental Shelf Bottom Communities The Organisms that Build Reefs Kinds of Coral Reefs The Ecology of Coral Reefs The Organisms of the Epipelagic Living in the Epipelagic Epipelagic Food Webs The Twilight World The World of Perpetual Darkness The Deep Ocean Floor Hot Springs, Cold Seeps, & Dead Bodies	
Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i> -Demonstrate an understanding of the most important physical characteristics influencing subtidal communities. -Describe the most important types of organisms found in unvegetated subtidal communities. -Explain the most important aspects (taxonomic position, morphology, nutrition, reproduction) of reef-building corals. -Explain the most important physical factors influencing the development, growth, and geographical distribution of coral reefs, including reef corals and other reef builders. -Demonstrate an understanding of the most important adaptations of epipelagic organisms and summarize examples of these adaptations. -Describe the most important groups of organisms that comprise the phytoplankton and zooplankton. -Demonstrate an understanding of the most important physical characteristics influencing communities of the ocean depths. -Explain the most outstanding biological adaptations of mesopelagic animals, particularly feeding, vertical migrations, and coloration.	

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SCIENCE DEPARTMENT
MARINE BIOLOGY

<p>Engage: <i>Anticipatory Set</i> Watch the opening scene of “Finding Nemo” showing the coral reef. Watch video about Living on the Ocean Floor. - https://www.youtube.com/watch?v=x2X6H1lkB0 Watch video on Rare life on the sea floor- The Abyss- BBC Wildlife - https://www.youtube.com/watch?v=utELpCi7ywI</p>	
<p>Exploration: <i>Student Inquiry</i> Simulate the life of an organism living in each of the specific ocean zones.</p>	
<p>Explanation: <i>Concepts and Practices</i> Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): LS1.B: Growth and Development of Organisms - As successive subdivisions of an embryo’s cells occur, programmed genetic instructions and small differences in their immediate environments activate or inactivate different genes, which cause the cells to develop differently—a process called differentiation. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. LS1.C: Organization for Matter and Energy Flow in Organisms - The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. The sugar molecules thus formed contain carbon, hydrogen, and oxygen; their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. LS4.C: Adaptation - Natural selection leads to adaptation—that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. ESS2.C: The Roles of Water in Earth’s Surface Processes - The abundance of liquid water on Earth’s surface and its unique combination of physical and chemical properties are central to the planet’s dynamics. These properties include water’s exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks. ESS2.E: The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth’s surface and the life that exists on it.</p>	
<p>Elaboration: <i>Extension Activity</i> Students will prepare a PowerPoint presentation on a specific ocean ecosystem to include the conditions of the ecosystem and the adaptations required to live there. Worksheets Videos</p>	
<p>Evaluation: <i>Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)</i> CW: Create a children's book using organisms from the coral reefs. CW: Ch 13 WS Test: Ch 13 CW: Ch 14 WS Test: Ch 14</p>	<p>CW: Ch 15 WS Test: Ch 15 CW: Ch 16 WS Test: Ch 16 CW: Student PowerPoint Presentations</p>

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SCIENCE DEPARTMENT
MARINE BIOLOGY

Unit 7: Chapter 17 Resources from the Sea, Chapter 18 The Impact of Humans on the Marine Environment, Chapter 19 The Oceans & Human Affairs	
Content: Humans and the Sea	
Essential Questions: What resources are provided by the ocean? What is humans' impact on the marine environment? How can humans reduce their impact on the marine environment?	What is the history of the ocean in human life? How does biodiversity affect humans? How do Earth's surface processes and human activities affect each other?
Standards: HS-LS2-7, HS-LS4-5, HS-LS4-6, HS-ESS2-2, HS-ESS2-7, HS-ESS3-5, HS-ESS3-4, HS-ESS3-6	
Time Frame: 4 Weeks	
Materials: Text: Marine Biology 8th Edition, Peter Castro, Michael E. Huber; McGraw Hill 2010 Diagrams to color, coloring supplies, computers, internet, library resources, DVD player	
Content: <i>As a result of this learning segment, students will know...</i> The Living Resources of the Sea Non-Living Resources from the Sea Floor Non-Living Resources from Seawater Modification & Destruction of Habitats Pollution Conserving & Enhancing the Environment Oceans as Barriers & Avenues Threatened & Endangered Species Oceans & Cultures Oceans & Recreation Prospects for the Future	
Student Learning Objective (SLO): <i>As a result of this learning segment, students will be able to...</i> -Identify the major fishing areas and fishing nations of the world. -Demonstrate an understanding of the concepts of nonrenewable resources, maximum sustainable yield, and overfishing. -List some of the most important non-living resources that we obtain from the ocean floor and from seawater. -Explain types, sources, and effects of marine pollutants including sewage, oil, toxic chemicals, solid waste, and thermal effluents. -Explain ways to reverse the degradation of the marine environment by conservation efforts, coastal management, the restoration of habitats, and the building of artificial reefs. -Identify threatened and endangered species because of drift nets, shark fishing, and shell collecting. -Demonstrate an understanding of how the oceans have influenced culture through history. -List some examples of maritime cultures at the present.	
Engage: <i>Anticipatory Set</i>	

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SCIENCE DEPARTMENT
MARINE BIOLOGY

Watch video on Why the Oceans Matter?

<http://video.nationalgeographic.com/video/why-ocean-matters>

Watch video on plastic pollution in the oceans.

<https://www.youtube.com/watch?v=1qT-rOXB6NI>

Exploration: *Student Inquiry*

<https://www.youtube.com/watch?v=6Vwhjz74aa8>

Go to the below website to research.

<http://www.pbs.org/wnet/need-to-know/environment/an-ocean-of-plastic/2686/>

How can we solve the plastic problem in the oceans? Choose one specific solution/law and research the steps to get it passed through legislation in our area.

Explanation: *Concepts and Practices*

Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):

ESS2.E: The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

ESS3.C: Human Impacts on Earth Systems – The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. Scientists and engineers can make major contributions—for example, by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. When the source of an environmental problem is understood and international agreement can be reached, human activities can be regulated to mitigate global impacts (e.g., acid rain and the ozone hole near Antarctica).

ESS3.D: Global Climate Change - Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities, as well as to changes in human activities. Thus science and engineering will be essential both to understanding the possible impacts of global climate change and to informing decisions about how to slow its rate and consequences—for humanity as well as for the rest of the planet.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience - Anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

LS4.D: Biodiversity and Humans - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. These problems have the potential to cause a major wave of biological extinctions—as many species or populations of a given species, unable to survive in changed environments, die out—and the effects may be harmful to humans and other living things. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.

Elaboration: *Extension Activity*

Watch Discoveries of New Drugs from the Sea

<https://www.youtube.com/watch?v=2GOxv8c6ouI>

Ocean Trash Can Lab

Chemicals Moving up the Food Chain (Biomagnification)

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Worksheets

Videos

<https://vimeo.com/113359330>

<https://www.youtube.com/watch?v=gsXiEy2kbGM>

Project: Research and then present the role of a key marine biologist throughout history. Develop the framework to simulate an interview with leading questions to elicit information from the scientist.

Evaluation: *Assessment (The above Essential Questions will be assessed with the following formative and summative measures:)*

CW: Ch 17 WS

Test: Ch 17

CW: Ch 18 WS

Test: Ch 18

CW: Ch 19 WS

Test: Ch 19

Lab: Ocean Trash Can

Project: Research and then present the role of a Marine Biologist. Develop the framework to simulate an interview with a famous scientist. Use leading questions to elicit information from the scientist.